



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE/NOAA FISHERIES

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CRUISE REPORT¹

VESSEL: *Townsend Cromwell*, Cruise 00-11 (TC-261)

CRUISE PERIOD: 08 September-06 October 2000

AREA OF OPERATION: Northwestern Hawaiian Islands (NWHI)

TYPE OF OPERATION: Personnel from the Coral Reef Ecosystem Investigation, Honolulu Laboratory, National Marine Fisheries Service, NOAA, conducted reef assessments/monitoring in waters surrounding the NWHI.

ITINERARY:

08 September Departed Honolulu.

09 September Arrived Nihoa Island. Conducted two towed-diver digital video habitat surveys/fish counts (~6 km) along E, S and W shores. Conducted one complete (fish and benthic) rapid ecological assessment (REA) along W side. Conducted a second fish assessment along SW side. Conducted one remote-sensing ground-truth dive. Disembarked Flint/Nishida and established short camp on Nihoa.

10 September Arrived Necker Island. Conducted four towed habitat surveys/fish counts around entire island (~10 km). Conducted three complete REA dives along S and W sides. Completed three remote-sensing dives. Conducted Necker conductivity-temperature-depth (CTD).



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- 11 September Conducted French Frigate Shoals (FFS) CTD. Arrived N anchorage FFS. Conducted four towed habitat surveys/fish counts along NE outer barrier reef and patch reefs of the N lagoon interior (~12km). Fish team conducted two dives to intercalibrate between NWHI Coral Reef Assessment and Monitoring Program (NOW-RAMP) fish assessment protocols and reef fish assessment protocols of DeMartini and Parrish used at FFS and Midway since 1992. Benthic team conducted two REAs in the vicinity of fish calibration surveys. Off-loaded four pallet loads of supplies to U.S. Fish and Wildlife Service (USFWS) Tern Island field station.
- 12 September Conducted five towed habitat surveys/fish counts along ENE and N outer barriers (~13 km). Fish team conducted three additional fish assessment intercalibration dives. Benthic team conducted three REAs near the fish assessment sites.
- 13 September Conducted three towed habitat surveys/fish counts along E inner barrier, East Island W side, and around La Perouse Pinnacles (~10 km). The tow vessel experienced significant outboard motor problems (Honda 75 had to be replaced with Honda 50). Three benthic and fish REAs were completed in the central portion of FFS. The remote-sensing team surveyed the outer barrier, conducted shallow water CTDs every 2 nautical miles (nmi)..
- 14 September Conducted three towed habitat surveys/fish counts along interior patch reefs and along the inner barrier of the Gin Islands (~9 km). The tow vessel experienced significant outboard motor problems using the spare engine (Honda 50). The benthic and fish teams completed three REAs at the south central portion of the atoll. Remote-sensing team joined the benthic team.
- 15 September Conducted five towed habitat surveys/fish counts along outer barrier, SE and S and southern interior patch reefs (~12 km). The fish, benthic and remote-sensing teams completed three REAs along S portion of FFS.
- 16 September Conducted one towed habitat survey/fish count around Gardner Pinnacles in large NW swell (~12-15 ft) (~3 km). High swell and surge, low visibility prevented fish and benthic teams from working.
- 17 September Conducted Maro Reef CTD. Arrived Maro Reef. Conducted five towed habitat surveys/fish counts along reef spurs of S end of Maro Reef (~14 km). Benthic, fish and remote-sensing teams conducted three REAs at S end of Maro Reef.

- 18 September Conducted four towed habitat surveys/fish counts along N and central reef spurs at Maro Reef (~12 km). Benthic, fish and remote-sensing teams conducted three REAs in central Maro Reef.
- 19 September Conducted four towed habitat surveys/fish counts along S and central reef spurs at Maro Reef (~11 km). Benthic, fish and remote-sensing teams conducted three REAs in S central Maro Reef.
- 20 September Conducted four towed habitat surveys/fish counts along NW and W reef spurs (~12 km). Benthic, fish, and remote-sensing teams conducted two REAs along NW portion of Maro Reef. Large NW and SW swells prevented work in some areas.
- 21 September Conducted Laysan CTD. Arrived Laysan Island. Conducted six towed habitat surveys/fish counts around all of Laysan Island (~15 km). Benthic, fish and remote-sensing teams conducted three REAs at N and E sides of Laysan. Provided water and supplies to USFWS personnel on Laysan.
- 22 September Conducted Lisianski CTD. Arrived Neva Shoals/Lisianski Island. Conducted four towed habitat surveys/fish counts along E and SE sides of Neva Shoals (~12 km). Benthic, fish and remote-sensing teams conducted two REAs.
- 23 September Conducted four towed habitat surveys/fish counts along NE and N sides of Neva Shoals/Lisianski Island (~11 km). Fish, benthic and remote-sensing teams conducted three REAs. Departed Lisianski Island en route to Midway Atoll to effect repairs to ship's service diesel generators by picking up contracted electrician. Departure estimated to result in 2 days of lost production time.
- 24 September In transit to Midway. Arrived at Midway at 1600 and departed Midway at 1900. Ship proceeding to Pearl and Hermes Reef.
- 25 September Arrived Pearl and Hermes Reef. Conducted six towed habitat surveys/fish counts around NE and E outer barriers (~17 km). Fish, benthic and remote-sensing teams conducted three REAs of NE and E outer barrier.
- 26 September Conducted six towed habitat surveys/fish counts around SE and S outer barrier and central lagoon (~17 km). Fish, benthic and remote-sensing teams conducted three REAs in E and S lagoon interior and S outer barrier.
- 27 September Conducted five towed habitat surveys/fish counts of W and SW outer barrier and W open lagoon interior (~15 km). Fish, benthic

and remote-sensing teams conducted two REAs in W and central lagoon interior. Departed for Lisianski Island and Neva Shoals.

- 28 September Arrived Lisianski/Neva Shoals. Conducted four towed habitat surveys/fish counts along W and SW portion of Neva Shoals (~12 km). Fish, benthic and remote-sensing teams completed two REAs of SW Neva Shoals. High NW swell caused high surge and low visibility.
- 29 September Conducted three towed habitat surveys/fish counts along NW and W sides of Lisianski Island (~9 km). Fish, benthic and remote-sensing teams conducted one REA near Lisianski Island. Continued low visibility and squally weather hampered all teams. Departed Lisianski en route to Midway Islands to disembark contractor electrician hired to troubleshoot generator problems.
- 30 September In transit. Arrived Midway at 1700 to disembark electrician, crew member, and scientist Matt Dunlap and pick up parts for generators and small boat engines. Departed Midway at 1930 en route to Pearl and Hermes Reef.
- 01 October Arrived Pearl and Hermes Reef. Conducted two towed habitat surveys/fish counts along NNW outer barrier reef (~5 km). Experienced problems with outboard motor of towing vessel. Fish and benthic teams completed three REAs of W, SW and S outer barrier reefs. Departed Pearl and Hermes Reef en route to Kure Atoll.
- 02 October Arrived Kure Atoll. Conducted six towed habitat surveys/fish counts along NE, N, NW, W and SW outer barrier reefs (~18 km). Fish, benthic and remote-sensing teams completed three REAs along N, NW and W sides of outer barrier.
- 03 October Conducted six towed habitat surveys/fish counts along E, SE, S and SW outer barrier and western entrance into the lagoon (~17 km). Fish, benthic and remote-sensing teams completed three REAs along E and S outer barriers and in the lagoon.
- 04 October Conducted four towed habitat surveys/fish counts along the inner barrier of NE and N sides and over patch reefs of the lagoon interior (~14 km). Fish, benthic and remote-sensing teams completed three REAs in the inner barrier and interior lagoon. Departed Kure en route to Pearl and Hermes Reef. Conducted CTD off Kure.
- 05 October Arrived Pearl and Hermes Reef. Conducted five towed habitat surveys/fish counts along the NW and SE outer barriers and NW reef flat (~15 km). Fish, benthic and remote-sensing teams

conducted three REAs of NW and SE outer barriers and SE inner barrier and reef flat. Departed Pearl and Hermes Reef en route to Midway Atoll. Conducted CTD off Pearl and Hermes Reef.

06 October Conducted CTD off Midway Atoll. Arrived Midway Atoll. Fish team conducted intercalibration surveys between time series protocols at Midway and REA protocol. End of cruise.

MISSIONS AND RESULTS:

63	Rapid Ecological Assessments of corals, fish, algae and invertebrates.
4	Additional reef fish assessment to calibrate protocols.
105	Towed diver digital video habitat surveys/fish counts/temperature-depth transects (~301 km).
215	Hours of digital video footage.
31	CTD stations.

Benthic Team Mid-Season Update:

To date, the benthic team has collected data at 38 different sites (Nihoa = 1, Necker = 3, French Frigate Shoals = 15, Maro Reef = 11, Laysan = 3, Lisianski = 5). Because of the time required for the post-dive processing of material, invertebrate data has been collected at only 30 sites. All sites ranged in depth from 10 ft to 60 ft and most had hard bottoms; a few soft bottom sites have been investigated, but at this time, soft bottom sites have been disproportionately sampled. Methodologies for the benthic team have focused on specimen collection (invertebrates and algae) and/or infield data acquisition (coral and macroinvertebrates) with the goal of acquiring a comprehensive catalogue of species diversity and relative abundance.

No final data are available, but preliminary observations suggest each location has a diverse and different flora and fauna. For invertebrates, high diversity of macroinvertebrates was observed at French Frigate Shoals while Maro Reef had a depauperate echinoderm and macroinvertebrate fauna. In general, the flora and fauna of Maro Reef was unusual compared to other sites. Nearly every Maro Reef site had low coral cover and high cover of algal turf compared to other sites. This may be related to its depauperate urchin fauna. Laysan had an unusual algal flora compared to the other islands; several forms/species were collected at Laysan that had not been seen at previous sites. Coral diversity and cover at Lisianski was high relative to other locations.

After several difficulties with faulty equipment, Daria Sciliano (Hyperspectral Team) has managed to collect an entire suite (both hyperspectral signatures for her library and water column data) of usable data at Lisianski. At other sites, she was only able to obtain limited hyperspectral signatures for her library. Poor water conditions and equipment difficulties at Maro Reef limited her ability to acquire data. Her problems have been solved, however, and, she should be able to collect more data at future sites.

**SCIENTIFIC
PERSONNEL:**

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Attachments

Appendix A: Benthic Habitat Log

Nihoa-1 (lat. 23° 03 3 N, long. 161° 05 8 W)
9 September 2000 (2:05 pm)

Dove off leeward side of Nihoa. Maximum depth of 55 ft in a boulder/rubble field. Area obviously receives considerable wave action at some time of the year because of the lack of small boulders and sand. Large boulders are predominately of terrigenous origin (basalt) and any sand present is at least half calcareous and half basalt. Boulders were covered with a thick algal turf. Even though it appeared to be a prime site for cone snails, there were surprisingly few: only a single individual of *Conus lividus* (juvenile) was crabbed. Large invertebrates were relatively rare overall, with only *Linckia multifora*, *Echinometra mathaei*, and *Echinostrephus aciculatus* being common. A large *Octopus cyanea* was also observed on the dive by Dan Van Ravensway. A specimen of *Pteraeolidia ianthina* was collected by Karen Geisler. Rubble and two bags of sand were collected which yielded a variety of small invertebrates, with a large number of crabs and alpheid shrimp. Numerous encrusting sponges were also observed on shaded portions of the boulders and within dead *Porites* heads. Only one dive was conducted by the benthic team at Nihoa (two were done by the fish team) for logistic reasons associated with the remote censusing team.

Nihoa-2
9 September 2000

No dive or specimens.

Necker-3 (lat. 23° 34 4 N, long. 164° 42 3 W)
10 September 2000 (10:20 am)

Dove off Necker Island in about 35 ft of water. Bottom was scoured pavement with rubble filled depressions. Area receives some scour; most of the algae are short turf. Clumps of large macroalgae were present and some were collected for an invert wash. Depressions housed fist-sized rubble, which consisted of well worn rocks. There was an obvious lack of branching corals in the area, but one dead *Porites* head was collected. *Echinothrix diadema* and *Echinometra mathaei* were common, particularly the diadema. The pavement was a good cone habitat and yielded several live and dead cone shells. Numerous sponges were observed at this site and rubble, two bags of sand, and collection of macroalgae were sampled for invertebrates.

Necker-4 (lat. 23° 34 7 N, long. 164° 42 4 W)
10 September 2000

This dive was conducted by Matt Dunlap. Collections of rubble and two bags of sand were returned to the *Cromwell* for processing. Dive site was relatively deep at 50 ft and was a spur and groove type of habitat. A pin cushion star, *Culcita novaeguinea*, was collected with an associated *Periclemenes* shrimp. Substrate had slightly more coral

coverage than Necker-3, but still did not exceed 15%. Two small *Acropora* tables were observed.

Necker-5 (lat. 23° 34 4 N, long. 164° 41 4 W)
10 September 2000

This dive was also conducted by Matt Dunlap. Collections were again made of rubble and a single bag of sand. The plankton mesh bag was not taken on the dive, however, therefore rubble was collected in a standard mesh bag, so many of the smaller invertebrates may have been lost. Matt collected a dead (but intact) *Porites* head, which yielded a nice assortment of invertebrates. *Echinometra mathaei* was relatively common on the shallow (30 ft) surge-swept pavement.

French Frigate Shoals-6 (lat. 23° 52 5 N, long. 166° 18 28 W)
11 September 2000 (12:01 pm)

Dove off the west side of Tern Island in a spur and groove zone. Maximum depth was approximately 40 ft with a moderate current and some surge. Our transect ran over the top of a spur into a sand channel, with the top of the spur in 15 ft of water. Because of problems with the second transect line and the current, only one transect was laid and surveyed by Dan. Spur was scoured pavement with encrusting *Porites*. Several areas of dead coral yielded a nice matrix to contain inverts, but because of the surge, collecting was difficult. *Echinostrephus aciculatus* was common. In addition to rubble, two bags of sand were collected from the sand channel at the base of the spur.

French Frigate Shoals-7 (lat. 23° 52 0 N, long. 166° 18 28 W)
11 September 2000 (4:20 pm)

Dove off west side of Tern island a short distance south of FFS-6. Maximum depth about 30 ft. A spur and groove environment with very little current or surge, making it a pleasant dive. Numerous invertebrates were collected and two bags of sand with a high percentage of micromolluscs (or so it appears) were collected from different sand channels. The nudibranch *Halgardia terramtuensis* was collected. Pavement areas on spurs yielded several individuals of *Conus*. Additionally, a diversity of *Cerithium*, *Trivia*, and *Drupella* was collected from the site. Several holothurians were present (including a *Balcis* parasitized *Holothuria atra*). *Echinostrephus aciculatus* was also present. Unlike at other sites, *Echinometra* was relatively rare: only two individuals were observed near the end of the dive.

French Frigate Shoals-8 (lat. 23° 47 38 N, long. 166° 13 59W)
12 September 2000 (am)

North side of the atoll, east of Tern Island and north of Trig Island. Maximum depth approximately 50 ft. Spur and groove habitat, with moderate coral cover. Low surge made for a nice dive. Numerous *Echinostrephus aciculatus* in the area. One very large individual of *Acanthaster planci* was also observed. In addition to rubble, two bags of sand were collected.

French Frigate Shoals-9 (lat. 23° 52 9 N, long. 166° 15 1 W)
12 September 2000 (am)

North of Tern Island in approximately 45 ft of water. A spur and groove habitat with some surge, very little sand in the channels. Coral cover relatively low, with considerable exposed reef rock. Mollusk abundance and diversity very high, with *Turbo sandwichensis* and numerous *Conus* species were very common. In addition, *Echinostrephus aciculatus* was abundant and *Polythea caecia* (anthozoan) was common. Also observed on the dive was one *Scyllarides haanii* (observed by Karen Geisler) and floating near the surface were the jellyfish *Pelagia noctiluca*. In addition to rubble, one bag of sand was collected.

French Frigate Shoals-10 (lat. 23° 52 9 N, long. 166° 15 8 W)
12 September 2000 (am)

Dove near Shark Island to the west of Tern Island with a maximum depth of approximately 30 ft. This site was in a similar area as FFS-7, but not as nice a dive. Surge was low, and habitat seemed to be more patchy. We dropped in on a sand/rubble patch. Found two tests of the heart urchin *Brissus latecarinatus* in the sand. Sand had a high shell-to-grain ratio, and only one bag was collected in addition to rubble. Search of the sand revealed no common sand dwelling mollusks, but surge in the area most likely obscured trails, even though a thorough search of the habitat revealed no sign of *Terebra*, *Nassarius*, or *Conus pulicaris*, the most common sand dwelling shells in the main islands. Other common animals were *Linkia multifera* and *Echinostrephus aciculatus*. *Holothuria atra* was the most common sea cucumber, but holothuroids were relatively rare overall. No cucumbers were observed in the sand, which is also unusual.

French Frigate Shoals-11 (lat. 23° 47 7 N, long. 166° 94 97 W)
13 September 2000 (am)

Dove in a back reef area on the east edge of French Frigate Shoals. Long boat ride and we got separated from the fish group. Dive was in 15 ft of water with high surge pavement environment with cemented down rubble washed from the reef crest. Many echinoderms sighted, the highest diversity seen yet at any island. *Echinometra mathaei* was the dominant organism on the reef. Also present in good numbers were large burrowing anemones, possibly *Heteractis* sp. Brittlestars, including *Ophiocoma erinaceus*, *O. pica*, and *O. brevipes* were also present in large numbers. One bag of sand, rubble, and one clump of a red, slightly calcified algae were collected from the site.

French Frigate Shoals-12 (lat. 23° 47 326 N, long. 166° 13 198 W)
13 September 2000 (am)

Patch reef near East Island. Maximum depth, approximately 45 ft, but most of the dive was shallower (around 20 ft). Reef was interesting in that the coral was heavily eroded by bivalves, especially *Arca ventricosa* and *Chama iostoma*. These two bivalves were the most common organisms at the site. The holothurian *Actinopyga obesa* was observed for the first time. In addition to rubble, one bag of sand was also collected.

French Frigate Shoals-13 (lat. 23° 43 957 N, long. 166° 10 375 W)
14 September 2000 (am)

Dove on a patch reef in the vicinity of the Gin Islands. Maximum depth was approximately 30 ft. Water visibility was very poor, and the reef was heavily bio-eroded and covered with fine turf algae and blue-greens. The calcium carbonate rock was chalky and soft. Sand patches with moderately coarse sand surround the patch reef, and an extensive search turned up only two sand crabs (same species). Surprisingly, no sand mollusks were found, especially when the habitat appeared to be ideal for *Terebra* and *Conus pullicaris*. This is unusual. I spent nearly 30 minutes searching the sand for these animals, so inadequate search time does not seem to account for the lack of these species in the area. Sand patches were subject to currents, and also seemed to lack conspicuous worm fauna, which may account for the lack of these species. Moderately high energy may account for the lack of a diverse sand fauna. In addition to rubble, one bag of sand was collected.

French Frigate Shoals-14 (lat. 23° 44 691 N, long. 166° 10 363 W)
14 September 2000 (am)

I did not make this dive. Environment was an emergent reef to the west of Gin Island and was very shallow. Most of the area surveyed was less than 15 ft deep. An interesting barnacle was collected which, according to Dan VanRavenswaay, formed an extensive coating in the shallow. The barnacle was heavily crusted with calcareous algae, which made identification impossible. A specimen was preserved for laboratory identification. No rubble was collected, but Karen Geisler collected one bag of sand.

French Frigate Shoals-15 (lat. 23° 46 107 N, long. 166° 15 689 W)
14 September 2000 (am)

Dove off the basalt island called La Prouse. An impressive dive with coral bommies and unusual formations, the most interesting of which was a mushroom-shaped coral outcrop. A cave with a white tip shark and two large ulua was also at the site. A bag of sand was collected from inside the cave in our search for cave bivalves. Other fauna in the cave, however, did not appear to be any different from that growing outside. The cave was not large, so the environment may not have been sufficiently different to allow the development of unique fauna. Common invertebrates at this site included a purple demospongia and *Echinostrephus aciculatus*. Present in large numbers on the rocks, especially in the cave, was the nudibranch *Pteraeolidia ianthina*. This nudibranch was perhaps the most common invertebrate at the site. In addition to two bags of sand, rubble was collected that yielded a nice diversity of invertebrates, including several new finds for me on this trip.

French Frigate Shoals-16 (lat. 23° 38 265 N, long. 166° 10 768 W)
15 September 2000 (am)

Dove south of Disappearing Island in approximately 50 ft of water. Bottom had moderately high coral cover, interspersed with rubble and a few sandy patches.

Invertebrates at this site were cryptic, as few large echinoderms were present. Of note, however, was *Echinothrix calamaris*, the first time I have recorded this species in the NWHI. Also present at this site was *Actinopyga obesa*, a cucumber that has been relatively uncommon. In addition to some rubble, a single bag of sand was collected from this sight.

French Frigate Shoals-17 (lat. 23° 38 894 N, long. 166° 09 311 W)
15 September 2000 (am)

This shallow water site (10-20 ft depth) had very high surge, making collections difficult. The pavement was scoured and, as expected, inhabited by numerous *Echinothrix diadema*. Some small specimens of *Echinometra mathaei* were also present, but were relatively rare compared to *Echinothrix*. The high scour pavement should have been a good habitat for cone snails, but none were observed. This may be the result of the difficult collecting conditions present at the sight. In addition to some rubble, a single bag of coarse sand was collected from this sight.

Additional French Frigate Shoal invertebrates (observed by other divers): *Conus stiatius*, *Charonia tritonis*, *Diadema paucispinum*, *Alpheus deuteropus*

Maro-18 (lat. 25° 20 4 N, long. 170° 29 65 W)
17 September 2000 (am)

Dove off the southeast end of Maro Reef in approximately 50 ft of water. Bottom had good coral cover and fairly high diversity. Macroinvertebrates were rare, especially echinoderms. Only a few individuals of *Echinostrephus aciculatus* were observed. A single individual of *Diadema paucispinum* was also seen--a first for me on this trip. *Acra ventricosa* was also common. No sand was in the dive region, so only rubble was collected. This area was rich in sponges. During the safety stop, a dozen Galapagos sharks showed up and circled us.

Maro-19 (lat. 25° 21 245 N, long. 170° 32 226 W)
17 September 2000 (am)

Dove off the southeast end of Maro reef near some shallow water, where almost-emergent reef was seen. Maximum depth was approximately 20 ft. Area had high surge and moderate coral cover. As with Maro-18, macroinvertebrates were rare, and echinoderms were practically absent. Only a few individuals of *Echinometra mathaei* and *Echinostrephus aciculatus* were present. This area had a lot of sponge growth on the undersides of the rubble. One bag of sand was collected along with rubble and a clump of *Halimeda*.

Maro-20 (lat. 25° 25 859 N, long. 170° 32 520 W)
18 September 2000 (am)

Dove near the north end of Maro Reef. Maximum depth approximately 30 ft. Visibility very poor at this site. Site had coral bommies with sand patches and channels. Bommies

were predominately dead coral covered with turf algae, but some live coral heads were in the area. Sand was coarse, suggesting the region gets high surge relatively frequently. Although this habitat was ideal for urchins, not a single urchin was observed at this site. This site had a lot of sponge growth. Nor was a single cucumber observed at this site, even though adequate sand was available. In addition to rubble, one bag of sand was also collected.

Maro-21 (lat. 25° 24 253 N, long. 170° 32 525 W)
18 September 2000 (am)

This dive spot was in the center of Maro Reef and relatively calm. I spent the majority of the dive in a sand patch near the anchor because this was the first time on this trip that a low-energy sand patch had been observed. Sand was rich with gobies and their commensal shrimp (*Alpheus* sp.). In addition, sand contained many micro mollusks so two sand samples were collected. Oddly, no sand dwelling macro mollusks were observed in the sand patch other than *Tellina robusta*. A small rock of coral in the center of the sand patch provided rubble. Once again, no echinoderms were observed on this dive. In a large crevice, Matt Dunlap observed approximately 10 large lobsters, but their identity was unclear. As with all of the other sites, this area had a lot of sponges.

Maro-22 (lat. 25° 24 715 N, long. 170° 36 622 W)
19 September 2000 (am)

A murky dive on coral reef with many spires of turf-covered rubble. Maximum depth was approximately 40 ft. As with all of the other sites at Maro Reef, macroinvertebrates were uncommon, especially echinoderms. No echinoderms were found at this site even though it appeared to be an ideal habitat. In fact, other than a few bivalves, no macroinvertebrates were even collected. Site lacked sand, but rubble was taken that yielded a nice diversity of small crabs and worms, again a common feature at this reef. Karen observed a seven-foot Galapagos shark cruising the area, but the rest of us did not see it. *Bryopsis* sp. was seen at this site growing in large, sinuous tufts; a sample was collected for invertebrates. Numerous sponges coated the undersides of rubble.

Maro-23 (lat. 25° 25 071 N, long. 170° 35 024 W)
19 September 2000 (am)

Yet another murky dive on Maro Reef. This dive was also to about 40 ft at its deepest, but most of the dive was considerably shallower. The site was large coral patch edged by silty sand. Coral cover was pretty good, but the site still had a lot of turf-covered rubble. I observed numerous individuals of *Holothuria whitmaei*, the first for Maro Reef, and a single specimen of *H. atra*, also a first. Otherwise, no other echinoderms were found at this site. This site had good sponge growth. This site also had a lot of shingle corals, creating little caves on the tall rubble pinnacles (some extended 30 ft from the sandy bottom). Some sand was collected from well beneath one of these shingles. Hopefully some interesting bivalves will be found.

Maro-24 (lat. 25° 25 071 N, long. 170° 35 024 W)
20 September 2000 (am)

Dove off the north side of Maro Reef. Somewhat murky dive, but it was some of the best visibility at all of Maro Reef. Area was similar to other Maro sites, with turf-covered coral rubble and some live corals. Sand surrounded the bottom of the patch, at about 30-40 ft. Macroinvertebrate diversity was very low. Once again, no echinoderms were observed. Two specimens of *Epitonium ulu* were found on the underside of *Fungia scutaria*, a first for me. The snails were with egg masses. Also saw a manta ray on this dive.

Maro-25 (lat. 25° 25 071 N, long. 170° 35 024 W)
20 September 2000 (am)

Dove a finger of reef extending north from Maro Reef. Dive was in fairly shallow water, but the reef dropped very quickly into deep water. Reef was predominately turf-covered rubble with a nice diversity of live coral. Macroinvertebrates were rare. Only a single echinoderm species was found, a single individual of *Holothuria atra*. *Porites lobata* was relatively common, and contained the burrowing shrimp *Alpheus deuteropus*. In addition to rubble, a single bag of sand was collected.

Additional Maro Reef invertebrates: *Charonia tritonis*, *Octopus cyanea?*, *Aplysia dactylomela*, *Panulirus marginatus*, *Panulirus penicillatus*, *Heterocentrotus mammillatus*, *Conus striatus*

Laysan-26 (lat. 25° 47 070 N, long. 171° 43 152 W)
21 September 2000

Most of this site was shallow (< 25 ft). Deep crevices and caves traversed the area. One crevice was as deep as 40-50 ft and from an undercut at the bottom of this crevice a bag of coarse sand was collected. Otherwise, the area was wave-swept coral rock pavement with scattered heads of *Pocillopora meandrina* and *P. eydouxi*. Many of the coral heads were dead and covered with coralline algae. Surge was strong, and visibility low (approximately 25 ft). Invertebrate fauna seemed typical for this type of habitat: *Echinometra mathaei* and *Echinostrephus aciculatus* were common. *Ophicoma pica* and *O. erinaceau* were common in dead coral heads. Several cone snail individuals were recovered from shallow crevices in the pavement.

Laysan-27 (lat. 25° 47 281 N, long. 171° 44 151 W)
21 September 2000

This site was pavement with considerable coral and coralline algae cover. Coral cover consisted almost entirely of coral heads (*Pocillopora*), and coralline algae were in clumps. Wave surge was strong and visibility was relatively poor. As with Laysan-26, urchins were common, particularly *Echinostrephus aciculatus*. Maximum depth was approximately 40 ft. In addition to rubble, one bag of sand was collected.

Additional Laysan invertebrates: *Stenopus hispidus*, *Cypraea isabella*, *Cypraea sulcidentata*, *Trochus intextus*, *Actinopyga obesa*, *Balcis* sp., *Acanthaster planci*, *Placobranchus ocellatus*

Neva-28 (lat. 25° 58 279 N, long. 173° 52 236 W)
22 September 2000

Dove off the southeast edge of Neva Shoal. Maximum depth approximately 55 ft. Area had high coral cover with good visibility and no surge or current. Coral diversity was very high, perhaps the highest of any area we have encountered so far. Non-coral areas on the bottom were dead plate corals with a lot of three-dimensional heterogeneity. *Echinostrephus aciculatus*, *Echinometra mathaei*, *Ophiocoma pica* and *O. erinaceus* were common. At 50 ft, the reef ended and a large rubble field began and extended out into the gloom. In addition to rubble, sand was collected from a small hollow.

Neva-29 (lat. 25° 56 947 N, long. 173° 54 130 W)
22 September 2000

Dove off the southeast corner of Neva Shoal in approximately 20 ft of water. Coral cover on bottom was low, and substrate was primarily coralline algae. Sand channels cut through the bottom. *Periglypta reticulata* and *Echinostrephus aciculatus* were common. In addition to rubble, one sand sample was collected.

Neva-30 (lat. 26° 00 767 N, long. 173° 52 508 W)
23 September 2000

Dove along the eastern edge of Neva Shoal in about 40-50 ft of water. Area had a variety of coral cover, ranging from rubble-strewn regions to areas of nearly 100% coral cover. Coral diversity was high. Water clarity good, with little to no surge. Rubble areas were predominately old, dead coral heads with some coralline algae mixed in. Echinoderms were relatively rare at this site, with *Ophiocoma pica* and *O. erinaceus* being the most common. Also present in the areas of high coral cover was evidence of *Alpheus deuteropus*. Sand was collected from a sand flat at 50 ft which appeared to surround the reef.

Neva-31 (lat. 26° 01 384 N, long. 173° 54 394 W)
23 September 2000

This site was located in from the eastern edge of Neva Shoal. Maximum depth was approximately 30 ft. This patch reef surrounded by sand had moderate visibility and coral cover. Large areas of the bottom were covered by *Halimeda*, of which a sample was collected for invertebrate analysis. Much of the bottom was covered with a fine layer of silt. A sample of very silty sand was collected along with rubble. No large invertebrate was common at this site.

Additional Neva Shoal invertebrates: *Conus leviathan*, *Tripneustes mamm.*

PH-32 (lat. 27° 57 455 N, long. 175° 48 126 W)
25 September 2000

Dove on the northeast corner of Pearl and Hermes, just north of North Island. Area was a poorly developed spur and groove that was relatively level with wide sand channels. Maximum depth was approximately 50 ft in the sand. Bottom had a different coral community than other areas we have visited. Primary coral was *Pavona duerdeni* growing in fence like colonies. Area also contained a large number of dead *Pocillopora* heads that may have been dead from a bleaching event which is still occurring (tow boarders have seen bleached areas of *Pocillopora*). Visibility was good and surge moderate. In addition to collecting rubble, one bag of moderately coarse sand was collected. Site had a rich invertebrate fauna, of which *Echinostrephus aciculatus* was the most common macroinvertebrate.

PH-33 (lat. 27° 52 795 N, long. 175° 43 802 W)
25 September 2000

Dove on the eastern side of Pearl and Hermes Atoll, just south of North Island. The site had well developed spur and groove topography, perhaps the best example of which I have seen in the Pacific. Spurs were littered with *Pocillopora* heads, most of which were dead or half dead and covered with turf algae. Groove was sandy with undercut ledges on the sides. Invertebrates were dense and diverse, with *Echinmetra mathaei* and *Echinostrephus aciculatus* as the two most common macroinvertebrates. Large specimens of *Acanthaster planci* were present. In addition to rubble, one bag of sand was collected.

PH-34 (lat. 27° 49 191 N, long. 175° 47 565 W)
26 September 2000

Dove on the interior south east side of the lagoon. Channels were deep (> 60 ft), but "patch" reef nearly rose to the surface. Reef was composed of loosely consolidated *Porites compressa* rubble overgrown with *Microdicton* and a fluffy red algae. *Heterocentrotus mammillatus* was the most abundant macroinvertebrate. Approximately 40% of the *Heterocentrotus* were dead or dying. No apparent cause could be found; it may have been a result of disease. The tow teams reported a similar phenomenon elsewhere around the Lagoon. In addition to rubble, one bag of sand was collected.

PH-35 (lat. 27° 48 086 N, long. 175° 51 712 W)
26 September 2000

Dove near the west channel on the side of Pearl and Hermes. Maximum depth was approximately 15 ft. Bottom was "scoured," containing only a few *Pocillopora* heads jutting up from a flat sand/rubble bottom. Most of the bottom was covered with *Padina*. Macroinvertebrates were rare, but microinvertebrate diversity was high in the rubble and sand. In addition to rubble, one bag of sand was also collected.

PH-36 (lat. 27° 51 021 N, long. 175° 54 731 W)
27 September 2000

Dove just inside the west opening of Pearl and Hermes. Conditions were not the greatest, as a northwest swell made the site surgy. Maximum depth of the dive was only 15 ft, with most of it less than 10 ft. Area was scoured consolidated reef rubble, with very little in the way of loose rock. *Echinostrephus aciculatus* was abundant. Also common at the site were *Arca ventricosa*, *Spondylus tenebrosus*, and *Pinctada margaritifera*. In the sand and rock surrounding the coral rock spur were numerous dead bivalve shells. In addition to rubble, one bag of sand was also collected.

PH-37 (lat. 27° 47 4 N, long. 175° 57 3 W)
27 September 2000

Dove on the western edge of Pearl and Hermes reef. Site was shallow, with maximum depth approximately 20 ft. Frequent high surge has left this pavement outcrop devoid of all corals with the exception of a few heads of *Pocillopora*. On the lee side of the spur, algae and other corals were also common, with sponges, particularly a ropey pinkish-yellow sponge in crevices. Macroinvertebrates were relatively rare, with only *Actinopyga obesa* and *Echinostrephus aciculatus* being common. In addition to rubble, one bag of sand was also collected.

Additional Pearl and Hermes invertebrates: *Linkia guildingi*, *Panulirus marginatus*, *Panulirus penicillatus*, *Distorsio burgessi*, *Charonia tritonis*.

Neva-38 (lat. 25° 76 782 N, long. 173° 56 769 W)
28 September 2000

Dove off the southwest corner of Neva Shoal. Maximum depth approximately 30 ft. Bottom was predominately bare coralline algae with some live coral. Area had high physical relief and was surrounded by a rubble and sand patch. High surge and a stiff current moved through the site. Area lacked large invertebrates; most notably, no echinoderms other than *Ophiocoma erinaceus* and *O. pica* were observed at the site. In addition to rubble, one bag of sand was collected.

Neva-39 (lat. 25° 56 659 N, long. 173° 57 899 W)
28 September 2000

Dove off the southeast corner of Neva Shoal in approximately 20 ft of water. Site had high surge and relatively low visibility. Coral cover and diversity at the site was very high. *Porites lobata* and *flabellata* were common. As with Neva-38, macroinvertebrates were uncommon, with only *Ophiocoma pica* and *O. erinaceus* being observed at the site. Evidence for *Alpheus deutropus* was also found. In addition to rubble, one bag of sand was collected.

Neva-40 (lat. 26° 03 675 N, long. 173° 57 610 W)
29 September 2000

Snorkeled off the east side of Lisianski Island in < 10 ft of water. Bottom was beach rock with sand. Beach was moderately coarse sand. On the north end of the site, calcareous, karsted, beach rock was exposed but wave-washed. Area was murky. Common invertebrates included zoanthids (probably multiple species), *Aplysia dactylomela* and *A. juliana* in the rocky/sand shallows. Cone snails were also common, and most individuals appeared to be *Conus abbreviatus*. On the rocky outcropping, *Littorina pintado*, *Nerita picea*, and *Nerita plicata* were present, along with a large, unidentified grapsid crab.

PH-41 (lat. 27° 54 397 N, long. 175° 54 804 W)
1 October 2000

Dove off the northwest side of Pearl and Hermes Atoll in approximately 50 ft of water. Bottom was spur and groove and heavily scoured, so much so that no rubble was collected because nothing could be chipped off the bottom. *Echinostrephus aciculatus* was common, as was *Palythoa caesia* and *Spondylus tenebrosus*.

PH-42 (lat. 27° 46 617 N, long. 175° 59 256 W)
1 October 2000

Dove off the southwest side of Pearl and Hermes Atoll in approximately 50 ft of water. Bottom was spur and groove with deep sand channels. *Echinostrephus aciculatus* and *Echinometra mathaei* were common. *Ophiocoma pica*, *O. erinaceus* and *Alpheus deutropus* were abundant at the site.

PH-43 (lat. 27° 45 313 N, long. 175° 56 569 W)
1 October 2000

Dove off the south side of Pearl and Hermes reef near Seal-Kittering Island. Maximum depth was approximately 45 ft. Bottom topography was a "pseudo" spur and groove, because groove had little or no sand in them. The bottom was undulating hills of scoured limestone with deep holes. *Echinostrephus aciculatus* was common at this site, and two very large individuals of *Panularis marginatus* were observed in crevices. Also common was *Palythoa caesia*. In addition to rubble, one bag of sand was collected.

Kure-44 (lat. 28° 26 617 N, long. 178° 17 797 W)
2 October 2000

Dove off the northeast side of Kure Atoll in approximately 60 ft of water. Bottom was a classic spur and groove, with the spurs consisting of scoured limestone dotted with *Pocillipora* heads (all about the same size, suggesting same age). Grooves were deep and sandy. Sides of the spurs had *Porites lobata* plates which could be peeled back. *Echinostrephus aciculatus* and *Palythoa caesia* were common. All other macroinvertebrates were relatively rare. Free-floating *Codium* clumps were common on the sand patches. In addition to rubble, one bag of sand was collected.

Kure-45 (lat. 28° 27 212 N, long. 178° 20 594 W)
2 October 2000

Dove off the north side of Kure Atoll in approximately 55 ft of water. Bottom topography was spur and groove, with spurs consisting of scoured limestones. Sides of the spurs had considerable coral growth, primarily plates of *Porites lobata*. Invertebrate fauna was rich, especially the molluscan fauna. Common macroinvertebrates included *Echinostrephus aciculatus*, *Echinometra mathaei*, *Cypraea helvola*, *Palythoa caesia*, *Ophiocoma pica*, and *O. erinaceus*. In addition to rubble, one bag of sand was collected.

Kure-46 (lat. 28° 25 601 N, long. 178° 17 156 W)
3 October 2000

Dove off the east side of Kure Atoll, just north of Green Island. Bottom was spur and groove, approximately 60 ft maximum depth. Poor coral cover, with *Porites lobata* shingles being prominent. In some areas, the *P. lobata* formed large heads. *Echinostrephus aciculatus* was common, as was *Palythoa caesia*, *Actinopyga obesa* and *Linkia multifera*. *Porites* shingles proved to be a good habitat for microinvertebrates. In addition to rubble, one bag of sand was collected.

Kure-47 (lat. 28° 22 991 N, long. 178° 18 421 W)
3 October 2000

Dove off the southeast corner of Kure Atoll, just south of Green Island. Bottom was level (maximum depth approximately 55 ft), "pseudo" spur and groove. The pavement/reef rock bottom was interspersed with wandering channels of sand. *Porites lobata* was common, although coral cover in general was low. *Echinometra mathaei* was common at this site, as was *Holothuria atra* in the sand and *Ophiocoma erinaceus* in crevices and rubble. One specimen of *Bohadschia paradoxa* was collected, a first for this trip. Evidence of *Alpheus deuteropus* was observed in the *P. lobata*, and a specimen of the ship was most likely obtained (but this is uncertain). Also, several *Linkia multifera* with *Stilifera* parasites were observed; these have been absent since French Frigate Shoals (?).

Kure-48 (lat. 28° 26 935 N, long. 178° 18 479 W)
4 October 2000

Snorkeled on the inside of the lagoon on the back reef of the northeast side of Kure Atoll. Maximum depth was only 8 ft and visibility was very good. Bottom was scoured limestone with coral heads and small patches of sand. Some exposed rock, with a few specimens *Nerita picea* on it, suggesting it remains exposed most of the time. No littorinids were present. *Hetercentrotus mammillatus* and *Actinopyga obesa* were common at this site, as were cone snails in the cracks in the pavement. In addition to some rubble, one bag of sand was collected.

Kure-49 (lat. 28° 26 116 N, long. 178° 20 475 W)
4 October 2000

Dove in the central lagoon at Kure Atoll in approximately 10 ft of water. Bottom was rubble in sand. Little live coral was observed, and algae were covered with tufts of red algae. *Echinometra mathaei* was the most abundant macroinvertebrate at the site. Also present at the site was *Ophiocoma brevipes*, a first record for this trip. In addition to rubble, one bag of sand was also collected.

Additional Kure Atoll invertebrates: *Charonia tritonis*, *Cypraea tessalata*, *Panularis marginatus*, *Casmaria erinaceus kalosmodix*, *Tonna dolium*, *Chama iostoma*.

PH-50 (lat. 27° 56 950 N, long. 175° 51 006 W)
5 October 2000

Dove on the north side of Pearl and Hermes Atoll in approximately 60 ft of water. Bottom was heavily scoured reef rock covered with a thick layer of coralline algae, forming nodules that rose several feet off the bottom. Fissures 20 ft deep, with sandy bottoms, cut through the landscape, creating large overhanging "caves" and steep walls. This area was devoid of macroinvertebrates, with the exception of a few small colonies of *Palythoa caesia*. In addition to some rubble, one bag of sand was collected from the bottom of a fissure (no sand was available on the top).

PH-51 (lat. 27° 46 827 N, long. 175° 48 206 W)
5 October 2000

Dove off the south edge of Southeast Island in approximately 55 ft of water. Bottom was level, low-relief, reef-rock covered with a thick layer of *Dictosphaeria cavernosa*. Large sand patches/channels wandered through the harder substrate. Area was devoid of coral heads, and coral cover was very low. *Echinostrephus aciculatus*, *Echinothrix calamaris*, *Holothuria whitmaei*, and the lobster *Panularis marginatus* were common at this site. In addition to rubble, one bag of sand was collected.