

March 16, 2004

CRUISE REPORT

VESSEL: *Oscar Elton Sette*, Cruise 04-02 (OES-08)

CRUISE PERIOD: February 3 - February 26, 2004

AREA OF OPERATION: Territory of American Samoa (Fig. 1)

OVERVIEW:

The NOAA ship *Oscar Elton Sette* successfully completed the biennial American Samoa Reef Assessment and Monitoring Program (ASRAMP 2004) cruise to monitor, map, and conduct strategic research of the coral reef ecosystems of American Samoa over the period February 3 – 24, 2004. As part of NOAA’s Coral Reef Conservation Program, this multi-disciplinary effort was led by the Coral Reef Ecosystem Division of the Pacific Islands Fisheries Science Center in collaboration with the following key partners: NOAA’s Fagatele Bay National Marine Sanctuary (FBNMS), the National Park Service’s National Park of American Samoa, the American Samoa Government’s Department of Marine and Wildlife Resources (DMWR) and Department of Commerce, the U.S. Fish and Wildlife Service (USFWS), the University of Hawaii’s (UH) Joint Institute for Marine and Atmospheric Research (JIMAR) and Hawaii Mapping Research Group (HMRG), the University of Guam (UoG) Marine Laboratory, and the B.P. Bishop Museum. Additional NOAA support was provided by the National Centers for Coastal Ocean Science (NCCOS) Biogeography Program of the National Ocean Service (NOS), the Climate Monitoring and Diagnostics Laboratory of the Office of Oceanic and Atmospheric Research (OAR), and the National Weather Service Forecast Office in American Samoa.

During the cruise, six teams of multi-disciplinary scientists conducted Rapid Ecological Assessment (REA) surveys for fish, corals, other invertebrates, and algae (63); towed diver surveys of benthic habitats and ecologically and economically important fish and macroinvertebrate taxa (115), closely-spaced oceanographic surveys in shallow (290) and deep (36) water; Coral Reef Watch oceanographic mooring deployments () and recoveries (); satellite-tracked drifter deployments (); Tethered Optical Assessment Device (TOAD) drop camera surveys of deepwater habitats (70); QTC acoustic benthic habitat classification surveys (): bioacoustic surveys of the water column (); and multibeam benthic habitat mapping surveys (). These surveys covered coral reef ecosystems around each of the 7 primary islands/atolls (Tutuila, Aunu’u, Ofu, Olesega, Ta’u, and Swains Island and Rose Atoll) of American Samoa. Multibeam surveys could not be conducted at Rose Atoll or Swains Island. Since the primary objective of the ASRAMP is to monitor the status of and temporal and spatial changes of the coral reef ecosystems of American Samoa, most of the biological and oceanographic surveys were conducted at sites

previously assessed by CRED during the 2002 ASRAMP cruise of the NOAA ship *Townsend Cromwell* or earlier surveys by Drs. Green, Birkeland, and Craig.

In the broadest terms, the coral reef ecosystems of American Samoa remain generally healthy and appear to be continuing a long-term recovery from severe damage due to a series of natural disturbances over the previous two decades: a crown-of-thorns seastar infestation in 1978 and Hurricanes Tusi in 1987, Ofa in 1990, and Val in 1991. While this improving trend appears to be continuing in general, very preliminary analyses of these surveys shows significant localized damage to corals on the west and north sides Swains, Tutuila, Ofu, Olesega, and Ta'u Islands due to the passage of Hurricane Heta on January 4-5, 2004. Wave-induced storm damage was most severe in coral rich shallow waters (0-12 m) on the west and northwest side of Swains Island, where extensive breakage of most of the branching corals (Pocilloporids and Montiporids) was observed. In some areas, high recent mortality was observed. In many cases, broken branches remained alive and had begun the process of re-attaching to the substrate. Storm damage at the other islands was much less extensive (~5-10 %) at exposed locations. Some of the shallow protected bays on the north side of Tutuila may have also suffered damage from increased siltation due to increased runoff from storm-induced loss of vegetation. A small, but noteworthy, crown-of-thorns (*Acanthaster sp.*) infestation was observed on the east side of Swains Island. Although indistinguishable in these observations, other possible changes to corals may have been caused by mild coral bleaching events reported in 2002 and 2003 in response to anomalously warm ocean temperatures. Preliminary analyses of reef fish population suggests continued low abundance of large fishes (> 20 cm) around all islands, with lowest abundances around the more populated islands (Tutuila and the Manu'a Islands).

The following sections of this Cruise Report provide: a chronology of activities, a statistical summary of operations, tables of station locations for each type of operation, summaries of preliminary findings by each survey team, and a list of participants.

CHONOLOGY:

- 29 January *Oscar Elton Sette* arrived Pago Pago Harbor, Tutuila, American Samoa to complete OES-04-01. Continued work to create replacement for Tethered Optical Assessment Device (TOAD) lost on OES-0401.
- 30 January Launched CRED Research Vessel *AHI* (Acoustic Habitat Investigator). Joyce Miller of the Habitat Mapping Team and CDR Ken Barton of the OSCAR ELTON SETTE interviewed by local television station about upcoming cruise. Disembarked E. DeMartini, A. Friedlander, J. Phillabotte, B. Zgliczynski, B. Flint. Embarked R. Brainard, S. Bak, R. Schroeder, T. Donaldson, and C. Musberger. Continued work to create replacement for Tethered Optical Assessment Device (TOAD) lost on OES-0401.
- 31 January Conducted meeting of scientific party and Operations Officer for OES-0402 to prepare for cruise. Fish team conducted training dive to work on

REA survey protocols. Continued work to create replacement for Tethered Optical Assessment Device (TOAD). Disembarked J. Gove.

- 01 February Conducted 4 hour operational test of AHI to prepare for transit to Manua Islands. Conducted meeting of fish and benthic REA teams to determine survey stations for cruise. Continued work to create replacement for Tethered Optical Assessment Device (TOAD). Disembarked J. Firing.
- 02 February Conducted shipboard orientation for new scientists, and dive safety management meeting and drill for all scientists. Chief Scientist R. Brainard presented an overview of the cruise to about 30 mayors of the villages of American Samoa to familiarize them with cruise objectives and upcoming activities. Meeting was arranged by Fatima Sauafea of the Pacific Islands Regional Office and Ray Tulafono, Chief of the American Samoa Department of Marine and Wildlife Resources. This meeting was also attended by CDR Ken Barton, J. Miller, and Bruce Appelgate. R. Brainard and Ray Tulafono were interviewed by the local television station. R. Brainard, J. Miller, and Bruce Appelgate participated in an American Samoa GIS coordinating meeting to discuss cruise activities. R. Brainard participated in planning meetings with the Peter Craig of the National Park Service, Chris Hawkins of the AS Department of Commerce, and Doug Fenner of DMWR. Purchased six drums of gasoline for small boats. Embarked J. Kenyon, R. Hoeke, and M. Moews.
- 03 February Met with Representative Wallace Thompson of Swains Island. Cast off R/V AHI with Scott Ferguson and J. Miller. Departed Pago Pago Harbor, Tutuila, American Samoa at 0940 with the following scientific staff on board: R. Brainard, R. Schroeder, J. Laughlin, K. Page, R. Hoeke, M. Timmers, J. Kenyon, J. Jones, M. Moews, C. Kistner, T. Donaldson, S. Bak, J. Rooney, C. Musberger, S. Godwin, J. Maragos, N. Daschbach, and Penekosova Peau enroute to Manua Islands with R/V AHI in escort. Conducted shipboard orientation briefing, fire and emergency drill, abandon ship drill, dive safety management drill, and recompression chamber exercise. Deployed satellite tracked drifter SVP #44769 at mid-point between Tutuila and Ofu at position 14°15.065'S, 170°06.649'W. Arrived at Ofu Island at 1630. AHI safely moored alongside pier. Conducted nighttime operations consisting of 4 TOAD drop camera surveys with the newly rebuild camera system. All systems worked well. Conducted 1 deepwater CTD to 500 m. CTD winch failed to stop properly during upcast. Conducted 3 ADCP transects.
- 04 February Conducted six towed diver habitat and fish surveys, three fish and benthic REA surveys, and 23 shallow water CTDs around Tau Island. All surveys went from northeast to southwest along the south coast. Deployed subsurface temperature recorder #1151 in 6.1 m of water on the south side of Tau at position 14°15.0475'S, 169°26.8015'W. Mooring team met with

village chief at Tau to get approval to deploy SST buoy. Conducted tests of CTD winch. Conducted 4 TOAD drop camera surveys and 4 ADCP transects around Manua Islands.

- 05 February Conducted six towed diver habitat and fish surveys, three fish and benthic REA surveys, and 14 shallow water CTDs around the northern half of Tau Island. Deployed SST buoy #306-025 in 13.7 m of water of the west side of Tau just south of Tau Village harbor at position 14°14.6229'S, 169°30.5662'W and subsurface temperature recorder (STR) #1152 in 10.1 m of water near large coral bommies at east end of Tau at position 14°14.1268'S, 169°05.1446'W. Conducted 2 deepwater CTDs, 3 TOAD drop camera surveys, and 4 ADCP transects.
- 06 February Conducted six towed diver habitat and fish surveys, three fish and benthic REA surveys, and 20 shallow water CTDs around the southeastern half of Olesega and Ofu Islands and within shallows pools in Ofu lagoon. Deployed STR#1149 in 9.8 m of water at REA monitoring site off Olesega Village at position 14°10.9052'S, 169°37.5972'W. Conducted 1 shipboard CTD and 3 ADCP transects. Conducted 4 TOAD drop camera surveys. Deployed satellite-tracked SVP drifter #44765 between Olesega and Tau at position 14°18.315'S, 169°32.656'W.
- 07 February Conducted six towed diver habitat and fish surveys, three fish and benthic REA surveys, and 25 shallow water CTDs around the northwestern half of Olesega and Ofu Islands. Deployed STR#1148 in 6.4 m of water on the northwest side of Olesega near the REA monitoring site off Sili Village at position 14°09.8358'S, 169°37.4920'W. Deployed STR#1150 in 6.1 m of water on the west side of Ofu near the REA monitoring site off Ofu Village at position 14°10.4174'S, 169°40.8990'W. Conducted 3 TOAD drop camera surveys. Departed Manua Islands enroute to Rose Atoll at 2230.
- 08 February Arrived Rose Atoll at 0730. Conducted six towed diver habitat and fish surveys around entire atoll at mid-depths. Conducted three fish and benthic REA surveys on northeast and southeast facing fore reef slopes. Retrieved 2002 CREWS buoy #262-005 (Argos ID 10214) and deployed new CREWS buoy #262-004 (Argos ID 27267) at same position 14°33.0840'S, 168°09.6110'W. Conducted 1 shallow water CTD. Shipboard ADCP system and CTD winch failed. After troubleshooting, ADCP apparently repaired around 2300. Conducted 4 ADCP transects around Rose Atoll. Water depths too deep to allow TOAD camera surveys. Deployed satellite tracked drifter SVP#44767 east of Rose Atoll at position 14°34.415'S, 168°12.559'W.
- 09 February Conducted six towed diver habitat and fish surveys around entire atoll at deep (20-25 m) and shallow (5-10 m) depths. Conducted three fish and

benthic REA surveys on southeast and southwest facing fore reef slopes. Retrieved Aanderaa RCM9 current meter #417 deployed in 3.4 m of water in the sill of the high velocity pass into Rose Atoll at position 14°32.1110'S, 168°09.2890'W. Conducted 22 shallow water CTDs. Conducted 5 shipboard CTDs and 12 ADCP transects around atoll.

- 10 February Conducted six towed diver habitat and fish surveys around deep (20-25 m) northwest and southwest reef slopes, the lagoon interior and backreefs. Conducted three fish and benthic REA surveys on southwest facing fore reef slopes near the shipwreck site. Deployed STR#1047 in 3.4 m of water on coral pinnacle next to CREWS buoy at position 14°33.0775'S, 168°09.6114'W. Deployed STR#1146 in 7.9 m of water on same coral pinnacle next to CREWS buoy at position 14°33.0753'S, 168°09.6116'W. Conducted 21 shallow water CTDs. Conducted 4 shipboard CTDs and 8 ADCP transects around atoll.
- 11 February Conducted four towed diver habitat and fish surveys around deep (20-25 m) east and north reef slopes, the lagoon backreefs. Conducted three fish and benthic REA surveys on northwest facing fore reef slope and two lagoon pinnacle reefs. Deployed STR#1147 in 7.9 m of water on engine block of wrecked longliner at REA monitoring site at position 14°33.0407'S, 168°10.0195'W. Deployed wave and tide recorder (WTR)#0364 in 17.1 m of water on the east reef terrace at position 14°32.8660'S, 168°08.2564'W. Conducted 3 shipboard CTDs around atoll. Deployed STR#1145 in 2.4 m of water at REA monitoring site on pinnacle just inside pass at position 14°32.2675'S, 168°09.2050'W. ADCP failure prevented current profiler transects. Departed Rose Atoll enroute to Tau Island at 2230.
- 12 February Arrived at Tau Island at 0730. Conducted six towed diver habitat and fish surveys around deep (20-25 m) and shallow (5-10 m) north and west reef slopes. Conducted three fish and benthic REA surveys on the north, northwest, and west fore reef slopes off Tau Villages. Conducted two test radiometry casts of the Biospherical multi-channel radiometer. Conducted 5 TOAD drop camera surveys and 3 shipboard CTDs.
- 13 February Conducted six towed diver habitat and fish surveys around deep (20-25 m) and shallow (5-10 m) east and south reef slopes of Olesega and Ofu Islands. Conducted three fish and benthic REA surveys off east Olesega, and south and west Ofu. Conducted shallow water biospherical radiometer casts off Ofu Island. Conducted shallow water CTD transect in Ofu lagoon. Conducted 5 TOAD drop camera surveys and 2 shipboard CTDs off Olesega and Ofu Islands.
- 14 February R/V AHI alongside at 0630 to transfer personnel and equipment. Embarked scientist Lara Hansen of the World Wildlife Fund at 0645 and

departed Manua Islands enroute to Tutuila. Arrived off Tutuila at 1230 and disembarked scientists Daschbach and Hansen via small boat. Embarked scientist Stephani Holzwarth and departed for Swains Island at 1345.

- 15 February Arrived at Swains Island at 1200. Conducted 4 towed diver habitat/fish surveys around northwest, north, northeast, and southeast fore reefs. Conducted 2 fish and benthic REA surveys. Conducted 1 shallow water CTD. Conducted 6 bioacoustic transects and 4 shipboard CTDs.
- 16 February Conducted 6 towed diver habitat/fish surveys around Swains Island. Conducted 3 fish and benthic REA surveys. Recovered Ocean Data Platform (ODP) #267-001. Deployed STR#1142 at former ODP anchor in 14 m of water at position 11°03.5130'S, 171°05.4550'W. Conducted 16 shallow water CTDs and ? radiometry casts. Ships crew and some scientific staff visited Swains Island. Conducted 7 bioacoustic transects and 4 shipboard CTDs. Deployed satellite-tracked SVP drifter #29109 at position 11°05.729'S, 171°05.512'W.
- 17 February Conducted 4 towed diver habitat/fish surveys and 2 drop dive habitat/fish surveys around Swains Island. Conducted 3 fish and benthic REA surveys on western fore reef. Conducted 1 invertebrate and algae survey of the shallow back reef. Conducted 12 shallow water CTDs in Swains Lake and around lagoon. Conducted CTD tow in shallow lagoon. USPHS Medical Officer diagnosed patient from Swains Island with needing a medical evacuation. Embarked patient Rapeti Ogevai and her one year old daughter from Swains Island for medical evacuation to Pago Pago at 1745 and immediately departed Swains Island enroute to Pago Pago.
- 18 February Arrived at Pago Pago at 1400 to disembark patient Ogevai and her daughter. Launched three REA boats at 1445. Embarked scientist Fatima Sauafea. Departed Pago Pago Harbor at 1520. Conducted 1 towed diver habitat/fish survey and 1 fish and benthic REA survey over Taema Bank. Conducted 6 TOAD drop camera surveys along southern bank of Tutuila, 1 shipboard CTD, and 4 bioacoustic transects.
- 19 February Conducted 6 towed diver habitat/fish surveys around Aunuu Island and east end of Tutuila. Conducted 3 fish and benthic REA surveys off Aunuu and the northeast side of Tutuila. Retrieved Aunuu SST buoy #268-002 (Argos ID23494) and re-deployed SST buoy #306-022 (Argos ID30585) in 7.6 m of water at the same position 14°17.0229'S, 170°33.7357'W. Conducted 20 shallow water CTDs and 8 radiometry casts. Conducted 6 TOAD drop camera surveys of east and northeast bank of Tutuila. Conducted 1 shipboard CTD. Conducted 3 bioacoustic transects.

- 20 February Conducted 6 towed diver habitat/fish surveys along northeast coast of Tutuila. Conducted 3 fish and benthic REA surveys along northeast and north coast of Tutuila. Conducted 19 shallow water CTDs and 4 radiometry casts. Deployed STR#1143 at REA site Tut-5 in Masafau Bay in 5.8 m of water at position 14°15.1163'S, 170°37.4250'W. Conducted 7 TOAD drop camera surveys of east and northeast bank of Tutuila. Conducted 1 shipboard CTD. Conducted 3 bioacoustic transects.
- 21 February Conducted 6 towed diver habitat/fish surveys along north coast of Tutuila. Conducted 3 fish and benthic REA surveys along north coast of Tutuila. Large long period swell (16 sec) resulted in high surge and low visibility. Conducted 20 shallow water CTDs and 5 radiometry casts. Deployed SST buoy #306-023 (Argos ID30595) in 8.2 m of water in Fagasa Bay at position 14°17.0615'S, 170°43.3471'W to replace SST buoy #268-001 (Argos ID23489), which broke its mooring and washed ashore during Hurricane Heta on January 5, 2004. Conducted 7 TOAD drop camera surveys of north, northwest, and southwest banks of Tutuila. Conducted 1 shipboard CTD. Conducted 3 bioacoustic transects.
- 22 February Conducted 6 towed diver habitat/fish surveys along southeast coast of Tutuila. Conducted 3 fish and benthic REA surveys along southeast coast of Tutuila. Conducted 25 shallow water CTDs and 9 radiometry casts. Conducted 5 TOAD drop camera surveys of south bank of Tutuila. Conducted 1 shipboard CTD. Conducted 5 bioacoustic transects.
- 23 February Conducted 6 towed diver habitat/fish surveys along south coast of Tutuila from Pago Pago to Larsen's Bay. Conducted 3 fish and benthic REA surveys along southeast coast of Tutuila. Conducted 31 shallow water CTDs, 1 lagoon CTD tow. Deployed STR#1141 in 1.2 m in lagoon off airport at position 14°19.8301'S, 170°42.1544'W. Conducted 5 TOAD drop camera surveys of south bank of Tutuila. Conducted 1 shipboard CTD. Conducted 1 bioacoustic transects.
- 24 February Conducted 6 towed diver habitat/fish surveys along southwest coast of Tutuila from Step's Point to Point Taputapu. Conducted 3 fish and benthic REA surveys at Larsen's Bay, Fagatele Bay, and Leone Bay along south coast of Tutuila. Recovered Aanderaa RCM9 current meter #415 deployed in 2002 off Step's Point at position 14°22.4960'S, 170°45.4993'W. Deployed Wave and Tide Recorder (WTR) #0385 in 22 m of water at same position. Deployed two subsurface temperature recorders (STR #1144) in 20.1 m of water at position 14°21.8706'S, 170°45.7557'W and STR#1371 in 6.7 m of water at position 14°21.8413'S, 170°45.7197'W in Fagatele Bay National Marine Sanctuary. Conducted 7 TOAD drop camera surveys of south bank of Tutuila. Conducted 1 shipboard CTD. Conducted 5 bioacoustic transects. Deployed SVP drifter #29110 at position 14°19.518'S, 170°58.016'W.

- 25 February Conducted 6 towed diver habitat/fish surveys along northwest coast of Tutuila, including one offshore reef. Conducted 3 fish and benthic REA surveys along west and northwest coast of Tutuila. Deployed SST buoy #306-024 (Argos ID30611) in 22 m of water at position 14°19.6940'S, 170°50.0010'W in Amanave Bay SST Buoy #268-004, which broke from its mooring during Hurricane Heta on January 5, 2004. Conducted 12 shallow water CTDs. Conducted 5 TOAD drop camera surveys of south bank of Tutuila. Conducted 1 shipboard CTD. Conducted 1 bioacoustic time series station. Deployed SVP drifter #44770 at position 14°31.186'S, 170°42.090'W.
- 26 February Arrived Pago Pago, Tutuila at 1015 to complete cruise. Refueled ship. Disembarked Miller.
- 27 February Off-loaded CRED container, boat rack, 19' SAFE boat, 55 gal fuel drums and racks, and ship's fuel drums for storage during OES-04-03. Conducted interview with local television station and Fatima Sauafea. Chief Scientist Brainard met with Ray Tulafono, Chief of the American Samoa Department of Marine and Wildlife Resources to discuss preliminary cruise results. Brainard and Schroeder met with Peter Craig, Chris Hawkins, Nancy Daschbach, Fatima Sauafea, and ~10 other members of the American Samoa Coral Reef Advisory Group to discuss the cruise. Disembarked Donaldson, Kenyon, Maragos, Jones, Bak, Laughlin, Kistner, and Moews.
- 28 February Disembarked Brainard.
- 29 February Disembarked Holzwarth, Hoeke, Page, Timmers, and Godwin.

SUMMARY STATISTICS:

Towed Diver Habitat/fish Surveys – 115 tows, ~231 km

- Ta'u Island – 18 tows, ~39 km
- Olesega Island – 9 tows, ~20 km
- Ofu Island- 9 tows, ~20 km
- Rose Atoll – 22 tows, ~45 km
- Swains Island – 14 tows, ~26 km
- Aunuu Island – 4 tows, ~7 km
- Tutuila Island – 39 tows, ~74 km

Fish and Benthic REA Surveys - 63

- Ta'u Island - 9
- Olesega Island - 4
- Ofu Island- 4
- Rose Atoll - 14

Swains Island - 10
 Aunuu Island - 1
 Tutuila Island – 21

CREWS buoy recovery and deployment – 1
 Rose Atoll - 1

Ocean Data Platforms (Sontek ADP/SBE37) - 1
 Swains Island recovery - 1

SST buoy (SBE39) recoveries/deployments - 4
 Ta'u Island -1
 Aunuu Island - 1
 Tutuila Island - 2
 Fagasa Bay - 1
 Amanave Bay - 1

Aanderaa Current Meter (RCM9) recoveries – 2
 Rose Atoll Pass – 1
 Step's Point, Tutuila - 1

Subsurface Temperature Recorder (SBE39) deployments - 14
 Ta'u Island – 2
 Ofu Island – 1
 Olesega Island – 2
 Rose Atoll - 4
 Tutuila Island – 4
 Fagatele Bay NMS – 2
 Airport Lagoon – 1
 Masefau Bay – 1
 Swains Island - 1

SVP satellite-tracked drifter deployments – 6
 Settlement/recruitment plate recoveries/deployments – 2 arrays
 Rose Atoll – 1
 Swains Island - 1
 Shipboard CTDs to 500 m - 36
 Shallow water CTDs – 290 casts
 Shallow water Profiling Radiometer casts - 41
 TOAD drop camera surveys - 76
 QTC acoustic habitat classification surveys - ? km
 Shipboard ADCP/TSG transects – 38 (Note- ADCP failure 2/11)

MISSIONS AND RESULTS

TEAM SUMMARIES

Towed-diver Habitat/Fish Survey Team (Rusty Brainard, Molly Timmers, Joe Laughlin, Jeremy Jones, Stephani Holzwarth)

Shallow water habitats were surveyed using pairs of towed divers on towboards equipped with a downward-looking high resolution digital still camera with dual strobes (benthic towboard) and forward-looking digital video camera (fish towboard) to quantify habitat composition and complexity, and abundance and distribution of ecologically and economically important fish and macroinvertebrate taxa. The downward-looking camera was maintained ~1 m of the bottom and was programmed to photograph benthic substrate every 15 seconds. The benthic towboard was also equipped with paired red lasers to project a 20 cm scale onto the digital imagery. The diver-observer on the benthic towboard observed and recorded habitat composition and characteristics (substrate percentages) over 5 minute ensembles, and tallied conspicuous macroinvertebrates (crown-of-thorns seastars, boring and free urchins, sea cucumbers, giant clams, octopus, lobster), and marine debris. The diver-observer on the fish towboard recorded fish greater than 50 cm total length along a 10 m swath for 4 minutes followed by a 1 minute all around search in the same 5 minute ensembles as the benthic observer. Both towboards were instrumented with precision temperature and depth recorders (Seabird SBE39). GPS positions, temperature and depth were recorded every 5 s along each transect. The data were downloaded and presented in an ArcView GIS and overlaid on high resolution IKONOS imagery.

During the cruise (Feb. 3 – 26, 2004), a total of 115 towed diver surveys covering ~231 km of habitat were conducted around the Manu'a Island group of Ta'u, Olesega, and Ofu Islands, Rose Atoll, Swains Island, Tutuila Island, and Aunu'u Island. Of these, 18 tows were conducted around Ta'u covering ~39 km of habitat; 18 tows were conducted around Ofu and Olesega Islands covering ~40 km of habitat; 22 tows were conducted around and within Rose Atoll covering ~45 km of habitat; 14 tows were conducted around Swains Island covering ~26 km of habitat; 39 tows were conducted around Tutuila Island covering ~74 km of habitat; and 4 tows were conducted around Aunu'u Island covering ~7 km of habitat. Of the 22 towed diver surveys at Rose Atoll, 16 tows were conducted along the forereef, 4 along the backreef, and 2 within the central lagoon. In the forereef habitats, 6 tows were conducted along an ~15 m 'mid-depth' isobath covering 11.57 km of habitat surveyed; 6 tows were conducted along an ~25 m 'deep' isobath covering 9.27 km of habitat; and 4 tows were conducted along an ~5 m 'shallow' isobath covering 10.08 km of habitat. The 14 tow surveys around Swains Island resulted in three circumnavigations at similar 'shallow', 'mid', and 'deep' depths. Of the 39 Tutuila tow surveys, 2 were conducted over a 20-25 m bank off the northwest coast off Fagamalo and 1 was conducted over Taema Bank south of Pago Pago Harbor.

Fish Observations: (Joe Laughlin, Jeremy Jones, and Stephani Holzwarth)

Manu'a Islands and Rose Atoll

Parrotfishes were the most commonly observed fishes over 50cm total length (TL) with over 205 observations including 158 sightings of the pacific steep head parrotfish (*Chlorurus microrhinos*) and 45 observations of the redlip parrotfish (*Scarus rubroviolaceus*). Surgeonfishes were also commonly sighted with 146 observations primarily of the blacktongue unicornfish (*Naso hexacanthus*). The most commonly observed sharks for this survey period were the benthic feeding reef whitetip shark (*Triaenodon obesus*) with 8 observations and the reef blacktip shark (*Carcharhinus melanopterus*) with 7 observations. It was noted that the gray reef shark (*Carcharhinus amblyrhyncos*) was only sighted 4 times throughout this survey period (40 surveys covering 85 km of habitat). Other notable observations included 13 sightings of the Napoleon wrasse (*Cheilinus undulatus*), 3 sightings of the bumphead parrotfish (*Bolbometopon muricatum*) and a large aggregation of big eye jacks (*Caranx sexfasciatus*) with over 750 individuals just south of the pass into the lagoon at Rose Atoll.

Swains Island

Fish observations at Swains Island were greatly influenced by the presence of several large schools primarily on the islands north reef. These schools were encountered several times throughout the survey resulting in an artificially high total count for certain species. Rainbow runners (*Elagatis bipinnulata*) were the most commonly recorded fish over 50 cm total length (TL) with 532 observations including a single observation of over 400 fish. The second most commonly observed fish for this survey period was the blackfin barracuda (*Sphyraena genei*) with 501 observations, stemming from multiple encounters with a school of approximately 80 individuals. Planktivores were also common, especially the blacktongue unicornfish (*Naso hexacanthus*) and snappers of the genus *Macolor* (*M. macularis* and *M. niger*). Other notable observations included 29 sightings of the Napoleon wrasse (*Cheilinus undulatus*), 23 sightings of the dogtooth tuna (*Gymnosarda unicolor*), and a large aggregation of bigeye jacks (*Caranx sexfasciatus*) with over 2000 individuals milling loosely on the north reef of the island.

Tutuila and Aunu'u Islands

Parrotfishes were the most commonly observed fishes over 50cm total length (TL) with 218 observations including 83 sightings of the pacific steep head parrotfish (*Chlorurus microrhinos*) and 84 observations of the redlip parrotfish (*Scarus rubroviolaceus*). Surgeonfishes were also commonly sighted with 78 observations primarily of the blacktongue unicornfish (*Naso hexacanthus*). The most commonly observed shark for this survey period was the benthic feeding reef whitetip shark (*Triaenodon obesus*) with 9 observations. It was noted that the gray reef shark (*Carcharhinus amblyrhyncos*) was only sighted 3 times throughout this survey period. Other notable observations were 12 sightings of the Napoleon wrasse (*Cheilinus undulatus*) over 50cm TL.

Benthic Observations: (Molly Timmers and Rusty Brainard)
Ta'u Island

The dominant habitat along the fore reef slopes of the west and south shores of Ta'u were observed to be carbonate pavement. The fore reef slopes of along the north and east shores were dominated by both carbonate pavement and spur and groove habitats. For the 18 towed-diver habitat surveys, there was an average of 23.9% live coral cover with 4.67% appearing pale (or stressed), and 1.12% appearing white. A total of 0.31% appeared to have recently died. A total of ~593 giant clams (*Tridacna sp.*) were observed for an average of ~15.2 per linear kilometer of survey. No crown-of-thorns starfish (*Acanthaster sp.*) were observed. Very large (~10 m across) *Porites sp.* coral heads (bommies) were observed along portions the east and west fore reef slopes. A precipitous vertical wall was observed along much of the south shore. The tips of many of the branching corals (*Pocillopora sp.* and *Acropora sp.*) were observed to be broken, particularly on the shallow north and west fore reefs.

Ofu and Olosega Islands

The dominant habitats observed along the fore reef slopes of the south, west, and north shores of Ofu and Olosega Islands consist of carbonate pavement and spur and groove. The fore reefs of the east shores were observed to be continuous reef and carbonate pavement. For the 18 towed-diver habitat surveys, there was an average of 15.5% live coral cover with 1.95% appearing pale, 0.7% appearing pale white, and 2.9% appearing recently dead. The highest incidents of recently dead coral habitat were located along the west and north reef slopes. A moderate amount of the shallow branching corals (*Pocillopora sp.* and *Acropora sp.*) were observed broken or leveled across their tops. Many of these broken corals appeared to have been subsequently invaded by turf algae, initially at the tips and moving along the stems. A few of these branching corals were nearly completely covered with turf algae, indicating likely mortality. This breakage is assumed to be in response to the passage of category 5 Hurricane Heta in early January 2004. A total of ~114 giant clams were observed for an average of ~2.9 per linear kilometer of survey. No crown-of-thorns seastars (*Acanthaster sp.*) were observed.

Rose Atoll

The dominant habitats observed along the forereef consisted of continuous reef and carbonate pavement. The dominant habitats along the backreef and lagoon environments was observed to be pinnacle patch reefs, rubble and sand flats. Typical depths of lagoon interior are 20-25 m. The outer reef slopes are generally very steep, except for gently sloping terraces on the N end and on the NE end of the diamond shaped atoll. Coral and algae cover are generally depth stratified on all of the reef slopes. Typically, live coral cover is low over the shallow forereefs (2-5 m) and moderately good (15-40%) over the intermediate depths (5-18 m). Overall, live coral cover for the fore reef slopes was 25.3%. In these intermediate depths, members of the genus *Pocillopora* dominate the coral fauna, followed by faviids, *Porites*, *Montipora*, *Acropora*, and soft corals. Along

some of the deeper (18-30 m) areas, such as the reef slope on the SE and NW sides, live coral cover, including octocorals and the presence of massive colonies of *Porites*, was high (40-60%). The carbonate platform that forms the basis of the atoll is heavily encrusted with coralline algae and, to a substantially lesser extent, fleshy and turf algae. Assessments of 40–60 % cover by coralline algae are common through many of the surveys.

For the 22 towed-diver habitat surveys, 3.27% of the coral habitat appeared pale, 2.18% appeared white, and 0.4% appeared to have recently died. The coral habitat appearing white was primarily observed on *Pocillopora sp.* primarily along the shallow SW fore reef slope of the atoll. The pattern of white Pocilloporids suggested possible crown-of-thorns predation. Surprisingly, however, not a single crown-of-thorns seastar (*Acanthaster sp.*) was observed during 22 towed diver surveys. With similar effort, the 2002 towed diver surveys at Rose Atoll did not note a similar pattern of white Pocilloporids, but did note that no crown-of-thorns were observed. Between the 2002 and 2004 surveys, over ~99 km of habitats between depths of 3 m and 30 m were surveyed without a single observation of crown-of-thorns.

Towed diver surveys at Rose Atoll revealed very few conspicuous macroinvertebrates. The exception being giant clams (*Tridacna sp.*) on the patch reefs in the lagoon. A total of ~1136 giant clams were observed with 94.8% recorded in the backreef and lagoon environments for an average of 76.5 per linear km of lagoon and backreef survey. Very few free urchins and no lobsters were observed at Rose Atoll. In some areas of the shallow reef slopes, boring urchins were observed in high abundance. A few sea cucumbers (*Holothuroidea*) were observed during the towed diver surveys.

At each of the 3 depths surveyed along the SW reef slope, large increases in cyanobacteria (blue-green algae) were observed as the surveys approached the site of the 1993 shipwreck of the longliner *Jin Shiang Fa*. The effects of the wreck can be clearly seen over a distance of about 1 km. The cyanobacteria is much more abundant to the northwest of the wreck site than to the southeast, suggesting a mean alongshore current to the northwest.

Swains

The dominant habitat of the reef slopes around most of the island was continuous reef, with the exception along the south shore where spur and groove was observed. Live coral cover was generally high (20-65%) at shallow, mid, and deep depths around most of the island. Overall, live coral cover averaged 32.2% over all depths. The dominant coral fauna along the 5 m isobath appeared to be *Pocillopora sp.*; along the 15 m isobath appeared to be *Montipora sp.*, and along the 25 m isobath appeared to be *Porites sp.* Along the east shore, the benthos was dominated by dense thick *Microdictyon sp.* algal cover. Within the shallows (0 - ~12 m) along the north and west fore reefs, extensive coral fragmentation and debris of Pocilloporids and Montiporids were observed. In many of these shallow areas, the large majority of the branching corals appeared to have been leveled. While most of the remaining stems and many of the coral fragments remained

alive, some shallow areas had evidence of high recent mortality (0 – 42.9%), as evidenced by turf algae invasion on white corals. Interestingly, many of the coral fragments were alive and appeared to have initiated the process of recolonization. The nature (widespread physical breakage and recent mortality) and distribution (shallow reefs on west and north sides) of the damage, strongly suggest that the damage was caused by the passage of Hurricane Heta on January 4-5, 2004. This category 5 Hurricane passed along the west side of Swains. For the 14 towed-diver habitat surveys, 2.92% of the coral habitat appeared pale, 2.71% appeared white, and 5.8% appeared to have recently died. Only 1 giant clam (*Tridacna sp.*) was observed. A total of 90 crown-of-thorns seastars (*Acanthaster sp.*) were observed, a significant and noteworthy difference from all other areas of American Samoa surveyed. While crown-of-thorns were observed scattered around the entire island, predominantly deeper than ~12 m, 46.6% located along the south or southeast reef slope. This localized ‘infestation’ of crown-of-thorns caused significant coral damage through predation of Montiporids (primarily) and Pocilloporids.

Overall, Swains Island provided an interesting natural laboratory to study the life, death, and regeneration of reef ecosystems. The coral cover and fish abundance were the highest observed in American Samoa, yet the west and northwest reef slopes were severely impacted by physical damage by a recent Hurricane and the southeast side had a small crown-of-thorns ‘infestation’.

Tutuila

The dominant habitats around the entire island, including Aunuu Island and Taema Bank, were continuous reef and carbonate pavement with an exception along the west side where the dominant habitats were continuous reef and spur and groove. For the 39 towed-diver habitat surveys around Tutuila, there was 19.2% live coral cover with 2.76% appearing pale, 0.89% appearing white, and 2.3% appearing to have recently died. Around Aunuu Island, the average live coral cover was 27.4% on the leeward sides of the island and 7.3% on the more exposed and banklike windward and southern sides. An estimated 69.2% of the recently dead coral was observed along the north shore of Tutuila between Cape Matatula and Afono Bay and 10.6% was observed along the southwest shore between Leone and Amanave. Most of the recently dead is presumed to have been caused by the January 4-5, 2004 passage of Hurricane Heta to the west of Tutuila. The amount of damage appeared to depend on the amount of exposed to the north and west swells generated by the storm. Some of the protected bays (e.g. Masefau Bay) on the north side of Tutuila appeared to have suffered little direct physical damage from the storm. More exposed areas, including less protected bays were observed to have increased storm damage, as evidenced by an abundance of recently overturned Acroporids. In many areas, an estimated 10% of the table corals were overturned. Aside from direct physical damage from the storm, a few of the protected bays on the north side of Tutuila appeared to have suffered from increased siltation, possibly in response to reported increases of runoff due to removal or damage of terrestrial vegetation of the surrounding watershed (Peter Craig, personal communication). Possible evidence of the vegetation damage was a moderate abundance of palm fronds and other tree damage found along the reef on all sides of Tutuila.

Only two crown-of-thorns seastars (*Acanthaster sp.*) were observed and both were located in Masefau Bay. A total of 126 giant clams (*Tridacna sp.*) were observed.

Fish Team (Robert Schroeder, Terry Donaldson, and Craig Musburger)

From 3–26 February, 2004, the fish census surveyed 38 stations— 9 at Tau, 9 at Ofu/Olosega, and 12 (plus 2 collecting dives) at Rose Atoll, 8 at Swains Island, and 22 in the vicinity of Tutuila Island, including 1 at Taema Bank and 1 at Aunuu Island. Quantitative belt transects (BLT), stationary point counts (SPC), and qualitative REA surveys (for species presence) were conducted at each of these sites, using the same methodology as in 2002 and summarized below. The benthic team (corals, algae, invertebrates) followed the fish team at all sites.

Fish transect stations consisted of 3 consecutive 25-m lines set along a single depth contour at 13–15 m. As each line was set, the observers swam about 5-m apart along either side along each side of the line, counting and recording size classes for all fishes >20-cm total length (TL) within an area 4-m wide and 4-m high. At the end of each 25-m line, the divers turned around and, while remaining on either side of the line, began counting and recording size classes of all fishes within 2-m of their side of the line and 4-m off the bottom. Four stationary point counts were made at each transect station, generally ~15-m from the transect line. SPCs consist of the diver counting and recording the size classes for all fishes >25-cm total length observed in a cylindrical volume 10-m in radius during a 5-minute period. In addition, the divers recorded the species of fishes seen outside the transect area and outside the SPC counts, on an opportunistic basis. During REA surveys, the divers record all species observed during the dive. These observations of the diversity are combined with fish observed by other divers (benthic team, tow team, or mooring team) to develop an island-wide listing of all fishes observed.

At Ta'u Island, 3 sites were “monitoring stations” (established in 2002) and 6 were new stations. At Ofu/Olosega Islands, 5 sites were monitoring stations and 4 were new. At Rose Atoll, 8 sites were monitoring stations and 4 were new. At Swains Island, 7 sites were monitoring stations and 1 was new. Around Tutuila Island, 13 sites were resurveys of monitoring stations and 9 were new sites. Of the Tutuila sites, 12 were off villages, which implement some form of marine tenure of their nearshore reef resources. New stations around all islands were selected based on sides of the island not previously sampled, reference to priority monitoring sites in “The American Samoa Coral Reef Monitoring Program”, and previous surveys conducted in recent year (i.e., A. Green).

Overview of Fishes

In general, sharks, large predators and other large (>30 cm TL) fish appeared to be rare at reefs around the Manu'a Islands and Rose Atoll, somewhat more abundant at Swains Island, and lowest around Tutuila Island. Our subjective impression (pending statistical confirmation) was that large fish were somewhat fewer than in CRED's 2002 surveys. Artisanal fishing boats were sighted on about a half-dozen occasions while working the Manua Islands.

The total number of coral reef fish species CRED documented in 2002 for each of the islands was 127 for Ta'u, 168 for Ofu/Olosega, 222 for Rose Atoll, 168 for Swains

Island, and 228 for Tutuila Island. The total number of fish species observed in 2004 was: 227 at Ta'u (79% increase), 271 at Ofu/Olosega (61% increase), 272 at Rose Atoll (23% increase), 220 at Swains Island (31% increase), and 338 (48% increase) for Tutuila. The substantially higher figures from the 2004 surveys reflect (in part) greater sampling effort (i.e., about twice the number of man-dives). Again, Rose exhibited higher diversity as it has the most diverse habitat types. Considering common reef fish families, these islands were similar with wrasses ranking as the most specious (36-42 spp/island), followed by surgeonfish (26-31), damselfish (18-22) and parrotfish (6-11).

Manu'a Islands and Rose Atoll

No humphead parrotfish (*Bolbometopon muricatum*) were sighted at the Manu'a Islands, Rose Atoll, Swains, or Tutuila, and only about 6 humphead wrasse (*Cheilinus undulatus*) were observed by the fish REA team at the Manu'a Islands and Rose Atoll. Some humphead wrasse larger than 100 cm were observed at Swains, and an apparent resident spawning aggregation was observed by the towed diver survey team.

Effort to collect specimens was applied at two stations within the lagoon at Rose Atoll. Target species included *Dascyllus auripinnis* and *Cirrhilabrus katherinae*? The former species was not observed at any of the sites at Rose Atoll, but was reported as rare in the lagoon by the fish towboard team. Four specimens of the latter species were taken with hand net.

Swains Island

At Swains, the most common large fish were snapper (mainly *Lutjanus bohar*), followed by parrotfish and surgeonfish (mainly *Naso* spp.). Groupers were mostly represented by small *Cephalopholis* spp.

It was reported that about two-dozen people now reside on Swains Islands, compared to only a family of four in 2002. Most species of larger fish (e.g., >20cm TL) are potential fishing targets primarily by spear for subsistence (e.g., snapper [except *Lutjanus bohar*, which is believed to be ciguatoxic], parrotfish, surgeonfish, jacks, grouper). It is unknown what, if any, level of fishing from outside pressure Swains receives.

Fish habitat appeared to be of highest quality (e.g., percent and diversity of live coral cover and substrate relief) on the N side of the island. The W side appeared to be of lowest habitat quality (e.g., broken and dead coral overgrown by algae) as it was heavily impacted by recent storms.

Tutuila

Tutuila has the largest island population with well over 90% of the Territory's residents. For example, sharks were extremely rare as only about 4 individuals were seen by the fish team during its entire time underwater (66 man-dives, each over an hour long of observation). Subsistence and commercial fishing is common but a ban on fishing with SCUBA was implemented about 2 years ago. Common target species include surgeonfish, grouper, snapper (except larger *Lutjanus bohar*, which are believed ciguatoxic), wrasse, parrotfish, and jacks. As in February 2002, recruitment was heavy

for some species, especially the striped bristletooth (*Ctenochaetus striatus*). The site (Nuuuili, TUT-10) of the sea-side road construction/fill activity of 2002, which produced increase sedimentation and algae then, did not appear noticeably different in fish habitat or assemblage composition during our 2004 survey (pending statistical confirmation).

Impact of the Hurricane Heta was clearly evident at many of the stations (e.g., broken and overturned corals, leaves, branches and occasional garbage on the bottom). Conditions at about half of the sites along the north side of Tutuila were hampered by large swells, re-suspending sediment in the water column and greatly reducing visibility (e.g., 1-4 m). At about 3 of these stations, the quantitative fish data is not representative, especially for the SPC method, which requires 10m of minimum visibility. While few fish could be seen, it is believed that many sought shelter in holes of deeper water.

Fish Family Summaries

Manu'a Islands and Rose Atoll

Damselfish (Pomacentridae) were by far the most abundant family by number, with one species in particular, the midget chromis (*Chromis acares*), especially dominant. Diversity within this family was relatively low. It was not unusual to observe fewer than seven damselfish species at a given site. While all islands supported high densities of damselfish, they were especially dominant at Rose Atoll where it was common to observe 100-200 individual midget chromis on a single transect.

Two families, the surgeonfish (Acanthuridae) and the wrasses (Labridae), were common and showed relatively high diversity at all locations. Thirty or more species of surgeonfish were observed at both Rose Atoll and Ofu/Olosega with only slightly fewer at Tau. Several species of bristletooth surgeons (*Ctenochaetus spp.*) and the orangespine unicornfish (*Naso lituratus*) were most common, but no single species dominated the surgeonfish species composition at any site. Among wrasses, the bird wrasse (*Gomphosus varius*), the ornate wrasse (*Halichoeres ornatissimus*) and the sunset wrasse (*Thalassoma lutescens*) were common, but again no single species dominated this very diverse family. One notable exception would be the inside of the lagoon at Rose Atoll which was heavily dominated by the threespot wrasse (*Halichoeres trimaculatus*) which was rare or absent from most other locations surveyed.

Among larger fish (>20cm), groupers (Serranidae), snappers (Lutjanidae), and parrotfish (Scaridae) were most common. Groupers were largely dominated by the peacock grouper (*Cephalopholis argus*) which seemed to be the most common species among all large fish. The most common snappers were the smalltooth jobfish (*Aphareus furca*), twin-spot snapper (*Lutjanus bohar*), and blue-lined snapper (*L. kasmira*). Parrotfish showed considerably higher diversity with several species including rainbow (*Scarus forsteni*), redlip (*S. rubroviolaceus*), bridled (*S. frenatus*), dark-capped (*S. oviceps*), bullethead (*Chlororus sordidus*), pacific steephead (*C. microrhinos*), and tan-faced (*C. frontalis*) parrotfish contributing to the family's abundance. Also common among larger fish were the orangespine unicornfish (*Naso lituratus*), the bigeye emperor (*Monotaxis grandoculis*), and the pinktail (*Melichthys vidua*) and black (*M. niger*) triggerfishes. A few large dogtooth tuna (*Gymnosaurda unicolor*) were sighted along the outer reef slope.

One family which showed extremely low abundance and diversity was the jack family (Carangidae). Very few, if any, jacks were observed on belt-transects at each site. When present, the most common species was the bluefin trevally (*Caranx melampygus*). Infrequent sightings were made of rainbow runners (*Elagatis bipinnulata*) and black jacks (*Caranx lugubris*). One large school of bigeye trevally (*C. sexfasciatus*) was observed by the tow team southwest of the channel at Rose Atoll, but the fish REA team observed no such occurrences.

Herbivorous fishes (e.g., large schools of *Naso lituratus*, *Acanthurus triostegus*, and *Ctenochaetus striatus*) were common at Rose. At the site of the 1993 longliner grounding (the central SW side), high densities of herbivores (surgeonfish, parrotfish and pygmy angelfish) continued to dominate. Heavy cover by cyanobacteria and related blue-green “algae,” in response to iron-enrichment from corroding wreckage, was visible at this outer reef slope station (ROS-7), in contrast to other “reference” sites (hundreds of meters away) surveyed along this arm (ROS-4, -5, -23), and stations elsewhere around the atoll. Pieces of wreckage were still visible around the transect area.

Swains Island

Twenty species of damselfishes (Pomacentridae) representing 8 genera were observed. The midget chromis (*Chromis acares*), the bicolor chromis (*Chromis margaritifer*), the black damsel (*Chromis xanthurus*), Dick’s damsel (*Plectroglyphidodon dickii*), and the Johnston Island damsel (*Plectroglyphidodon johnstonianus*) were among the most commonly seen species. As in 2002, the midget chromis appeared to have the highest numerical density of all fish. No effort was made to collect *Dascyllus auripinnis* because only three individuals were observed at this locality. Curiously, a common and nearly ubiquitous species elsewhere in American Samoa, the princess damsel (*Pomacentrus vaiuli*), was not observed, nor was a common upper terrace species, the Pacific Gregory (*Stegastes fasciolatus*).

Twenty-eight species of surgeonfishes (Acanthuridae) representing 4 genera were observed. Frequently observed species included Thompson’s surgeonfish, *Acanthurus thompsoni* (over the drop-off), the blacktongue unicornfish (*Naso hexacanthus*), the bluespine unicornfish (*Naso unicornis*), and the bignose unicornfish (*Naso vlamingii*). The barred unicornfish (*Naso thynnoides*) was also observed and represents a range extension for this species (known from the Gilbert Islands west to East Africa).

Thirty-seven species of wrasses (Labridae) representing 16 genera were observed. The most frequently observed species included various cleaner wrasses (*Labroides bicolor*, *Labroides dimidiatus*, *Labroides pectoralis*, and *Labroides rubrolabiatus*), the bird wrasse (*Gomphosus varius*), the ringtail wrasse (*Oxycheilinus unifasciatus*), the six-line wrasse (*Pseudocheilinus hexataenia*), the barred thicklip (*Hemigymnus fasciatus*), and the wedge-tailed wrasse (*Labropsis xanthonota*). The most common species, however, appears to be the redribbon wrasse (*Thalassoma quinquivittatum*). The humphead wrasse, *Cheilinus undulatus*, has been discussed above. *Pseudocheilinus ocellatus* was also observed and represents a new record.

Twelve species of groupers (Serranidae: Epinephelinae), 4 species of fairy basslets (Serranidae: Anthiinae), and 1 species of soapfish (Serranidae: Diploprionini) representing eight genera were observed. The most commonly observed species were

the flagtail grouper (*Cephalopholis urodeta*), a smaller species, and the peacock grouper (*Cephalopholis argus*). The leopard hind (*Cephalopholis leopardus*) was observed in holes along wall faces and in deep coral. The hexagon grouper (*Epinephelus hexagonatus*) was observed in shallower water and was of relatively large body size (20-30 cm) for this normally small species. The blackspot grouper (*Epinephelus melanostigma*) was somewhat cryptic but spotted easily as it moved away from divers.

Ten species of snappers (Lutjanidae) from 4 genera were observed. The twin-spot or dogtooth snapper (*Lutjanus bohar*) was observed commonly on the lower terrace and down the reef slope, but also hovering above the slope. The one-spot snapper (*Lutjanus monostigmus*), the blacktail snapper (*L. fulvus*) and the humpback snapper (*L. gibbus*) appeared to be most common in the lower spur and groove zone (off the transects but detected during REA swims). Both *Macolor macularis* and *Macolor niger* were observed frequently.

Nine species of parrotfishes (Scaridae) from 4 genera were observed. The most commonly seen species were whitespot parrotfish (*Scarus forsteni*), and the redlip parrotfish (*Scarus rubroviolaceus*).

Eight species of jacks or trevallies (Carangidae), including the rainbow runner (*Elegatis bipinnulata*), the leatherjacket (*Scomberoides lysan*) and the small-spotted pompano (*Trachinotus bailloni*) were observed. More commonly seen species included the bluefin trevally (*Caranx melampygus*), the bigeye trevally (*Caranx sexfasciatus*), the black trevally (*Caranx lugubris*), the giant trevally (*Caranx ignobilis*), and the yellow-spotted trevally (*Carangoides orthogrammus*).

Several large dogtooth tuna (*Gymnosarda unicolor*) were observed. Some individuals were in excess of 1.5 m in length.

A large school of approximately 100 blackfin barracuda (*Sphyrnaena genie*) were observed at one site along the north coast. When not ciguatoxic, this species is a common food fish. It is unknown whether or not it is consumed at Swains.

Ten species of triggerfishes (Balistidae) from 7 genera were observed. The pinktail triggerfish (*Melichthys vidua*) and the black triggerfish (*Melichthys niger*) were quite common in the water column above the terrace, upper slope, and lower spur and groove zone (the latter off transects but surveyed by REA swims). The orange-striped triggerfish (*Balistapus undulatus*) was observed frequently in coral areas while the scythe triggerfish (*Sufflamen bursa*) was not uncommon in coral and rubble habitats.

Seven species of hawkfishes (Cirrhitidae) of 3 genera were observed. One may be a new species of the genus *Paracirrhites* (filmed on video by Craig Musburger, but not collected). The yellow hawkfish (*Paracirrhites xanthus*) was observed in harems but abundances were very low. *Paracirrhites arcatus*, in both normal and melanistic morphs, were very abundant. The flame hawkfish (*Neocirrhites armatus*) was observed in *Pocillopora eydouxi* (?) coral heads but was rare, however.

Sharks were rare and represented by just 2 species, the grey shark (*Carcharhinus amblyrhynchos*) and the whitetip shark (*Triaenodon obesus*) (both Carcharhinidae); both had low abundances and were relatively small. Greys were generally seen cruising along the reef crest, while whitetips tended to be observed deeper along dropoffs.

Tutuila

Twenty-eight species of surgeonfishes (Acanthuridae) representing 5 genera were observed. The most frequently observed species was the striped bristletooth, *Ctenochaetus striatus*. Thousands of juveniles (ca. 5-8 cm, TL) were seen on and adjacent to transects at many sites. The bluespine unicornfish (*Naso unicornis*), the brown surgeonfish (*Acanthurus nigrofuscus*), and the mimic surgeonfish (*Acanthurus pyroferus*) were also seen commonly. The Palette surgeonfish (*Paracanthurus hepatus*), popular in the aquarium trade (elsewhere), was also seen although rarely.

Fifty-four species of wrasses (Labridae) representing 20 genera were observed. The most frequently observed species included various cleaner wrasses (*Labroides bicolor*, *Labroides dimidiatus*, *Labroides pectoralis*, and *Labroides rubrolabiatus*), the bird wrasse (*Gomphosus varius*), the ringtail wrasse (*Oxycheilinus unifasciatus*), the six-line wrasse (*Pseudocheilinus hexataenia*), the barred thicklip (*Hemigymnus fasciatus*), and the checkerboard wrasse (*Halichoeres hortulanus*). The redribbon wrasse (*Thalassoma quinquivittatum*) was also common. The humphead wrasse, *Cheilinus undulatus*, was quite uncommon.

Fifteen species of groupers (Serranidae: Epinephelinae), 2 species of fairy basslets (Serranidae: Anthiinae), and one species of Swiss Guard basslet (Serranidae: Liopropomini) representing eight genera were observed. The most commonly observed species were the flagtail grouper (*Cephalopholis urodeta*), a small-sized species, and the peacock grouper (*Cephalopholis argus*). The leopard hind (*Cephalopholis leopardus*) was observed in holes along wall faces and in deep coral. The hexagon grouper (*Epinephelus hexagonatus*), the blacksaddle grouper (*Epinephelus howlandi*), the blackspot grouper (*Epinephelus melanostigma*), two coral trouts (*Plectropomus areolatus* and *P. laevis*), and the slenderspines grouper (*Gracila albomarginata*) were rarely seen. The blacktip grouper (*Epinephelus fasciatus*) and a species that resembles it closely, the Red-tipped grouper (*Epinephelus retouti*) were both seen but were also rare. Fairy basslets were not common at all.

Nine species of snappers (Lutjanidae) from 4 genera were observed. The twinspace or dogtooth snapper (*Lutjanus bohar*) was observed commonly on the lower terrace and down the reef slope, but also hovering above the slope. The onepoint snapper (*Lutjanus monostigmus*), the blacktail snapper (*L. fulvus*) and the humpback snapper (*L. gibbus*) were seen only occasionally. *Macolor macularis* and *Macolor niger* were observed frequently, the former species more frequently.

Eighteen species of parrotfishes (Scaridae) from 4 genera were observed. The most commonly seen species were the bullethead parrotfish (*Chlorurus sordidus*), the whitespot parrotfish (*Scarus forsteni*), the redtail parrotfish (*Scarus japonicus*), the dark-capped parrotfish (*Scarus oviceps*), the palenose parrotfish (*Scarus psittacus*), and the redlip parrotfish (*Scarus rubroviolaceus*).

Eight species of jacks or trevallies (Carangidae), including the rainbow runner (*Elegatis bipinnulata*), the leatherjacket (*Scomberoides lysan*) and the small-spotted pompano (*Trachinotus bailloni*), seen in schools at the north tip of the Cock's Comb, a high energy area along a split cliffline) were observed. The most commonly seen species was the bluefin trevally (*Caranx melampygus*).

Eighteen species of butterflyfishes (Chaetodontidae) from 4 genera were observed. The most commonly observed species included the reticulated butterflyfish (*Chaetodon reticulatus*), the saddled butterflyfish (*Chaetodon ephippium*), the raccoon

butterflyfish (*Chaetodon lunula*), the speckled butterflyfish (*Chaetodon citrinellus*), the ornate butterflyfish (*Chaetodon ornatissimus*), the chevroned butterflyfish (*Chaetodon trifascialis*) (around *Acropora* sp. table corals), the forceps butterflyfish (*Forcipiger flavissimus*), the longnose butterflyfish (*Forcipiger longirostris*), the pennant bannerfish (*Heniochus chrysostomus*), and the humphead bannerfish (*Heniochus varius*). Rare butterflyfishes included the dotted butterflyfish (*Chaetodon semion*) and the black-backed butterflyfish (*Chaetodon melannotus*).

Thirty-nine species of damselfishes (Pomacentridae) representing 8 genera were observed. The midget chromis (*Chromis acares*), the bicolor chromis (*Chromis margaritifer*), the half and half chromis (*Chromis iomelas*), the black damsel (*Chromis xanthura*), the taupou damsel (*Chrysiptera taupou*), the Dick's damsel (*Plectroglyphididon dickii*), the Johnston Island damsel (*Plectroglyphididon johnstonianus*), princess damsel (*Pomacentrus vaiuli*), the charcoal damsel (*Pomacentrus brachialis*), and the Pacific Gregory (*Stegastes fasciolatus*), were among the most commonly seen species. Clownfishes (*Amphiprion chrysoptera* and *A. melanopus*) were seen occasionally in association with anenomes.

Eleven species of triggerfishes (Balistidae) from 7 genera were observed. The pinktail triggerfish (*Melichthys vidua*) and the black triggerfish (*Melichthys niger*) were quite common in the water column above the terrace, upper slope, and lower spur and groove zone. The orange-striped triggerfish (*Balistapus undulatus*) was observed frequently in coral areas and the scythe triggerfish (*Sufflamen bursa*) was not uncommon in coral and rubble habitats.

Notes on Rare Species, Alternate Color-morphs, and Range Extensions

Note: localities are given in parentheses unless otherwise indicated.

The following groupers (Serranidae) were observed: *Anyperodon leucogrammicus* (Ofu/Olosega), *Cephalopholis sonnerati* (Rose Atoll, lagoon) and *Epinephelus macrospilos* (Tau; rare).

The soapfish, *Grammistes sexlineatus* (Serranidae), was observed at Ofu/Olosega and is presumed to be cryptic or rare (mainly because this species emerges from holes on reefs during daylight and so can be seen).

The following butterflyfishes (Chaetodontidae) were observed: *Chaetodon melannotus* (Tau), *Chaetodon plebius* (Ofu/Olosega), *Chaetodon punctatofasciatus* (Tau), *Chaetodon rafflesii* (Ofu/Olosega), *Chaetodon semion* (Ofu/Olosega), and *Heniochus monoceros* (Tau).

Herald's angelfish, *Centropyge heraldi* (Pomacanthidae), was observed at Ofu/Olosega. The flame angelfish, *Centropyge loriculus*, was observed at Ofu/Olosega, Tau, and Rose Atolls.

The smalltail wrasse, *Pseudojuloides cerasinus* (Labridae), was observed at Ofu/Olosega.

Moyer's dragonet, *Synchiropus moyeri*, thought to be endemic to marginal areas along the boundary of the Pacific and Philippine plates, was observed at Tau. A congener, Morrison's dragonet, *Synchiropus morrisoni*, was observed at Ofu/Olosega.

The single spine surgeonfish, *Naso thynnoides* (Acanthuridae), was observed at Rose Atoll. This species is known only from the Indian Ocean east to southern Japan and Papua New Guinea.

The blackbelly Picasso fish, *Rhinecanthus verracosa* (Balistidae) was observed twice at Ofu/Olosega. This species is known only from the Indian Ocean east to the Solomon Islands, Great Barrier Reef (Australia), Vanuatu and southern Japan; this sighting represents a considerable range extension.

Diminutive species of both blennies (Blenniidae) and gobies (Gobiidae) were observed and included the following species: *Blenniella paula* (Blenniidae; Rose Atoll), *Ecsenius bicolor* (Blenniidae; Tau and Ofu/Olosega), *Ecsenius opsifrontalis* (Blenniidae; Tau), *Eviota guttatus* (Gobiidae; Ofu/Olosega), *Eviota saipanensis* (Gobiidae; Ofu/Olosega and Tau) and *Eviota* sp. (Gobiidae; Tau), *Gobiodon citrinellus* (Gobiidae) in live *Acropora* sp. coral heads (Rose Atoll and Ofu/Olosega); *Trimma* sp. (Gobiidae; Tau), and *Asterropteryx bipunctatus*, *Asterropteryx ensiferus*, *Asterropteryx* sp., *Gnatholepis anjerensis*, *Istigobius decoratus*, and *Macrodontogobius wilburi* (all Gobiidae) in the lagoon at Rose Atoll.

At least one new species, a hawkfish (*Paracirrhites* sp.), was observed and filmed at Swains Island but not collected. The yellow hawkfish, *Paracirrhites xanthus*, was rare and Swain's Island appears to be at the western edge of its range. The arc-eye hawkfish (*Paracirrhites arcatus*) and the whitespot hawkfish (*Paracirrhites hemistictus*) were present in two color morphs (melanistic morphs tended to be in shallower water but not exclusively so). The blackside hawkfish (*Paracirrhites forsteri*) had several color morphs present. A wrasse, *Pseudocheilinus ocellatus*, normally seen in the western Pacific but seen in the east-central Pacific only at Johnston Island and Pitcairn Island, was seen by a tow team diver at Swains. This species is secretive and may likely be found at most localities in the region. The barred unicornfish, *Naso thynnoides*, was present at Swains, thus extending its range eastward. Some individuals of the flagtail grouper (*Cephalopholis urodeta*) observed below 50 ft had a curious "koi" color pattern seen usually at other oceanic islands, mainly in the western Pacific (Donaldson, unpublished data). This color pattern, which is fixed and not controlled behaviorally, departs considerably from this species' normal coloration.

Melanistic or alternate color morphs of various species were not commonly observed compared to Rose Atoll or Swain's Island. Several color morphs of the freckled hawkfish (*Paracirrhites forsteri*) were observed on and adjacent to transects. No relationship between color morph and habitat type has been established, however. Range extensions for and the rarity of some species remain to be verified.

Previously Known or Expected Species Rare or Absent from Localities

Lizardfishes (Synodontidae) were conspicuous by their absence; one unidentified species was observed during a TOAD run off of Ofu, however (depth ca. 60 m; TJD personal observation).

Scorpionfishes (Scorpaenidae) were rarely observed. These fishes are largely cryptic, so this is not surprising, however they should have been more evident.

Sebastipistes cyanostigma and *Pterois antennata* were observed at Ofu/Olosega and Rose Atoll, respectively.

The blacktip grouper, *Epinephelus fasciatus* (Serranidae) was seen rarely at all three localities. Normally, this species should be seen commonly.

The flame hawkfish, *Neocirrhites armatus* (Cirrhitidae), was present only at Ofu/Olosega, and rarely at that; this species was not found at Rose Atoll nor at Tau although suitable habitat existed at both localities (see previous data, A. Green's observations, etc.). Apparently, *Pocillopora* spp. have rebounded at Rose Atoll following the last bleaching event. If *N. armatus* was found there previously it may have been extirpated with the loss of favored corals from bleaching. The spotted coral croucher, *Caracanthus maculatus* (Caracanthidae), found frequently in *Pocillopora eydouxi* coral heads with *N. armatus*, was observed although in low numbers. The yellow-spotted scorpionfish, *Sebastipistes cyanostigma*, (Scorpaenidae), another obligate *Pocillopora* coral-dwelling species, was also absent except for a single record at Ofu/Olosega. The leopard blenny, *Exallias brevis* (Blennidae), yet another obligate coral-dwelling species, was rare at Tau and Ofu/Olosega but apparently absent from Rose Atoll.

Cardinalfishes (Apogonidae) were rare at all three localities. Greatest diversity (n = 6 spp.) was observed in the lagoon at Rose Atoll, however. There, cardinalfishes were found sheltering under coral bommies adjacent to pinnacles.

Three species of butterflyfishes (Chaetodontidae), *Chaetodon kleini*, *C. meyeri*, and *C. trifascialis*, reported previously were not observed.

Only the latticed sandperch, *Parapercis clathrata* (Pinguipedidae), was observed on reef pavement, rubble or coarse sand. Other species of this genus were expected to be seen.

Rabbitfishes (Siganidae) were absent from all localities surveyed.

The longnose surgeonfish, *Zebrasoma rostratum* (Acanthuridae), was present only at Rose Atoll and was very rare.

Sharpnose puffers (genus *Canthigaster*, family Tetraodontidae) were present only at Ofu/Olosega (1 species) and Rose Atoll (four species), but were generally rare at all localities.

Two damselfishes, *Pomacentrus vaiuli* and *Stegastes fasciolatus*, appeared to be absent from Swains. Both species are common throughout the central and western Pacific and occur elsewhere in American Samoa. Rabbitfishes (Siganidae) were also not seen.

Other Interesting Observations

Reef Flat Species (Ofu Lagoon)

The following species were seen exclusively on the reef flat (lagoon) at the American Samoa National Marine at Ofu: the spotted pilchard (*Amblygaster sirm*, Clupeidae), the yellow-spotted scorpionfish (*Sebastipistes cyanostigma*, Scorpaenidae) the small-spotted pompano (*Trachinotus bailloni*, Carangidae), the blue trevally (*Carangoides ferdau*, Carangidae), the red-spotted blenny (*Blenniella chrysospilos*,

Blenniidae), the lined rockskipper, (*Istiblennius lineatus*, Blenniidae), and the jewelled blenny (*Salarias fasciatus*, Blenniidae).

Recruitment pulses:

Manu'a Islands:

Thalassoma lutescens (Labridae) and *Paracirrhites arcatus* (Cirrhitidae) post-settlement and slightly older juveniles were observed regularly.

Rose Atoll:

Thalassoma lutescens and *Gomphosus varius* (both Labridae), and *Paracirrhites arcatus* (Cirrhitidae) juveniles were observed regularly.

Spawning aggregations

Apparent resident spawning aggregations were observed for the following species at Rose Atoll just prior to, during and after the full moon: the checkerboard wrasse (*Halichoeres hortulanus*, Labridae), the bluehead wrasse (*Thalassoma amblycephalum*, Labridae; also at Tau and Ofu/Olosega), the tan-faced parrotfish (*Chlorurus frontalis*, Scaridae; also at Tau and Ofu/Olosega), the steephead parrotfish (*Chlorurus microrhinos* (Labridae), and the bullethead parrotfish (*Chlorurus sordidus*, Scaridae; also at Tau and Ofu/Olosega).

A presumptive transient spawning aggregation was observed for the following species at Rose Atoll just prior to, during, and just after the full moon: the orangespine unicornfish (*Naso lituratus*, Labridae). Note that adults of a number of surgeonfish species were absent from stations during this time. Most notable was *Acanthurus lineatus* that may have migrated to the pass or to an underwater promontory to spawn. Also, large schools of adult convict tangs, *Acanthurus triostegus* (Acanthuridae), were observed moving along the reef slope after the passing of the full moon; it is possible that these were fishes returning from a spawning aggregation site.

Rose Atoll Reef Front and Spur and Groove Zone

Grouper diversity in the habitats surveyed was quite low but abundances of two or three species were high. *Cephalopholis urodeta* was the most commonly seen species, followed by *C. argus*. Both species had individuals that were relatively large- especially *C. urodeta*- and this was indicative of low fishing pressure. *Cephalopholis spiloparea* tended to occur below 12 m; some of the individuals observed were quite large for this species. Similarly, in the lower spur and groove and bench zones, *Epinephelus hexagonatus* was seen, although less commonly, and those observed were among the largest individuals of this species seen anywhere. *Epinephelus melanostigma* and, to a lesser extent, *E. howlandi*, were also observed although irregularly. *Epinephelus fasciatus* was rare and *Gracila albomarginata* was uncommon. *Cephalopholis leopardus* was observed in holes along the lower bench and is likely common in suitable habitats (reef slopes and walls with numerous holes).

Humphead wrasse (*Cheilinus undulatus*) were seen rarely. Bumphead parrotfish (*Bolbometapon muricatum*) were absent.

Apparently, Rose Atoll suffered considerable coral damage following a coral bleaching event. Regrowth of *Pocillopora* corals meant that favored habitat for hawkfishes was in abundance. *Paracirrhites arcatus* was most common; *Paracirrhites hemistictus* also so. Curiously, *Paracirrhites forsteri* was largely absent. Also, *P. hemistictus polystictus*, the dark morph of *P. hemistictus*, was found down to depths of over 14 m; normally, this species is found only in the spur and groove and the very upper reaches of the first terrace or bench. *Cirrhites pinnulatus* was found in the lower spur and groove zone but virtually all individuals were less than 20 cm TL. *Neocirrhites armatus* was absent in spite of the availability, now, of suitable habitat. (Check previous reports and relevance to bleaching and loss of microhabitat). *Cirrhitichthys falco*, a species that favors pavement on reef benches, was present, although in low numbers.

Rose Atoll Lagoon

The suite of species observed at pinnacles within the lagoon was, for the most part, consistent with that normally observed on shallow reef flats. A number of species not detected previously on transects outside of the lagoon were observed (see below). One species of grouper, *Cephalopholis sonnerati* (Serranidae), maintained mating groups consisting of a single male and two females, at larger coral bommies adjacent to the pinnacles (depth = 12-14 m).

Shallow water bommies were often undercut and had a surprising number of species present. These included some larger predators, such as the onepoint snapper, *Lutjanus monostigmus* (Lutjanidae), and the peacock grouper, *Cephalopholis argus* (Serranidae).

One large ray (*Himantura uarnack*, Dasyatidae) was observed on an adjacent shallow rubble flat (at the first collecting station, near the instrument buoy mooring site).

The following species were recorded from the lagoon at Rose Atoll but not, or rarely, elsewhere: the reticulate whipray (*Himantura uarnack*, Dasyatidae), the goldspot herring (*Herklotsichthys quadrimaculatus*, Clupeidae), a reef halfbeak (*Hyporhamphus acutus*, Hemirhamphidae), the tomato grouper (*Cephalopholis sonnerati*, Serranidae), the yellow cardinalfish (*Apogon luteus*, Apogonidae), the iridescent cardinalfish (*Apogon kallopterus*, Apogonidae), the fragile cardinalfish (*Apogon fragilis*, Apogonidae), the five-lined cardinalfish (*Cheilodipterus quinquelineatus*, Apogonidae), the graceful cardinalfish (*Rhabdamia gracilis*, Apogonidae), an unidentified cardinalfish resembling *Apogon apogonoides* (Apogonidae), a second unidentified cardinalfish (Apogonidae), Katherine's wrasse (*Cirrhilabrus "katherinae"*, Labridae), the orange-spotted goby (*Asterropteryx bipunctatus*, Gobiidae), the blue-speckled rubble goby (*Asterropteryx ensiferus*, Gobiidae), an unidentified *Asterropteryx* sp. goby (Gobiidae), the eyebare goby (*Gnatholepis anjerensis*, Gobiidae), the large-tooth goby (*Macrodonogobius wilburi*, Gobiidae), and the yellowmargin triggerfish (*Pseudobalistes flavimarginatus*, Balistidae; also recorded from sandy areas at Tau). A large humphead wrasse, *Cheilinus undulatus* (Labridae), was also observed in the lagoon.

Species with Uncertain Identifications

Several fish species have not been identifiable in the field. We have collected video and still photographic images or specimens for all of the unidentified species which

will allow for positive identification upon return to Honolulu. Summarized here are brief descriptions of the questionable species with our suspected identifications included.

Wrasses:

- A small (4-10cm) elongate wrasse of the genus *Pseudocheilinus* with orange/red spots dorsally and reddish lines ventrally on a white base. Possibly an unusual color morph of *Pseudocheilinus octataenia*.
- A color variant of the fourline wrasse, *Pseudocheilinus tetrataenia*, was found at Rose Atoll- this variant had a distinctive inverted triangle patch, colored royal or purple-blue, beneath the eye extending on to the operculum. This may be a new species.
- A color variant of the striated wrasse, *Pseudocheilinus evanidus*, was observed at Rose Atoll and at Ofu/Olosega. This fish was distinguished by having red or dark pink spots rather than yellow spots along its flank. This may be a undescribed species.
- An unidentified cleaner wrasse, *Labroides* sp. (Labridae), was observed repeatedly at Rose Atoll and Ofu/Olosega. The color pattern of this fish is distinct from that of the redlip cleaner wrasse, *L. rubriolabiatus*. This species may be undescribed.
- Cleaner mimics, *Aspidontus taeniatus* (Blennidae), were found infrequently at Rose Atoll and at Ofu/Olosega. This species resembles closely the cleaner wrasse *Labroides dimidiatus* (Labridae) and may be mistaken for it.
- A cleaner wrasse similar to *Labroides dimidiatus* with a yellow/orange band or spot $\frac{3}{4}$ of the way back towards the caudal region.
- A flasher wrasse of the genus *Cirrhilabrus*. This species is tentatively being recorded as *Cirrhilabrus katherinae*, but laboratory analysis of 4 captured individuals will be necessary to confirm this identification. *Cirrhilabrus "katherinae"* (Labridae) was very common within Rose Atoll lagoon and also observed in certain sand and rubble habitats outside of the lagoon. This species is known previously from marginal localities along the Pacific/Philippine plate boundaries (i.e., Izu Islands, Mariana Islands but also Pohnpei). If the identity of this species is confirmed, this represents a considerable range extension for this species. A terminal phase male and three initial phase presumptive females were collected with handnets from rubble and *Caulerpa* patches on and at the bottom of a slope at Station (), a collecting station, near the inner edge of the lagoon pass at a depth of 10-13m.
- A questionable *Labropsis* sp. wrasse has been identified as a juvenile color morph of the chiseltooth wrasse, *Pseudodax moluccanus* (Labridae) at Swains.
- *Labroides* sp. at Tutuila.
- *Oxycheilinus* sp. at Tutuila.
- *Thalassoma* sp. This wrasse had mottled black bands/patches over a greenish/white base and was seen occasionally foraging over current-swept colonized pavement and rubble areas.

Damsel fish:

- A charcoal grey damselfish fading to white/lighter grey towards the posterior. Smaller individuals show a distinct yellow fringe at the top of the dorsal fin. This yellow mark is faint or absent on larger individuals.
- A small, bright blue damselfish with a dark ocellus above the caudal peduncle. Some individuals show yellow margins to dorsal and anal fins. Most likely this species is *Chrysiptera taupou*.
- *Stegastes fasciolatus* (Pomacentridae) had “white tail” morph that was found solely at Tau Island, was absent from Rose Atoll, and dominated or coexisted with the normal morph at Ofu/Olosega. It is not known if this is simply a color variant of *S. fasciolatus* or if this is a different species. Photographs were taken of this fish but no specimens were collected.
- Another damselfish, possibly *Stegastes insularis* (Pomacentridae), was observed on a single station at Rose Atoll. This species is known only from Christmas Island (Line Islands) and Marcus Island.
- An unidentified species of damselfish, *Pomacentrus* spp (Pomacentridae), dusky blue in color, was observed rarely at Ofu/Olosega.
- *Pomachromis* sp. at Tutuila.
- Charcoal/white damselfish at Tutuila.
- A blue/grey damsel previously reported as unidentified has now been positively identified as *Pomacentrus brachialis* at Tutuila.

Hawkfish:

- A questionable hawkfish (Cirrhitidae), *Paracirrhites* sp. which resembles closely *P. arcatus*, but which has dark black lines bordering a white line running from the middle to the caudal peduncle was observed at Swains. This is possibly a new species which remains to be collected and described. Photographs and videos were taken.

Blenny:

- A light-colored blenny with yellow spots observed at Swains has not been identified.

Jacks:

- A large (60cm) silver carangid with extremely long (>1m) streamers extending from the tips of the dorsal and anal fins at Tutuila. This species was most likely either *Alectis ciliaris* or *A. indicus*. It is unusual for an individual of such large size to retain the streamers.

Scorpionfish

- *Scorpaenopsis* sp at Tutuila (photographed by Dr. James Maragos).

Benthic Team (Jean Kenyon and Jim Maragos – corals; Kim Page and Nancy Daschbach – algae; Scott Godwin – invertebrates)

Corals (Jean Kenyon and Jim Maragos)

Introduction

Two investigators, Jean Kenyon of the CRED and Jim Maragos of the USFWS, served as the coral dive team, participating in reef studies off four islands to the east of the main island of Tutu'ila in American Samoa. Three of the islands, Ta'u, Ofu, and Olosega are volcanic and a part of the Manu'a group while the fourth, Rose (Nu'u o Manu), is an atoll further to the east and a National Wildlife Refuge administered by the U.S. Fish and Wildlife Service. Although both investigators participated at all but four of the site surveys, results presented below are preliminary because the two investigators have not yet had the time to combine their respective data. Only Kenyon's field data are reported here for Ofu, Olosega, and Ta'u, and only Maragos' field data are reported here for Rose.

Methods

Coral survey methodology used at Manu'a and Rose is the same previously used during the Johnston, Howland, and Baker phase of the 2004 Equatorial survey (OES 04-01). At each REA site, the first two 25-m transect lines previously laid out by the fish team were videotaped. Kenyon collected the videotapes and will use them later to analyze percent cover data. The tapes also provide a permanent record of the condition of the benthos at each REA site. Both investigators shared in field collection of coral population and size distribution data. Each coral whose center fell within 0.5 to 1.0 meters along the first two transect lines were identified *in situ* to genus and assigned to one of 7 size classes based on the estimated length of their longest diameters; the seven size classes are: <5 cm, 6-10, 11-20, 21-40, 41-80, 81-160, and >160 cm. In addition, evidence of coral bleaching and disease were noted and photographed at the few sites where observed. Moreover, both investigators endeavored to take digital photographs of coral species, including those within a broader area beyond the transect lines to compile and document a more complete inventory of coral biodiversity at each REA site.

Additionally, Maragos resurveyed his two 2002 permanent monitoring sites at Rose Atoll and established two new permanent monitoring sites, each 50 m in length, off the SW ocean facing reef. At each permanent site, a 50 meter surveyor's tape was laid out along each transect alignment marked with stainless steel stakes previously installed at five meter intervals. A one meter square quadrat was laid sequentially and photographed along the entire transect at one-meter intervals for a total coverage of 50 m² per transect. These data will be later analyzed for the same parameters as the REA coral census data: percent coral cover, size class distribution, frequency, mean diameter, generic diversity, etc. John Rooney and Megan Moews kindly assisted in the permanent transect surveys.

Ta'u

Nine sites were surveyed by the coral team. Of these nine sites, three were previously surveyed by CRED in 2002, two were surveyed by David Fisk and Charles Birkeland for the American Samoa government in 2002, and the remaining four sites

were chosen on the basis of guidance provided by the American Samoa Coral Reef Monitoring plan or to fill in spatial gaps in survey locations. Most sites were characterized by low (i.e., relatively flat) topographical relief, and were colonized by encrusting *Montipora* and *Porites* as well as by numerous small (< 20 cm maximum diameter) colonies that form massive or branching morphologies. The only sites deviating from this general pattern were Ta'u 12, on the SW side of the island, which was characterized by moderately high topographical relief, and Ta'u 10, in a small cove on the N side of the island, which was characterized by coarse, wave-sculpted sand and boulders colonized by filamentous algae.

Colonies belonging to 23 anthozoan genera were observed by Kenyon and counted within belt transects during quantitative surveys (Table 1). Members of the genera *Montipora*, *Astreopora*, *Favia*, and *Porites* dominated the coral fauna in terms of number of colonies, with each genus contributing more than 10% of the total number of colonies. Visual estimates of percent live coral cover ranged from <1% at the sand/boulder site on the N shore mentioned above (Ta'u-10), to 40% at a site on the S shore near the outfall of Lafuti stream (Ta'u-2); visual estimates of percent cover await comparison with values derived from computer-assisted quantitative analysis of videotapes recorded along transect lines. A total of 1098 coral colonies (of which 1085 were scleractinians) were counted within a total survey area of 241 m², for an average colony density of 4.5 coral colonies/m². Density values at individual sites ranged from 1.0/m² at site Ta'u-10 to 13.6/m² at a site off the SW coast (Ta'u-12). Generic diversity values followed patterns similar to those for percent cover and colony density, with the lowest generic diversity at Ta'u-10, and the highest generic diversities observed at Ta'u-12 and Ta'u-2. Inspection of a histogram showing the size class distribution of anthozoan colonies counted and classified within belt transects shows that the majority (81.0 %) of colonies measure less than 20 cm in maximum diameter, with the greatest number of colonies occurring within the 5-10 cm size class.

Ofu and Olosega

Four sites were surveyed by the coral team at each of Ofu and Olosega, for a total of eight sites. Of these eight sites, three were previously surveyed by CRED in 2002, three were surveyed by David Fisk and Charles Birkeland for the American Samoa government in 2002, and the remaining two sites were chosen on the basis of guidance provided by the American Samoa Coral Reef Monitoring plan or to fill in spatial gaps in survey locations. Topographical relief varied considerably among sites surveyed, from sites characterized by low rugosity and moderate to high levels of encrustation with *Montipora* and *Porites*, to sites with high rugosity, frequently accompanied by relatively high coral diversity.

Colonies belonging to 28 anthozoan genera were observed by Kenyon and counted within belt transects during quantitative surveys (Table 1). Members of the genera *Montipora*, *Goniastrea*, and *Porites* dominated the coral fauna in terms of number of colonies, with each genus contributing more than 10% of the total number of colonies. Visual estimates of percent cover by live coral ranged from 2% at a site off the southeast exposure of Olosega (Olo-6), to 45% at a site with an eastern exposure (Olo-1); visual estimates of percent cover await comparison with values derived from computer-assisted quantitative analysis of videotapes recorded along transect lines. It is interesting

to note, however, that these two sites, so disparate in terms of estimated percent cover, showed the same generic diversity within surveyed belt transects, and were at the low end of the range of generic diversity indices calculated for each of the survey sites. A total of 1710 anthozoan colonies (of which 1607 were scleractinians) were counted within a total survey area of 327 m², for an average colony density of 5.2 anthozoan colonies/m². Density values at individual sites ranged from 3.2/m² at a site off Ofu village (Ofu-6), to 20.9/m² at a site off Olosega village (Olo-4); the latter site was also characterized by the greatest generic diversity. Inspection of a histogram showing the size class distribution of anthozoan colonies counted and classified within belt transects (Figure X) shows that the majority (88.0 %) of colonies measure less than 20 cm in maximum diameter, with the greatest number of colonies occurring within the 5-10 cm size class.

Visual comparison of size class data from both Ta'u and Ofu/Olosega with size class data derived from 2002 surveys conducted by CRED coral biologist Kenyon suggests a reduction in the proportion of colonies in larger (>20 cm) size classes tallied during 2004 surveys. While this preliminary observation could be an artifact of variation among sites surveyed and requires statistical analysis for validation, such a preliminary observation, if validated, could be a result of a typhoon that affected the high islands of American Samoa in early January 2004. Broken colonies of branching corals and unconsolidated rubble were noted in the course of several surveys, as well as sheared branches of intact *Pocillopora* colonies that were not yet colonized by epiphytic algae. Coral biologist James Maragos also noted a vast difference between luxuriant coral growth recalled from a 1992 surveys at a new CRED site (Ofu-8) just south of the sea arches on the west coast of Ofu and the present, scoured condition of the reef in both shallow (<15 ft) and deeper (45-50 ft.) water. Moreover he and others also reported more luxuriant coral growth in 1992 at an adjacent site (Ofu-6), (Maragos, Hunter and Meier 1994). Maragos briefly interviewed two fishers at the latter site who indicated that several large rainstorms over the past year, including the recent hurricane contributed to the demise of corals at site Ofu 6.

Rose Atoll

Rose Atoll is diamond shaped, measuring two km on a side, and with the ocean sides facing NE, SE, SW, and NW. In October 1993, Rose experienced a ship grounding and associated fuel spill that killed off corals and coralline algae over a broad reach of the SW reef crest and upper reef margins. Later dissolved iron from the wreckage stimulated growths of invasive cyanobacteria that still carpet much of the SW reef crest and slopes that discouraged recovery of coralline algae and corals. Shortly after the grounding in April 1994, Rose experienced massive coral bleaching in all habitats to depths of 20-25m that was witnessed by Maragos (1994) who accomplished the first post-shipwreck coral surveys at ocean-facing reef slopes and lagoon back reefs along all four sides of the atoll. In 1999-2000, Maragos revisited Rose as part of an emergency partial cleanup of the ship debris, and established 8 permanent transects at the base of patch reefs in the lagoon but was unable to resurvey ocean reefs. During the 2002 CRED visit to Rose, four of the lagoon sites were revisited and three new permanent transects established, one in the central lagoon, and two off the SW ocean facing reef (Ros-5, -7). REA surveys were also accomplished on all four ocean-facing sides of the atoll in 2002.

In 2004, a total of 12 REA surveys were accomplished at Rose, with 10 on ocean reefs and two in the lagoon. Four of the sites were located off the SW ocean-facing reef slope, two up-drift and two down-drift of the remains of the 1993 shipwreck on the upper reef slope, and permanent transects were also resurveyed (Ros-5P, -7P) or established (Ros-4P, -23P) at all four of these sites. Three additional REA sites were off the SE ocean-facing reef (Ros-2, -3 -21), two off the NW ocean-facing reef (Ros-6, -22), and one off the NE ocean-facing reef (Ros-1), all at depths between 10-15m. One lagoon REA site (Ros-8) was situated in the N lagoon near the pass, and the other (Ros-9) was situated near the opposite corner just off the SW back reef of the lagoon (Figure 3) at depths of 12-13m. Nine of the 12 sites in 2004 were previously surveyed during the January 2002 *Townsend Cromwell* expedition, and three were new sites (Ros-21, -22, -23P).

A total of 2,478 corals were censused by Maragos at six ocean and two lagoon REA sites, but only 33 individual stony corals (mostly *Montipora*, *Favia* and *Pavona*) and 11 soft corals (*Lobophyton*) contributed to the two largest size classes (>80 cm). All ocean reef slope sites showed numerous colonies of *Pocillopora* except off the NW reef slope. Other coral genera were also numerous on exposed, more windward sites (Ros-1, -2, -3, 4P), including (in descending order of abundance), *Montastrea*, *Montipora*, *Lobophyton*, *Favia*, *Porites*, *Acropora* and *Pavona*, (Table 1), but none of these were especially abundant off the NW (Ros-6, -22) reefs, and most were not large.

Few generalizations can be made for lagoon coral communities since only two disparate sites were surveyed (Ros-8, -9). Small colonies of *Porites* were unusually abundant and remaining coral genera not abundant at Ros-8 near the pass. In contrast *Montipora*, *Favia*, and *Astreopora* were unusually abundant at Ros-9 near the SW back reef. Although common on ocean reefs, *Pocillopora* and *Lobophyton* were nearly absent at the two lagoon sites.

Coral frequencies were highest (12.7 corals/m²) at the SW lagoon site (Ros-9), and moderate at all ocean facing reefs except those along the two NW ocean-facing sites, ranging between 3.5 and 5.5 corals/m². Coral colonies were lowest along the NW ocean-facing reefs (2.2 to 3.1 corals/m²) at sites Ros-6 and Ros-22, respectively. Coral frequency was moderate, averaged 3.6 corals at the remaining lagoon site near the pass (Ros-8). Coral frequency appeared to be directly correlated to percent coral cover visually estimated during the REA surveys. The highest cover (60%) was estimated at site Ros-9 in the SW lagoon, the lowest (5-15%) at the two NW ocean facing sites (Ros-6, -22) and nearby northern lagoon site (Ros-8). Remaining ocean facing reefs varied from 20-40% live coral cover. Likewise generic diversity at the transect sites was highest off the ocean reef sites (except the SW) ranging from 13-16 genera and lowest off the lagoon and NW ocean reefs, ranging from 8-10 genera per transect.

Although comparisons are not yet available for the permanent transect data, coral communities appear to be recovering from the coral bleaching of 1994 that affected all reefs, and from the 1993 ship grounding, that affected corals mostly at SW ocean and lagoon reefs (Ros-4P, -5P, -7P, -9P, 23P). Coral recolonization appears more diverse at ocean sites removed from the shipwreck, including several common coral genera other than *Pocillopora*. The lack of many large colonies anywhere at the atoll to 2004 suggests that most corals at the shallow depths died after the 1994 bleaching event and that coral recovery is still ongoing. It is more difficult to explain the lower coral development

(frequency, cover, diversity) at the two NW ocean sites (Ros-6, -22) but may be related to anomalous high temperatures off these reefs. The reef crest also looks deeper and less developed compared to the other more exposed reef faces (SE, SW, NE sides) elsewhere around the atoll perimeter. Additional oceanographic and coral reef monitoring may help elucidate the causes for the depressed coral abundance there.

Table 1. Number of corals (Class Anthozoa & Hydrozoa) reported at the REA sites at Ta'u and Ofu/Olosega by Kenyon and at Rose Atoll by Maragos during January 2004 surveys

coral genera	Ta'u		Ofu/Olosega		Rose	
	# of corals	percent of total	# of corals	percent of total	# of corals	Percent of total
<i>Acanthastrea</i>	2	0.20%	6	0.40%	0	0.00%
<i>Acropora</i>	85	7.70%	34	2.00%	121	4.86%
<i>Astreopora</i>	174	15.80%	86	5.00%	134	5.58%
<i>Coscinaraea</i>	0	0.00%	1	0.10%	13	0.52%
<i>Cyphastrea</i>	0	0.00%	0	0.00%	50	2.08%
<i>Diploastrea</i>	0	0.00%	0	0.00%	0	0.00%
<i>Echinophyllia</i>	0	0.00%	0	0.00%	2	0.08%
<i>Echinopora</i>	2	0.20%	8	0.50%	0	0.00%
<i>Favia</i>	139	12.70%	160	9.40%	273	10.96%
<i>Favites</i>	50	4.60%	29	1.70%	3	0.12%
<i>Fungia</i>	3	0.30%	8	0.50%	6	0.24%
<i>Galaxea</i>	31	2.80%	147	8.60%	0	0.00%
<i>Gardineroseris</i>	0	0.00%	0	0.00%	0	0.00%
<i>Goniastrea</i>	100	9.10%	234	13.70%	1	0.04%
<i>GonioporaAlveopora</i>	0	0.00%	4	0.20%	0	0.00%
<i>Hydnophora</i>	2	0.20%	3	0.20%	2	0.08%
<i>Leptastrea</i>	64	5.80%	51	3.00%	38	1.52%
<i>Leptoseris/Pachyseris</i>	0	0.00%	0	0.00%	23	0.92%

<i>Lobophyllia/Symphyllia</i>	0	0.00%	2	0.10%	7	0.28%
<i>Merulina/Scapophyllia</i>	2	0.20%	4	0.20%	2	0.08%
<i>Millepora</i>	0	0.00%	7	0.40%	0	0.00%
<i>Montastrea</i>	11	1.00%	34	2.00%	417	16.75%
<i>Montipora</i>	185	16.80%	298	17.40%	350	14.06%
<i>Oulophyllia</i>	0	0.00%	0	0.00%	0	0.00%
<i>Palythoa/Zoanthus</i>	1	0.10%	1	0.10%	1	0.04%
<i>Pavona</i>	3	0.30%	9	0.50%	132	5.30%
<i>Platygyra/Leptoria</i>	32	2.90%	130	7.60%	1	0.04%
<i>Pocillopora</i>	67	6.10%	146	8.50%	454	18.23%
<i>Porites</i>	128	11.70%	200	11.70%	143	5.74%
<i>Psammocora</i>	0	0.00%	10	0.60%	27	1.08%
<i>Sandalolitha</i>	3	0.30%	1	0.10%	0	0.00%
<i>Sarcophyton</i>	2	0.20%	5	0.30%	2	0.08%
<i>Seriatopora</i>	0	0.00%	0	0.00%	0	0.00%
<i>Sinularia/Lobophytum</i>	10	0.90%	90	5.30%	287	11.53%
<i>Stylaster/Distichopora</i>	0	0.00%	0	0.00%	0	0.00%
<i>Stylophora</i>	0	0.00%	0	0.00%	0	0.00%
<i>Turbinaria</i>	2	0.20%	2	0.10%	1	0.04%
Total area surveyed	241m2		327m2		546 m2	
Total # colonies:	1098		1710		2490	

Marine Algae (Kim Page and Nancy Daschbach)

Manu`a Islands

Algal Highlights:

- A total of 16 sites were surveyed for quantitative algal data at the Manua Islands: 9 at Ta`u, 4 at Olosega, and 3 at Ofu.
- Crustose coralline, turf algae and an encrusting *Lobophora* sp. were the most common algae in the photoquads at all three islands.
- A diminutive species of *Laurencia* was common at Olosega.
- *Peysonnelia* sp. was very common at Ofu.

Site Descriptions:

Ta`u Island

TAU-7 2/4/04

This site was on the Eastern side of the island with depths ranging from 38 to 42 feet. This site was a gentle reef slope with high sand and sediment. Crustose coralline algae as well as turf algae were the most abundant in the photoquadrats. *Halimeda* sp., a blue-green, and *Peysonnelia* sp. were seen as well in the photoquadrats. During the random swim a *Microdictyon* sp. was found as well.

TAU-2 2/4/04

This site was on the Eastern side of the Southern bight. This reef had a gentle slope to approximately 50 feet where it dropped in a vertical wall to a greater depth. The sample depth on the top of the reef ranged from 37 to 45. Crustose coralline algae, turf algae, blue-green, *Halimeda* sp., *Haloplegma* sp., *Chlorodesmis* sp., and a gelid were found seen in the photoquadrats. *Peysonnelia* sp. and *Chrysemenia* sp. were found during the random swim.

TAU-8 2/4/04

This site was on the Western side of the southern bight. This site was characterized by premature spur and groove formations. Long stretches of reef with small sand channels and very little relief were seen. Part of the reef looked as if it had been scraped clean with very little coral while the next part seemed to have higher coral abundance. Turf algae, blue-green algae, *Dictyosphaeria versluysii*, *Lobophora* sp., and *Halimeda* sp. were seen in the photoquadrats. *Chlorodesmis* sp. was found during the random swim.

TAU-4 2/5/04

This site was on the North east side of Ta`u near a road. This site had poor visibility with depths ranging from 40- 45 feet. The first transect was characterized by the presence of large smooth rocks covered in turf algae while the second transect had more coral cover. Turf algae, crustose coralline algae, and *Neomeris* sp. were found in the photoquadrat area. During the random swim, *Chlorodesmis* sp., *Halimeda* spp., blue-green algae, and a gelid species were also found.

TAU-5 2/5/04

This site was on the North west side of Ta`u Island. The reef was dominated by turf algae and crustose coralline pavement with small sand channels interspersed. Depths ranged from 40 to 45 feet. In addition to turf and crustose coralline algae, *Boodlea* sp., *Chlorodesmis* sp., *Lobophora* sp., *Galaxaura filamentosa*, and *Dictyosphaeria versluysii* were seen in the photoquads. During the random swim *Padina* sp., *Haloplegma* sp., *Valonia* sp., and *Halimeda* spp. were also found.

TAU-9 2/5/04

This site was on the west side just south of the village in a very beautiful cove. The shallow area was surveyed qualitatively by snorkel and was characterized by calcium carbonate pavement with branched corallines and deep sand channels. The quantitative survey took place in depths ranging from 42- 50 feet. This reef had high relief with many coral pinnacles. The benthos was covered with primarily crustose coralline algae and turf. There were many more fish (herbivores and predators) at this site compared to others visited. In addition to turf and crustose coralline algae, blue green algae, *Halimeda* sp., *Chlorodesmis* sp., *Lobophora* sp., *Neomeris* sp., were also seen in the photoquads. During the shallow snorkel, what might be *Porolithon onkodes*, *Amphiroa* sp., and *Callophycus* sp. were collected. During the deeper dive, what appears to be *Tydemanina expeditionis*, *Actiontrichia* sp., *Haloplegma* sp., as well as a few species of *Halimeda* were collected during the random swim.

TAU 11 2/11/04

This site was on the NW corner in front of Faleasao village. The first transect had very little relief and was dominated by colorful Montiporids. The second transect was characterized by *Porites* bommies with hard silted substrate separating them. Turf algae and crustose coralline algae dominated the photoquadrat area. *Dictyosphaeria versluysii*,

a red filamentous cyanobacteria, and *Haloplegma* sp. were also seen in the photoquadrats. *Gibsmithia* sp., *Amansia* sp., *Halimeda* sp., *Chlorodesmis* sp., *Caulerpa* sp., *Amphiroa* sp., and a gelid were also collected from this site.

TAU 12 2/11/04

This site was on the SW corner of Ta`u Island with depths ranging from 45 to 50 feet. This site had high relief with large *Porites* bommies scattered among other mounds of reef substrate. Turf and crustose coralline algae were dominant in the photoquadrats. *Lobophora* sp., *Chlorodesmis* sp., *Peysonnelia* sp., *Halimeda* sp., *Tydemania* sp., *Actinotrichia* sp., *Liagora* sp., and blue green algae were also seen in the photoquadrats. During the random swim, *Dictyosphaeria versluysii*, *Neomeris* sp., and *Amansia* sp. were collected.

Olosega Island

OLO1 2/6/04

This site was on the east side of the Olosega Island. It was characterized by the presence of very large coral heads (largest I have ever seen) and other healthy corals cemented together with very clean (minimally epiphytized) crustose coralline algae. The depths of this site ranged from 37 to 45 sloping into deeper water. In the photoquadrats crustose coralline algae was dominant while, turf algae, *Halimeda* sp., *Peysonnelia* sp., *Amphiroa* sp., and a blue-green algae were also seen. *Actinotrichia* sp., *Chlorodesmis* sp., *Dictyosphaeria versluysii*, and a *Wragelia* sp. were found during the random swim.

OLO4 2/6/04

This site was south west side of Olosega Island directly off shore from the village of Olosega. This site had moderate relief with depths ranging from 40 to 44 feet and was characterized by crustose coralline knobs with diminutive coral species. Crustose coralline algae, an encrusting brown assumed to be a *Lobophora* sp., turf algae, Blue green algae, *Amphiroa* sp., *Halimeda* sp., and *Peysonnelia* sp. were seen in the photoquadrats. Additionally, *Jania* sp., *Chlorodesmis* sp., and other *Halimeda* spp. were found during the random swim.

OLO5 2/7/04

This site was off the old village of Sili on the northwest side of Olosega. This reef had high relief and dropped off to a sandy bottom at ~ 65. The sampling depth ranged from 34 to 41 feet. Crustose coralline algae, *Halimeda* sp., turf algae, blue-green cyanobacteria, *Amphiroa* sp., *Dictyosphaeria versluysii*, *Actinotrichia* sp., and *Chlorodesmis* sp. were seen in the photoquads. During the random swim *Haloplegma* sp., *Bryopsis* sp., *Gelidiopsis* sp., *Myriogramme* sp., and additional species of *Halimeda* were collected.

OLO 6 2/13/04

This site was on the southeast side of Olosega Island with depths ranging from 46 to 51. This site had little relief and with silt covered crustose coralline and turf algae dominating. There was also a diminutive species of *Laurencia* that was common in all of the photoquadrats. In addition to these, *Neomeris* sp., *Lobophora* sp., *Portieria hornemanni*, *Dictyosphaeria versluysii*, and blue green algae were seen in the photoquadrats. During the random swim, *Halimeda* spp., *Chlorodesmis* sp., *Bryopsis* sp., and *Peysonnelia* sp. were also collected.

*Ofu Island*OFU6 2/7/04

This site was off the village of Ofu on the west side of the island. This site had very high relief and may have once been a site of very large coral colonies. It is now dominated by crustose coralline algae. In addition to crustose coralline algae, *Halimeda* sp., turf algae, *Haloplegma* sp., and *Dictyosphaeria versluisii* were found in the photoquadrats. A few species of branched coralline algae as well as blue- greens, *Bryopsis* sp., and *Myriogramme* sp. were collected during the random swim.

OFU7 2/7/04

This site was in the lagoon off the national park beach on Ofu Island. It required a swim through breaking waves and a walk on very shallow (6 inches) of water. Once in deeper water there were coral heads separated by sand and rubble. During this qualitative assessment, *Caulerpa serrulata*, *Chlorodesmis* sp., *Laurencia* sp., *Halimeda* spp., *Haloplegma* sp., *Bryopsis* sp., and *Tydemanina* sp. were collected.

OFU 2 2/13/04

This site was on the southwest side of Ofu Island near the runway. This site had medium to high relief with depths ranging from 39 to 50 feet. The reef was dominated by large dead coral mounds with crustose coralline substrate covering. In addition to crustose coralline algae, turf algae, *Lobophora* sp., *Peysonnelia* sp., blue-green algae, *Halimeda* sp., *Haloplegma duperryi*, *Dictyosphaeria versluisii*, *Actinotrichia* sp. and *Carpopeltis* sp.. During the random swim, *Botryocladia* sp. and a large branched *Halymenia* sp. was collected.

OFU 8 2/13/04

This site was on the west side of Ofu Island in between the two islands off from the village of Ofu. This site had very little relief and was dominated by Pocilloporids and encrusting corals as well as turf and crustose coralline algae. In addition to these, blue green cyanobacteria, *Laurencia* sp., *Lobophora* sp., *Peysonnelia* sp., and *Halimeda* sp. were seen in the photoquadrats. During the random swim *Chlorodesmis* sp. was also collected.

	Ta`u Island Site Averages	Olosega Island Site Averages	Ofu Island Site Averages
GREEN ALGAE			
<i>Boodlea</i>	2.78 (5.89) 2.25 (0.35)		
<i>Chlorodesmis</i>	4.63 (6.05) 3.00 (0.82)	2.08 (4.17) 5.00	
<i>Dictyosphaeria</i>	4.63 (8.45) 2.44 (0.77)	4.17 (4.81) 5.00 (1.41)	11.11 (12.73) 3.83 (1.18)

<i>Halimeda</i>	11.11 (14.43) 3.15 (0.66)	20.83 (17.35) 3.33 (0.58)	22.22 (25.46) 3.75 (1.06)
<i>Neomeris</i>	2.78 (5.89) 3.25 (0.35)	2.08 (4.17) 4.00	
<i>Tydemanina</i>	0.93 (2.78) 5.00		
RED ALGAE			
<i>Actinotrichia</i>	1.85 (3.67) 4.00 (1.41)		2.78 (4.81) 5.00
<i>Amphiroa</i>		16.67 (18.00) 5.10 (0.36)	
<i>Carpopeltis</i>			2.78 (4.81) 5.00
<i>Galaxaura</i>	0.93 (2.78) 3.00		
Gelid	1.85 (3.67) 4.00 (1.41)		
<i>Haloplegma</i>	1.85 (3.67) 3.00 (0.00)		5.56 (4.81) 3.50 (0.71)
<i>Laurencia/Chondrophycus</i>		20.83 (41.67) 3.90	11.11 (19.25) 4.00
<i>Liagora</i>	0.93 (2.78) 4.00		
<i>Peyssonnelia</i>	3.70 (8.45) 3.17 (0.24)	10.42 (15.77) 2.63 (0.88)	47.22 (41.94) 3.49 (0.44)
<i>Portieria</i>		2.08 (4.17)	

		5.00	
crustose coralline	73.15 (31.40) <i>1.64</i> <i>(0.46)</i>	100.00 (0.00) <i>1.21</i> <i>(0.28)</i>	97.22 (4.81) <i>1.20</i> <i>(0.13)</i>
BROWN ALGAE			
<i>Lobophora</i>	10.19 (10.85) <i>3.23</i> <i>(0.22)</i>	33.33 (35.36) <i>2.80</i> <i>(0.35)</i>	30.56 (29.27) <i>2.88</i> <i>(0.18)</i>
CYANO-PHYTEA	14.81 (13.68) <i>2.93</i> <i>(0.36)</i>	54.17 (36.32) <i>3.18</i> <i>(0.83)</i>	30.56 (20.97) <i>3.39</i> <i>(1.27)</i>
TURF	91.67 (22.05) <i>1.33</i> <i>(0.35)</i>	83.33 (11.79) <i>1.95</i> <i>(0.50)</i>	97.22 (4.81) <i>1.99</i> <i>(0.31)</i>

Table 1: Algae of Manu`a Islands. Bold numbers indicate the number of photoquadrats in which an alga occurred, italicized numbers indicate the alga's relative abundance (rank) in relation to other algae occurring in the same photoquadrat. Standard deviation of island averages are given in parentheses.

ROSE ATOLL

Algal Highlights:

- Twelve sites were surveyed, 10 in fore reef habitat and 2 in lagoonal habitat.
- Rose atoll had a very high abundance of algae on the fore reef regions.
- The east was dominated by **very** *Microdictyon* and branched coralline algae. However, the *Microdictyon* sp. was completely absent from the west side surveys and there was noticeably less branched coralline algae.
- Site ROS 7P was near the 1993 ship wreck and appeared to have a larger abundance of turf algae. There also seemed to be higher turbidity in the water column.
- Inside the pass at ROS24 there was a very high abundance of *Liagora* sp..

Site Descriptions:

ROS 1, 2, 3, 21 2/8/04- 2/9/04

Site 1 was on the northeast quadrant and sites 2, 3 and 4 were on the southeast quadrant. All four of these sites were forereef habitat and very similar to each other with depths ranging from 45 to 55 feet. Site 3 seemed to have higher coral cover (Pocillaporids) than the other two sites, however they were all dominated by branched and crustose coralline algae. Blue-green cyanobacteria and *Microdictyon* sp. were also very abundant at the three sites. ROS2 had a very high abundance of *Caulerpa* sp. (possibly *C. cuppresoides*) compared to the other two sites however, it was present at all sites. In addition, to the above *Dictyosphaeria versluysii*, *Halimeda* spp., *Valonia* sp., and *Lobophora* sp. were seen in the photoquadrats. During the random swims, multiple

species of *Halimeda*, a very small filamentous *Caulerpa*, multiple blue-green species, as well as *Jania* sp. were collected.

ROS 4 and 22 2/9/04

Site 4 was on the southwest corner of the Rose Atoll and site 22 is on the northwest corner. These sites were also forereef habitat that was similar to the sites above with depths ranging from 40 to 50 feet. They differed in the complete absence of *Microdictyon* sp. and there was seemingly less branched coralline. There was still a dominance of crustose coralline algae and a dark brown/ gray blue-green cyanobacteria that seen to be growing on what is thought to be an encrusting growth form of *Lobophora*. In addition to the these, *Halimeda* spp., turf algae, *Dictyosphaeria versluysii*, and *Dictyota* sp. were seen in the photoquadrats. During the random swim *Caulerpa* sp. and a *Hypnea* sp. were also collected.

ROS 23 and 5 2/10/04

These sites were forereef sites on the southwest side of the atoll on either side of the 1992 shipwreck site. This habitat had higher coral cover than the other sides of the atoll dominated by Pocilloporids. There was also higher relief at these sites with depths ranging from 40 to 60 feet. There was a definite decrease in the presence of branched coralline that was seen on the east side as well as the continued absence of *Microdictyon* sp. for the west side. ROS 5 seemed to have a higher diversity of coral species than ROS 23. However they were similar in most respects. Crustose coralline, turf algae, an encrusting *Lobophora* sp. with a blue-green alga growing epiphytically, *Halimeda* sp., and branched coralline were seen in the photoquadrats. *Bryopsis* sp. and *Dictyota* sp. were seen commonly at ROS 5 in the photoquadrats but not at ROS 23. During the random swim additional *Halimeda* sp., as well as *Dictyosphaeria versluysii* were collected.

ROS 7P 2/10/04

This site was the closest site to the shipwreck. It was very similar to the site above with Pocilloporids dominating the coral; however there was an increase water turbidity with a lot of algal particulate matter in the water column (*Bryopsis* sp. and Blue-green cyanobacteria). There was also a noticeable increase in turf cover with less crustose coralline cover. In addition to these, Blue green cyanobacteria, *Lobophora* sp., *Bryopsis* sp., *Dictyota* sp., and *Halimeda* sp. were seen in the photoquadrats. Additional blue green and a gelid were found during the random swim.

ROS 6 2/11/04

This site was on the northwest side of the atoll near the pass. It was very similar to the other side on the west side of the atoll with Pocilloporids, crustose coralline and an encrusting *Lobophora* sp. as the dominant substrates. In addition to these, *Halimeda* sp., *Dictyota* sp., *Bryopsis* sp., branched coralline algae, and turf algae were seen in the photoquadrats.

ROS 8 2/11/04

This was a single pinnacle just inside the pass on the north part of the lagoon. This site was nearly devoid of life at the survey depth (~30 feet) with the exception of blue-green cyanobacteria and a Spondolid? oyster. In shallower depths, *Galaxaura filamentosa* as well as *Halimeda* sp. were found.

ROS 9P 2/11/04

This site consisted of two pinnacles in the southwest corner of the lagoon adjacent to the CREWS buoy site. These pinnacles were characterized by high abundance of giant

clams with a large *Porites* adjacent. There was a very interesting temperature regime with very warm water near the surface and cooler water at the bottom. There was very little algal abundance with only turf algae, blue-green algae and crustose coralline algae occurring in the photoquadrats. *Bryopsis* sp. was found during the random swim.

ROS 24 2/11/04

This was a qualitative snorkel on the north back reef west of the pass with depths of about 4 feet. There were small coral heads and an amazing abundance of *Liagora* species. *Halimeda* sp., *Caulerpa* sp., and *Bryopsis* sp. were also found at this site. We should do a quantitative dive here.

	Island Average
GREEN ALGAE	
<i>Bryopsis</i>	10.42 (22.79) 3.97 (0.21)
<i>Caulerpa</i>	3.47 (9.70) 5.13 (0.18)
<i>Dictyosphaeria</i>	16.67 (24.87) 5.82 (0.40)
<i>Halimeda</i>	37.12 (29.67) 4.62 (0.82)
<i>Microdictyon</i>	31.94 (47.25) 3.02 (0.53)
<i>Valonia</i>	2.78 (5.43) 7.00 (1.00)
RED ALGAE	
<i>Amphiroa</i>	0.69 (2.41) 7.00
<i>Galaxaura</i>	0.69 (2.41) 3.00
<i>Laurencia/Chondrophycus</i>	0.69 (2.41) 5.00

<i>Peyssonnelia</i>	2.08 (7.22) <i>5.67</i>
branched upright coralline	45.83 (41.51) <i>2.83</i> <i>(1.00)</i>
crustose coralline	86.11 (31.05) <i>1.59</i> <i>(0.50)</i>
BROWN ALGAE	
<i>Dictyota</i>	4.86 (8.30) <i>3.96</i> <i>(1.20)</i>
<i>Lobophora</i>	38.19 (44.02) <i>3.33</i> <i>(1.35)</i>
<i>Styopodium</i>	0.69 (2.41) <i>8.00</i>
CYANO- PHYTES	62.50 (28.54) <i>3.33</i> <i>(1.17)</i>
TURF	84.03 (20.55) <i>2.93</i> <i>(1.15)</i>

Table 1: Algae of Rose Atoll. Bold numbers indicate the number of photoquadrats in which an alga occurred, italicized numbers indicate the alga's relative abundance (rank) in relation to other algae occurring in the same photoquadrat. Standard deviation of island averages are given in parentheses.

Marine Invertebrates (Scott Godwin)

Introduction

The purpose of the activities for OES-04-02 was to select sites surveyed during previous rapid ecological assessments for long term monitoring and expand the baseline for survey sites. Selection of sites was based on their year-round accessibility and their representation of the habitats present at each site. Surveys focusing on marine invertebrates other than corals were performed in conjunction with surveys of coral and macroalgae, collectively termed the benthic survey. This benthic survey was conducted

collaboratively with fish surveys. This report will cover the non-coral invertebrates encountered and from this point forward any mention of marine invertebrates will mean this particular group.

Methods

Quantitative counts for specific target marine invertebrates were done along two separate 2X25 meter belt transects. This was followed by two 10X25 meter quadrat surveys accomplished by swimming a zigzag search pattern. A quadrat survey was conducted in conjunction with both 2X25 transects, which were used as the reference line for the long axis. The counts from these two 10X25 quadrats were combined into a single 10X50 meter area.

Based on data from previous rapid ecological assessments, a group of target species was chosen for quantitative counts. The species in this list were chosen because they have been shown to be common components of the reef habitats of the central and southern Pacific, and they are species that are generally visible (i.e.; non-cryptic) and easily enumerated during the course of a single 50-60 minute SCUBA survey.

These target species were:

CNIDARIA

Zoanthids – rubber corals

Actiniaria - Anemones

ECHINODERMS

Echinoids – sea urchins

Holothuroids – sea cucumbers

Ophiuroids – brittle stars (generally cryptic but are visible in some cases)

Crinoids – feather stars

MOLLUSCA

Bivalves – ark shells, spondylid oysters, pearl oysters, tridacnid clams

Nudibranchs – sea slugs

Gastropods – snails

Cephalopods - Octopus

CRUSTACEA

hermit crabs, lobsters, large crabs and shrimp

Collections of species that cannot be identified in the field, and samples of coral rubble were brought back to the laboratory on the research vessel. The cryptic organisms found in the rubble are picked out and preserved and the sand samples are dried and bagged so they can be examined for micro-mollusks at a later date.

The marine invertebrate species recorded and identified during the course of the field operations for OES-04-02 represent the non-cryptic fauna of the reef habitat and **should not** be considered the only species present at each site. There is an abundance of other organisms, both cryptic and non-cryptic, that dwells in these habitats that are not included in the rapid assessment scheme, which will be included in a final species inventory at a later date.

Sample Sites

Manua Islands

Ofu, Olosega and Tau

Total Sites Surveyed: 18

SITEID	LOCAL DATE	LATITUDE	LONGITUDE	NOTES
OLO-01	2004-02-06	14' 10.142	168' 36.496	E side Olosega
OLO-04	2004-02-06	14' 10.878	169' 37.611	Off Olosega village
OLO-05	2004-02-07	14' 09.817	169' 37.464	N side, off Sili village
OFU-06	2004-02-07	14' 10.401	169' 40.883	W side Ofu, off Ofu village
OFU-03	2004-02-07	14' 11.820	169' 39.677	Off E end of runway (Ofu), fish and coral only
OFU-07	2004-02-07	14' 10.476	169' 38.855	Backreef, algae and invert only
OLO-06	2004-02-13	14' 11.228	169' 36.500	SE side Olosega
OFU-02	2004-02-13	14' 11.076	169' 40.561	W side Ofu, off W end of runway
OFU-08	2004-02-13	14' 10.271	169' 41.134	W side Ofu, off Ofu village, near Nuutele island
TAU-07	2004-02-04	14' 13.644	169' 25.104	N end of E side
TAU-02	2004-02-04	14' 15.060	169' 26.816	S side at Laufuti Stream
TAU-08	2004-02-04	14' 15.737	169' 28.485	SW side, Papautam Pt.
TAU-04	2004-02-05	14' 12.744	169' 26.442	W of airport on N. side
TAU-05	2004-02-05	14' 12.877	169' 29.404	N. side near Loto Pt.

TAU-09	2004-02-05	14' 14.734	169'	30.387	W side S of Tau Village
TAU-10	2004-02-12	14' 12.876	169'	28.084	Central N shore
TAU-11	2004-02-12	14' 13.026	169'	30.748	Faleasau Village
TAU-12	2004-02-12	14' 15.476	169'	30.026	A. Greene site

The sites surveyed at Ofu and Olosega represented a variety of fore reef and back reef habitats. With the exception of the site OFU-06 the condition of all sites appeared to be good. The OFU-06 site was in very poor condition due to damage from freshwater storm runoff from a past storm event. This site has experienced a complete phase shift away from a coral dominated community to an algae dominated community. All other sites surveyed had a typical balanced compliment of species. Tridacnid clam densities were variable and gastropods and sponges were the most common species at all sites.

Rose Atoll

Total Sites Surveyed: 13

SITEID	LOCAL DATE	LATITUDE	LONGITUDE	NOTES
ROS-01	2004-02-08	14' 32.370	168'	E side
ROS-02	2004-02-08	14' 33.088	168'	S. side
ROS-03	2004-02-08	14' 33.316	168'	S. side
ROS-21	2004-02-09	14' 33.485	168'	SW side, A. Green SE1 site
ROS-04	2004-02-09	14' 33.565	168'	West side
ROS-22	2004-02-09	14' 32.766	168'	A. Green NW1 site
ROS-23	2004-02-10	14' 32.533	168'	A. Green SE3 site
ROS-7P	2004-02-10	14' 32.969	168'	W. side, east of wreck site
ROS-05	2004-02-10	14' 33.249	168'	W. side, west of wreck site
ROS-06	2004-02-11	14' 32.187	168'	N. side
ROS-08	2004-02-11	14' 32.267	168'	Patch reef immediately inside channel
ROS-24	2004-02-11	14' 32.256	168'	Back reef W. of channel

upwelling. These measurements provide insight into such properties as chlorophyll concentration, light availability, and reflectance signatures of substrate.

4. Deep Water CTDs (max 500 m) and Acoustic Doppler Current Profiler (ADCP) transects circumnavigating each island, which provides information on overall oceanographic structure, including chlorophyll and dissolved oxygen, and circulation patterns.
5. Continuous recording of surface temperature, salinity and chlorophyll with the shipboard thermosalinograph and fluorometer.

Long term oceanographic monitoring is accomplished by deployment and retrieval of a variety of internally recording and near real-time telemetered instrument platforms.

These instruments include:

1. Coral Reef Early Warning System (CREWS) Buoys: Surface buoys measuring a number of meteorological and oceanographic parameters which telemeter data in near-real time.
2. Sea Surface Temperature (SST) Buoys: Surface buoys measuring high resolution water temperature which telemeter data in near-real time.
3. Wave and Tide Recorders (WTRs) measure spectral wave energy, high precision tidal elevation, and subsurface water temperature.
4. Subsurface Temperature Recorders (STRs) measure high resolution subsurface temperature.
5. Aanderaa Current Meters measure high resolution subsurface currents and temperature.
6. Satellite-tracked Surface Velocity Program (SVP) Drifters provide surface layer circulation information and water temperature which telemeter data in near real-time.

Oceanography Team operations during the period of February 3-February 13, 2004 on cruise OES0402 are summarized in the following tables:

Location	Shallow Water CTD Casts	Radiometer Casts
Ta'u	37	2
Ofu/Olosega	50	5
Rose Atoll	44	-
Total	131	7

Mooring Deployments and Recoveries				
Location	Mooring Type	Serial Number	Operation	Date
Tau	STR	3933179-1151	Deployment	04-Feb-04
Tau	STR	3933179-1152	Deployment	05-Feb-04
Tau	SST	306-025	Deployment	06-Feb-04
Tau/Ofu	SST	268-003	Recovery	07-Feb-04
Ole	STR	3933179-1149	Deployment	07-Feb-04
Ole	STR	3933179-1148	Deployment	07-Feb-04
Ofu	STR	3933179-1150	Deployment	08-Feb-04
Rose	CREWS	262-005	Recovery	08-Feb-04
Rose	CREWS	262-004	Deployment	08-Feb-04
Rose	Aanderaa	417	Recovery	09-Feb-04
Rose	STR	3933179-1047	Deployment	10-Feb-04
Rose	STR	3933179-1146	Deployment	10-Feb-04
Rose	STR	3933179-1147	Deployment	11-Feb-04
Rose	WTR	2633179-0364	Deployment	11-Feb-04
Rose	STR	3933179-1145	Deployment	11-Feb-04

Drifter Deployments/Recoveries OES0402		
Location	Argos ID	Date
Enroute to Manu'a from Tutuila	44769	2/3/2004
Outside of Rose Atoll	44767	2/8/2004

In addition to the above CTD casts, two CTD “tows” were performed in the shallow lagoon on the south side of Ofu Island, within the boundaries of the American Samoa National Park. They were performed by swimming a SBE19 while collecting GPS track points every five seconds. These two CTD tows were performed in roughly the same area on February 7 and February 13, respectively, but at very different stages of tide: the first near low tide and the second near high tide. Circulation within this lagoon is of special interest due to its high gradient of coral diversity and suggestions of potential freshwater inputs.

The Biospherical™ Profiling Radiometer casts are a new operation to the CRED oceanographic monitoring. This instrument required extensive preparation and bench

testing during the first part of the cruise; the first casts were performed from the deck of the *Sette* on Feb. 12. The first radiometer operations were performed from a small boat on Feb. 13. Data was successfully collected with no significant issues with either the instrument itself or the custom deck unit/PC. More deployments and data processing are needed until efficient protocols are established. Excessive instrument angles ($>10^\circ$) due to small boat drift and shadowing of the instrument by the small boat are currently minimized during deployments, but their relative effect on the data are unknown.

All previously deployed moorings were successfully recovered from their original locations, with the exception of SST buoy 268-003, which was recovered from the National Park Service personnel on Ofu. It had been removed by an unknown party from its original deployment location on the east side of Ta'u. Members of the mooring team met with the *pulenu'u* (mayor) of the village of Ta'u to discuss good locations for a replacement SST buoy at Ta'u. This is likely an important step in the deployment of surface moorings in American Samoa; involving, or at least informing, local villages on mooring deployments will likely increase to longevity of surface moorings.

The recovery of the Aanderaa RCM9 current meter in the reef pass at Rose Atoll required planning around tidal cycles. Currents in the pass appeared to be dependent on both wave heights and tides, with maximum outflow occurring around or just after high tide and minimum outflow occurring just after low tide. No occurrences of current flowing into the lagoon were observed and all but minimal outflows were much too strong for liftbag operations. The Aanderaa RCM9 mooring was recovered at just after low water, when currents were estimated at ~ 0.25 knots.

Both the recovered CREWS buoy and SST buoy anchors appeared to be in good condition, and may be serviceable for further deployments. They were replaced with new anchors anyway, though, since there are not yet 2+ year deployment histories for the anchor/mooring hardware.

STR deployments were co-located with REA long-term monitoring sites wherever possible. A small subsurface float was attached directly to the reef near the STR location to assist in locating the instrument in the future at most deeper deployment sites.

Preliminary Observations

Although most data has not yet been sufficiently processed and checked for quality and biases, some inferences can be made. CTD casts showed surface water temperatures to be $\pm 0.3^\circ\text{C}$ of the monthly Pathfinder climatological values for February. CTD casts at Rose Atoll indicated much higher stratification within the lagoon than outside the lagoon, with an apparent lens of much lower salinity, lower temperature water over the west/center region of the lagoon, apparently associated with heavy rainfall during the data collection period. This supports hypothesized localized convergence in this area of the lagoon, as do observations recorded in 2002 of anomalously high temperature water during different meteorological conditions.

CTD "tows" through Ofu's lagoon yielded different data at different tidal stages. The salinities were very uniform throughout the area sampled during the higher tide; greater differences are apparent in the data collected at a lower tidal stage; with many signs of freshwater input, e.g. distinct areas of relatively lower salinity (33ppt vs. 35ppt) and lower temperature (29.5°C vs. 30°C). Higher overall temperatures were observed during the higher tide, likely due to meteorological conditions (it was a hotter, sunnier

day), than during the lower tide, evidence of the lagoon's dependence on prevailing meteorological conditions.

Almost 2 full years of data were recovered from the Aanderaa RCM9 current meter moored in the pass at Rose Atoll during CRED surveys in 2002. The overall mean velocity observed during this period was 52 cm/s (approximately 1 knot) outflow from the lagoon. Maximum recorded outflow is 166 cm/s while maximum inflow is only 50 cm/s. Although patterns of velocity sometimes followed a mixed/diurnal tidal cycle, overall flow was dominated by out flowing currents, with long periods of time (up to weeks) with no observed inflow. This further supports the hypothesized convergence from the CTD data and allows for further supposition that inflow is primarily from gravity wave overtopping and wave set-up along the reef crests of the atoll.

Habitat Mapping Team & Nighttime Operations (John Rooney, Megan Moews, Joyce Miller, Scott Ferguson, Bruce Appelgate, and Erin Duribi)

Night operations conducted during the period February 03-14, 2004 on cruise OES0402 have included Towed Optical Assessment Device (TOAD) deployments, QTC (benthic acoustic signature) data collection, acoustic doppler current profiler (ADCP) transects, and conductivity, temperature and depth (CTD) casts. TOAD deployments have generally been conducted between 1830 and midnight to minimize interfering with small boat-dependent daytime operations and overhead costs for required shipboard personnel after midnight. These have been followed by ADCP transects and CTD casts. CTD casts to 500 m were done along ADCP tracks that form a box around the island or atoll. A table summarizing night operations data collected on cruise OES0402 follows:

Location	No. TOAD deployments	No. Still Photos	No. Video segments	QTC Files	km of ADCP	CTD casts
Manua Islands	25	0	25	22	282	8
Rose Atoll	0	0	0	0	157	12
Total	25	0	25	22	439	20

TOAD deployments at the Manua Islands were challenging due to the steep bathymetry surrounding them, which was also exacerbated by offsets in the charted positions of the islands in the Nobeltec navigation software. Fortunately, the R/V *AHI* was able to conduct multibeam surveys between depths of approximately 20 m and 100 m prior to our operating around Ofu and Olosega Islands. They provided us with screen grabs for areas of particular interest of initial survey results overlain on more recent charts in which the offset has been corrected. These proved to be particularly useful tools for planning TOAD deployments.

At Rose Atoll there were no areas shallow enough to safely deploy the TOAD, that were not more effectively covered by the towboard team. Night operations were

therefore limited to CTD casts and ADCP lines. A drifter buoy was deployed southeast of Rose, another was deployed 6 km southwest of Tau Island, while a third was released between Tutuila and the Manua Islands.

All ADCP data collected during this leg is unfortunately suspect. There appear to be shorts in the ADCP, in the cabling or within the transducer itself. Some of the data may be recoverable. We also had continued problems with the CTD winch. The Senior Survey Tech, Phil White and Electronics Technician, John Skinner, put together and re-terminated a different CTD which was deployed from a winch above the longline pit.

Eight CTD casts were conducted to a depth of 500 m around the Manu'a Islands and 12 around Rose Atoll. Two CTD's to 100 meters were conducted at Ofu and Olosega immediately after radiometer casts. CTD profiles around the Manu'a Group were characterized in general by chlorophyll maximums that coincided with temperature decreases, salinity increases and dissolved oxygen decreases at approximately 100 meters. CTD profiles at Rose Atoll differed from the Manu'a Group profiles in that the temperature profile suggests a mixed layer to a depth of approximately 40 m, followed by a gradual and linear decline in temperature with increasing depth, with no distinct thermocline. Profiles from the fluorometer, dissolved oxygen and salinity sensors showed that the chlorophyll maximum occurred along with a salinity increase and a drop in dissolved oxygen at approximately 150 meters rather than a distinct thermocline.

Around all of the islands, and particularly Rose Atoll, shallow depths appear to be dominated by encrusting coralline algae, with coral becoming more prominent at deeper depths, which is a typical of areas experiencing coral bleaching events. We were also surprised at the lack of fish around the Manu'a Islands. The benthic topography was often rough-textured, with many holes and overhangs that could provide shelter. In other areas we have typically seen increases in fish density. Heavy fishing pressure, particularly from gill nets, has been suggested to explain The relative lack of fish around these islands is not easily explained due to lack of accurate information about the level of fishing activity. There have been some unsubstantiated suggestions of gill net fishing in the area.

Multibeam Benthic Habitat Mapping Aboard the R/V *AHI*

Multibeam benthic habitat mapping operations were conducted in the Manu'a group of American Samoa at Ofu, Olusega, and Ta'u Islands during the first two weeks of OES0402. The R/V *AHI* was offloaded from the NOAA Ship *Oscar E. Sette* in Pago Pago Harbor on Friday, Jan. 30, 2004, and transited from Pago Pago to Ofu Harbor in tandem with the R/V *Oscar E. Sette* on Feb. 3, 2004. Diesel fuel for the *AHI* operations was delivered to Ofu by the M/V *Manu'atele* on Feb. 4 and multibeam survey operations began that afternoon. The R/V *AHI* returned to Tutuila Island in tandem with the NOAA Ship *Oscar E. Sette* on Feb. 14, 2004. Scott Ferguson and Joyce Miller conducted all survey operations from Feb. 3-13. On Feb. 13 Joyce Miller reported aboard the *Sette* and John Rooney joined the *AHI* for transit to and multibeam surveys around Tutuila.

Daily operations included an initial CTD cast using a SeaBird SeaCat CTD; casts were done to approximately 150m in water depths of 170 to 300+ meters; a total of 6 CTD's were done. Multibeam surveys were conducted using the *AHI's* 240 kHz Reson 8101ER multibeam sonar coupled with a POS/MV GPS aided inertial navigation and motion sensor. Real-time corrections were made for all ship motion and predicted tides,

and the sound velocity profiles derived from the CTD casts were entered daily. Observation during real-time operations showed few offsets in the data, indicating no known problems with motion correction, sound velocity and predicted tide corrections.

From Feb. 4 – 12, approximately 48 hours of multibeam survey were conducted in water depths ranging from ~5 to 300+ meters. Approximately 24 sq. n.m. of seafloor were surveyed, resulting in a survey efficiency rate of ~0.5 sq. n.m./hr. Areas of particular interest, including American Samoa National Park on the south shore of Ofu Island and the southwest end of the airstrip on Ofu that is being evaluated for runway extension were thoroughly surveyed to depths as shallow as 5 meters. All areas were surveyed to a depth of at least 200m and coverage to 300 m was possible in many areas. In addition to Ofu, Olusega, and Ta'u Islands, a submerged volcanic ridge between Olusega and Ta'u was surveyed in depths of 40 to 300m. Existing nautical charts (NOAA Chart 83484) for Ofu, Olusega, and Ta'u include very little information about water depths less than 100 fm; therefore initial survey lines around each island were conservatively run in 50-100m water depths to establish a baseline. In some cases as few as three lines were needed to map between 20 and 250 m, due to the steep slope around Ta'u in particular. Ofu and Olusega proved to have broader "shoulder" areas between 5 and 100 meters and an average of 6 passes were needed to map these islands down to an average of 250m.

Preliminary processing and noise removal was completed for 1 ½ days of survey data (JD 036 and 037). Two full backups of the data were made. All data were returned to Tutuila where the two *AHI* computers have been installed. During *AHI* operations in the Manu'a group, two team members from the University of Hawaii, Bruce Appelgate and Erin Diurba, set up the processing system and continued analysis of survey data previously collected in CNMI and Guam in 2003.

RECORDS:

The following forms, logs, charts, and data records were kept and given to the Pacific Islands Fisheries Science Center upon termination of the cruise. These include all data captured onto computer storage media during the cruise. All the records are filed there unless indicated otherwise in parentheses.

QTC acoustic seabed classification data
 TOAD digital video tapes (VHS & MDV)
 ArcView GIS track files and shape files
 ADCP DOPPLER ping data files on CD-ROM*
 CTD Station Data Log Sheet
 Seabird CTD data files on CD-ROM*
 Digital camera photos (JPG file format) on CD-ROM*
 Marine Operations Log
 Project Area and Operations Chartlets
 Scientist's Log
 SCS data files (raw & compressed) on CD-ROM*
 Station Number and Activity Log

* All data files together on the same (1) CD-ROM

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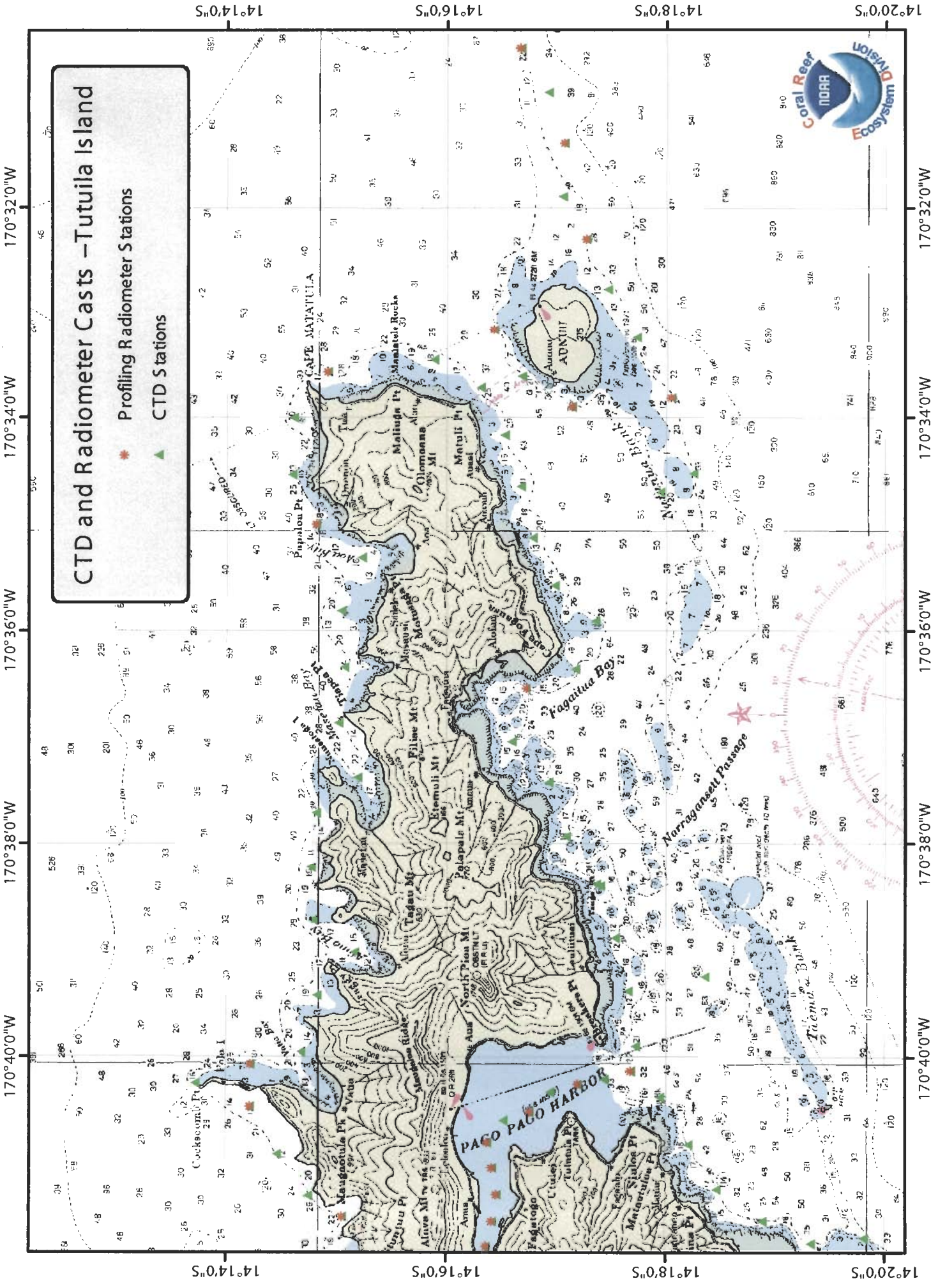
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CTD and Radiometer Casts – Tutuila Island

★ Profiling Radiometer Stations

▲ CTD Stations



170°40'0"W

170°38'0"W

170°36'0"W

170°34'0"W

170°32'0"W

14°20'0"S

14°18'0"S

14°16'0"S

14°14'0"S

170°40'0"W

170°38'0"W

170°36'0"W

170°34'0"W

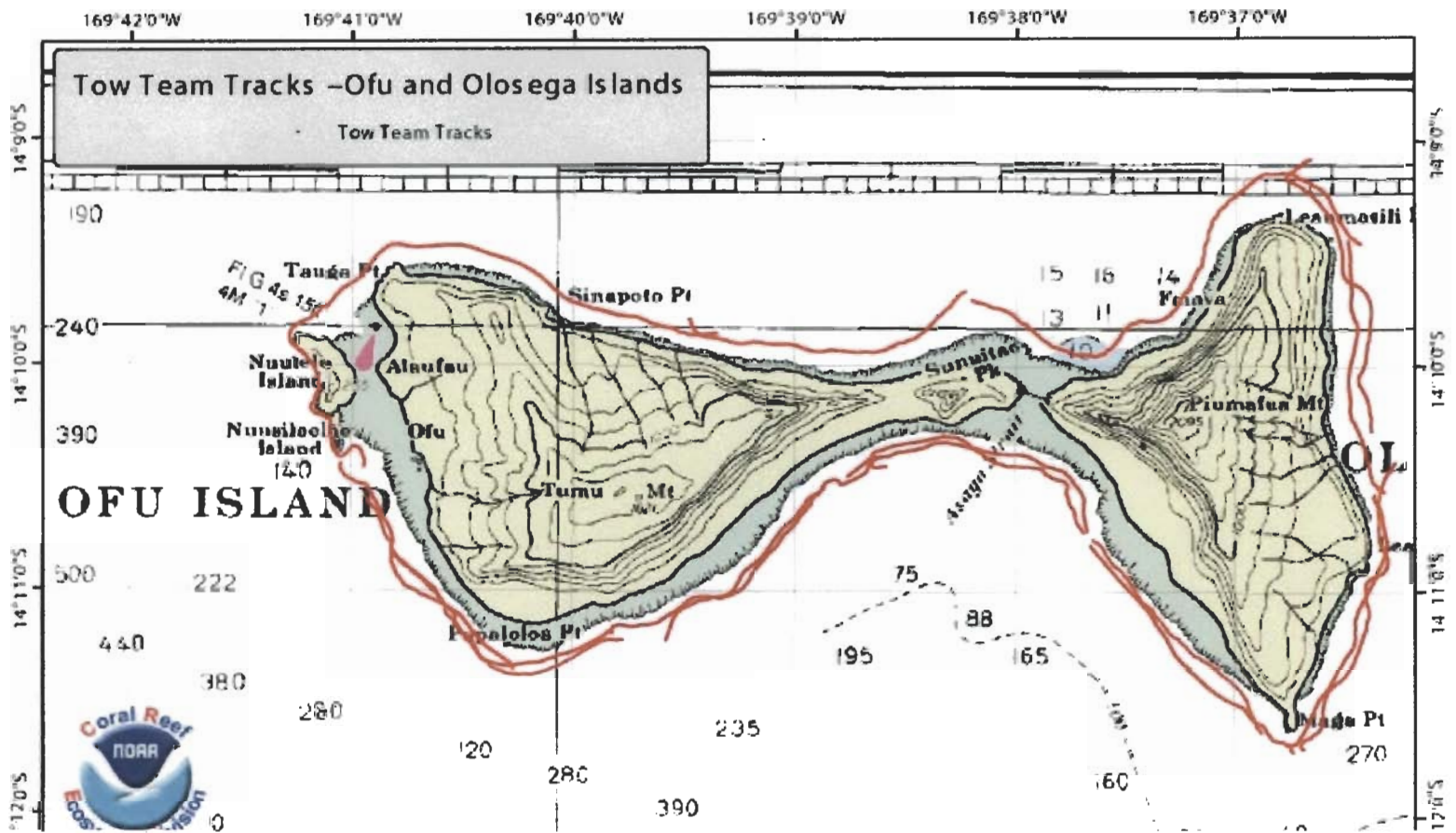
170°32'0"W

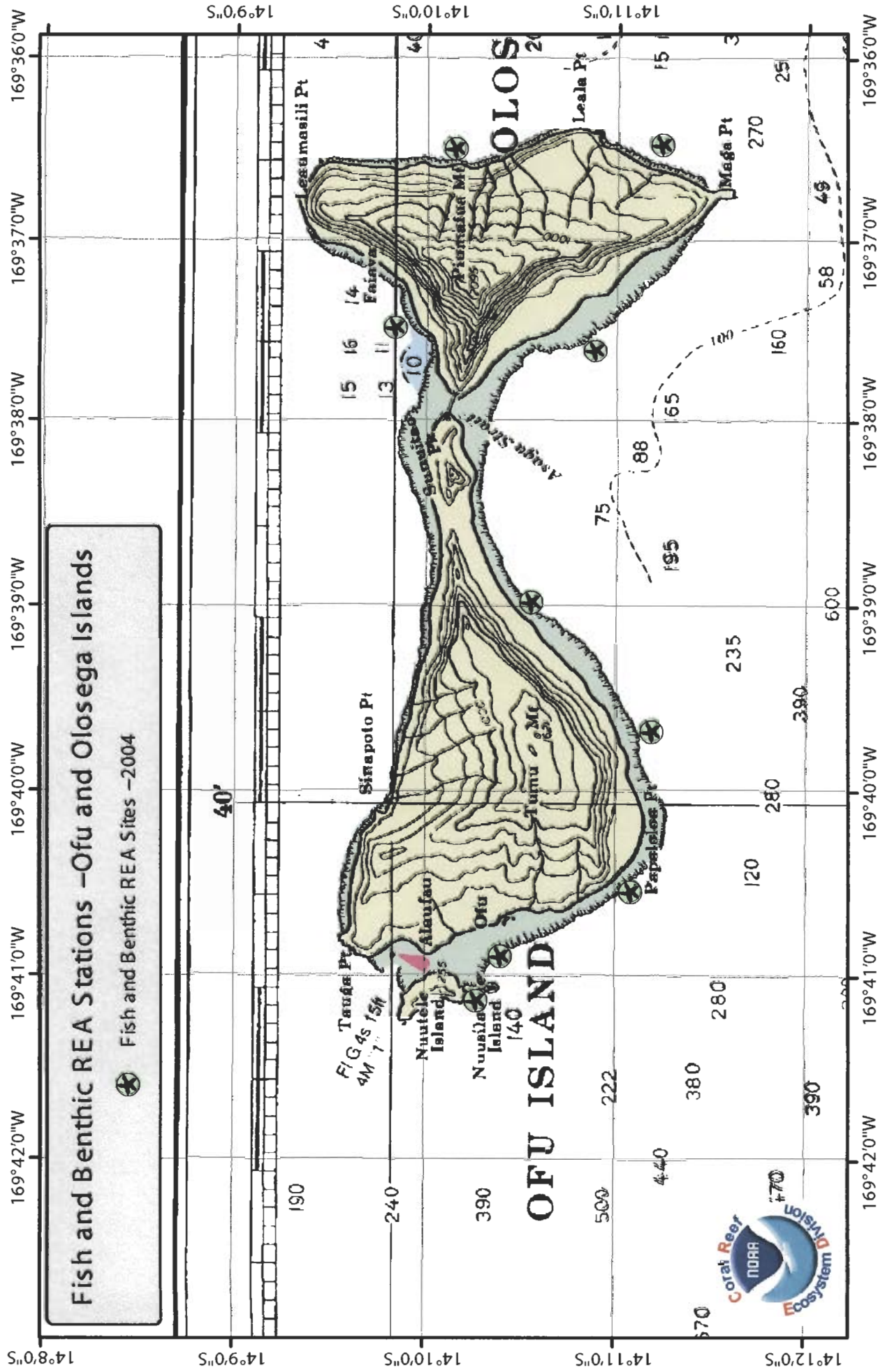
14°20'0"S

14°18'0"S

14°16'0"S

14°14'0"S





Fish and Benthic REA Stations –Ofu and Olosega Islands
 ⚡ Fish and Benthic REA Sites –2004



