



**U.S. DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
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## **CRUISE REPORT<sup>1</sup>**

**VESSEL:** NOAA Ship *Oscar Elton Sette*, Cruise SE-12-07

**CRUISE PERIOD:** 1–13 September 2012

**AREA OF OPERATION:** Hawaii: O`ahu Island, Maui Island, Moloka`i Island, Lāna`i Island.

**TYPE OF OPERATION:** Personnel from the Coral Reef Ecosystem Division (CRED) of the NOAA Pacific Islands Fisheries Science Center; and the State of Hawaii Department of Land and Natural Resources, Division of Aquatic Resources conducted baited remote underwater video surveys (BRUVS) and coral reef fish abundance surveys using the Pacific Reef Assessment and Monitoring Program (Pacific RAMP) stationary point count method in waters surrounding the islands of O`ahu, Maui, Moloka`i, and Lāna`i. All activities described in this report were covered by the following permit: Hawaii Department of Land and Natural Resources, Division of Aquatic Resources, Special Activity Permit No. 2012-43.

### **ITINERARY:**

Note: Daily field operations included Rapid Ecological Assessment (REA) fish surveys and baited remote underwater video camera surveys (BRUVS) of fish communities. Unless otherwise specified in the following daily summaries, these surveys occurred during each operational day.

- 1 September Start of cruise. Embarked all scientific crew. Departed Pearl Harbor, Honolulu, O`ahu Island, at 0930, and began field operations on the Waianae Coast of O`ahu Island.
- 2 September Continued field operations at O`ahu Island, from Kaena Point to Kahuku. Installed calcification accretion units (CAUs) with bioerosion blocks at one site. *Rubber Duck* suffered mechanical issues that required a shortened field effort. Began transit to Lahaina, Maui Island.

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<sup>1</sup> PIFSC Cruise Report CR-12-008  
Issued 9 November 2012



- 3 September Arrived Lahaina, Maui, and continued field operations from Ka'anapali to Kihei, Maui Island. Began transit to Lāna'i Island.
- 4 September Arrived Lāna'i Island, and continued field operations off south and west Lāna'i. Began transit to Maui Island.
- 5 September Arrived at Maui Island and continued field operations on the southeastern shore. Weather delay resulted in a half day of field operations. Began transit to Moloka'i Island.
- 6 September Arrived Moloka'i Island and continued field operations off of the western coast.
- 7 September Continued field operations at Moloka'i Island on the northeast coast. Began transit to Maui Island.
- 8 September Continued field operations at Maui Island, along the northeast coast. Installed two CAUs sites with bioerosion blocks.
- 9 September Continued field operations at Maui Island, along the northwest coast. Installed CAUs at one site with bioerosion blocks. Began transit to Moloka'i Island.
- 10 September Continued field operations at Moloka'i Island, along the southeast coast. Began transit to Lāna'i Island.
- 11 September Arrived at Lāna'i Island, continued field operations along the eastern coast. Began transit to O'ahu Island.
- 12 September Arrived at O'ahu Island, continued field operations along the Waianae coast.
- 13 September Continued field operations at O'ahu Island. Installed CAUs at one site with bioerosion blocks. Arrived at Pearl Harbor, Honolulu, O'ahu Island at 1630. Disembarked all scientists. End of cruise.

## MISSIONS:

- A. Conducted ecosystem monitoring of the species composition, abundance, and size distribution of populations of coral reef fishes of the shallow-water ( $\leq 30$  m) coral reef ecosystems of O`ahu Island, Maui Island, Moloka`i Island, and Lāna`i Island. In conjunction with fish surveys, divers estimated benthic percent cover, urchin abundance, reef complexity, habitat type, and record benthic photos for later percent cover analysis.
- B. Deployed calcification accretion units (CAUs) with bioerosion blocks, to allow for remote, long-term monitoring of environmental and ecological conditions of the coral reef ecosystems of O`ahu Island, Maui Island, Moloka`i Island, and Lāna`i Island.
- C. Deployed and retrieved baited underwater remote video camera systems (BRUVS) around O`ahu Island, Maui Island, Moloka`i Island, and Lāna`i Island, to examine coral reef fish communities in a diver-independent manner for comparison with diver-derived survey efforts and to extend sampling effort to ~ 100-m depths.

## RESULTS:

This section provides tallies of research activities (Table 1), a list of data collected during cruise SE-12-07 and a summary of important observations. For more information pertaining to the data collected and methodology employed at the islands visited, see Appendices A–E.

**Table 1.**--Statistics for cruise SE-12-07 to O`ahu Island (OAH), Maui Island (MAI), Moloka`i Island (MOL), and Lāna`i Island (LAN). The totals for scuba dives include all dives carried out for all activities at each island.

Research Activity	OAH	MOL	MAI	LAN	Total
Scuba Dives	77	105	111	60	353
<b>Biological Surveys</b>					
REA Sites: Fish	35	50	49	29	163
BRUVS Sites	25	29	27	19	100
<b>Biological Monitoring Installations</b>					
CAUs Deployed	10	0	15	0	25
Bioerosion Blocks Deployed	10	0	15	0	25

The following data were collected during this expedition:

**Rapid Ecological Assessment (REA) Fish Surveys:**

- Number, species, and estimated sizes of all fishes observed within visually estimated 7.5-m-radius stationary-point-count (SPC) surveys
- Abundance estimates of boring and motile urchins present within SPC surveys
- Visual estimates of benthic cover, habitat type, and habitat complexity
- Digital still photographs of the benthos along transect lines
- Digital still photographs of rare or interesting fish species

**Baited remote underwater video surveys (BRUVS):**

- Digital video footage of bottom-associated fishes
- Number, size, and species of fishes observed in front of stereo-video cameras during observation periods
- Qualitative habitat information

**Biological Monitoring Installations:**

- Installation of calcification accretion units (CAUs) to allow for assessment of calcification rates
- Installation of bioerosion blocks to allow for assessment of reef erosion rates

**SCIENTIFIC PERSONNEL:**

Jill Zamzow, Chief Scientist, Fish REA Team, University of Hawai'i (UH)-Joint Institute for Marine and Atmospheric Research (JIMAR), Pacific Islands Fisheries Science Center (PIFSC)-Coral Reef Ecosystems Division (CRED)

Jacob Asher, BRUVS team, UH-JIMAR, PIFSC-CRED

Paula Ayotte, Fish REA Team, UH-JIMAR, PIFSC-CRED

Jamie Barlow, BRUVS Team, PIFSC-Boating Safety Program (BSP)

Marie Ferguson, Fish REA Team, UH-JIMAR, PIFSC-CRED

Louise Giuseffi, BRUVS Team, PIFSC

Kevin Lino, Operations Lead, Fish REA Team, UH-JIMAR, PIFSC-CRED

Kaylyn McCoy, Assistant Operations Lead, Fish REA Team, UH-JIMAR, PIFSC-CRED

Marc Nadon, Fish REA Team, UH-JIMAR, PIFSC-Fisheries Biology and Stock Assessment Division (FBSAD)

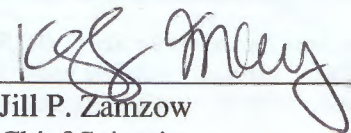
Benjamin Richards, Fish REA Team, PIFSC-FBSAD

Brett Schumacher, Hawai'i Department of Land and Natural Resources (DLNR), Division of Aquatic Resources (DAR)


Darla White, Fish REA Team, UH-JIMAR, PIFSC-CRED

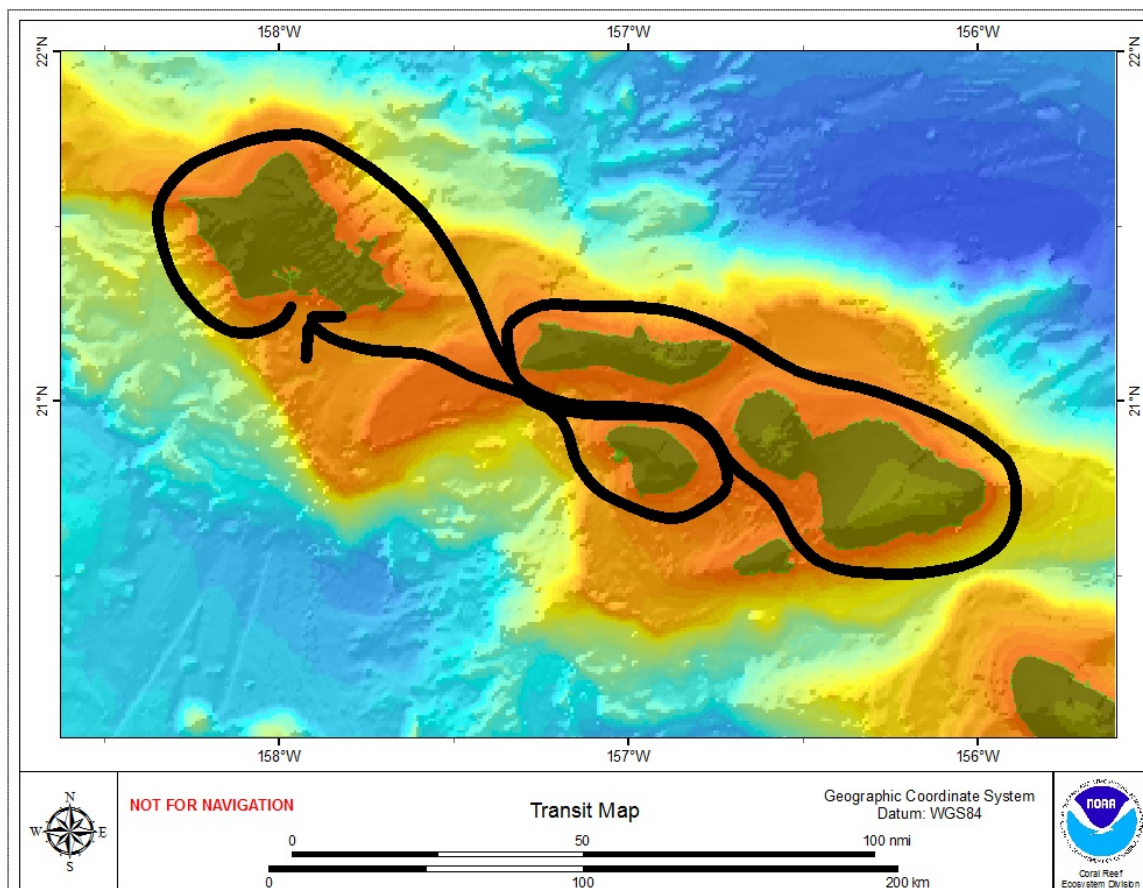
Ivor Williams, Data Manager, Fish REA Team, PIFSC-CRED

Approved by:

  
Jill P. Zamzow  
Chief Scientist  
Pacific Islands Fisheries Science Center

Approved by:

  
Samuel G. Pooley  
Science Director  
Pacific Islands Fisheries Science Center



**Figure 1.**--Track of the NOAA Ship *Oscar Elton Sette* for the cruise SE-12-07, September 1–13, 2012, with the islands of O`ahu, Maui, Moloka`i, and Lāna`i surveyed. Satellite image SIO, NOAA, U.S. Navy, NGA, GEBCO (Becker, 2009; Smith and Sandwell, 1997) © 2008 The Regents of the University of California.

## APPENDIX A: METHODS

This appendix describes the methods and procedures used by the Coral Reef Ecosystem Division (CRED) of the NOAA Pacific Islands Fisheries Science Center during its Main Hawaiian Islands (MHI) Annual Catch Limit (ACL) cruise, SE-12-07, on the NOAA Ship *Oscar Elton Sette* during the period of September 1–13, 2012. This is the first ACL cruise led by CRED at the islands of O`ahu, Moloka`i , Maui, and Lāna`i .

### A.1. Installations for Monitoring Marine Life

(Marie Ferguson, Kevin Lino, Kaylyn McCoy, Benjamin Richards, Brett Schumacher, Darla White, and Jill Zamzow)

CRED accomplishes long-term monitoring of the growth rates of corals and algae through the use of the following types of instruments that were retrieved or deployed during this cruise.

**Calcification Accretion Unit (CAU):** deployed at multiple sites, CAUs provide mechanisms to quantify accretion rates by crustose coralline red algae and scleractinian (hard) corals. Each CAU consists of two grey PVC plates ( $10 \times 10$  cm) separated by a 1-cm spacer. CAUs were installed on the benthos by pounding stainless steel rods by hand into bare substrate and then bolting plate assemblies to those rods. It has been demonstrated that PVC encourages growth of crustose coralline red algae and recruitment of corals, and the net weight gain of calcium carbonate ( $\text{CaCO}_3$ ) on the surfaces of the CAUs can be an indicator of net calcification. The CAUs installed during this cruise will remain on the benthos for about 3 years, enabling the recruitment and colonization of crustose coralline red algae and hard corals, upon which time they will be collected and analyzed. The data obtained from CAUs will enable a comparison of net calcification rates among islands and atolls and between archipelagos and form a baseline of accretion rates throughout the U.S. Pacific, allowing for future comparisons to determine possible consequences of increased ocean acidity and lowered aragonite saturation states.

**Bioerosion Block:** Bioerosion blocks are pieces ( $5 \times 5 \times 3$  cm) of  $\text{CaCO}_3$  cut from dead massive *Porites* sp. skeletons. These blocks act as a natural substrate for bioeroders to bore into and are used to quantify bioerosion rates and describe cryptic bioeroding communities. Deployed in positions alongside CAUs, these blocks will allow us to obtain baseline data on the spatial variability of both bioerosion rates and calcification rates throughout the Hawaiian Archipelago. After CAUs were installed, one bioerosion block was zip tied to the base of each rod that was used to secure the CAUs.

## **A.2. Diver Surveys of Reef Fishes**

*(Paula Ayotte, Marie Ferguson, Kevin Lino, Kaylyn McCoy, Marc Nadon, Benjamin Richards, Brett Schumacher, Darla White, Ivor Williams, and Jill Zamzow)*

Divers conducted Rapid Ecological Assessment (REA) fish surveys using the stationary-point-count (SPC) method at preselected REA sites. Each team consisted of 2 divers. All fish REA sites visited were selected using a stratified random sampling design in shallow (0–6 m), moderate (6–18 m), or deep (18–30 m) depth strata in forereef habitat strata. Surveys were performed using a 30-m transect line set along a single depth contour.

Once a transect line was deployed, the 2 divers moved to the 7.5-m and 22.5-m marks on this transect line to start their SPC surveys. Each of these marks or points, with 1 diver at each, served as the center of a visually estimated cylindrical survey area with a radius of 7.5 m. During the first 5 min, divers only recorded the presence of species within their respective cylinders. Afterwards, divers went down their respective species lists, which were created from their work during the initial 5 min of a survey, sizing and counting all individuals within their cylinder, one species at a time. Cryptic species missed during the initial 5 min of a survey could still be counted, sized, and added to the original species list. Additional species were recorded in the following time periods: 5–10 min and from 10 min to the end of survey. Fish species observed at a REA site but not inside the survey area were recorded for presence data.

After a survey was completed, divers recorded benthic habitat information within their respective cylindrical survey areas. Divers visually estimated habitat complexity, habitat type, urchin abundance, and percentage of cover for hard corals, macroalgae, crustose coralline red algae, turf algae, and sand. Every meter along the transect line, still photographs were taken of the benthos to the right side of the line. These images will be analyzed later.

## **A.3. Remote Video Surveys**

*(Jacob Asher, Jamie Barlow, and Louise Giuseffi)*

Baited (and unbaited) remote underwater video stations (BRUVS), stereo-video samplers, were used to provide estimates of fish abundance and size structure. A group of up to 8 units was deployed for approximately 20–60 min and then recovered and redeployed throughout the day.

BRUVS are termed *remote* because the systems are deployed on the seafloor independent from an operator or observer. Each BRUVS unit used two high-definition video cameras mounted 0.7 m apart on a base bar that was inwardly converged at 8° to gain an optimized field of view (with a forward-viewing range of ~ 10 m). These cameras were placed within PVC pipe housings with acrylic front and rear ports and mounted within a galvanized roll-bar frame. Stabilization arms and bait arms (20-mm plastic conduit) were attached and detached during and after deployment.



BRUVS were either unbaited or accommodated up to 1 kg of bait placed in a plastic-coated wire basket suspended on a bait arm 1.2 m in front of its unit. Each BRUVS was deployed by hand (each unit weighed ~ 50 kg) from the vessel at predefined Global Positioning System locations with a rope and floats attached. Established soak time was 20–60 min, after which time they were retrieved with the use of grappling surface floats, hauling lines, and an electric winch or pot-hauler. Video footage was retrieved from the cameras and archived for later analysis.

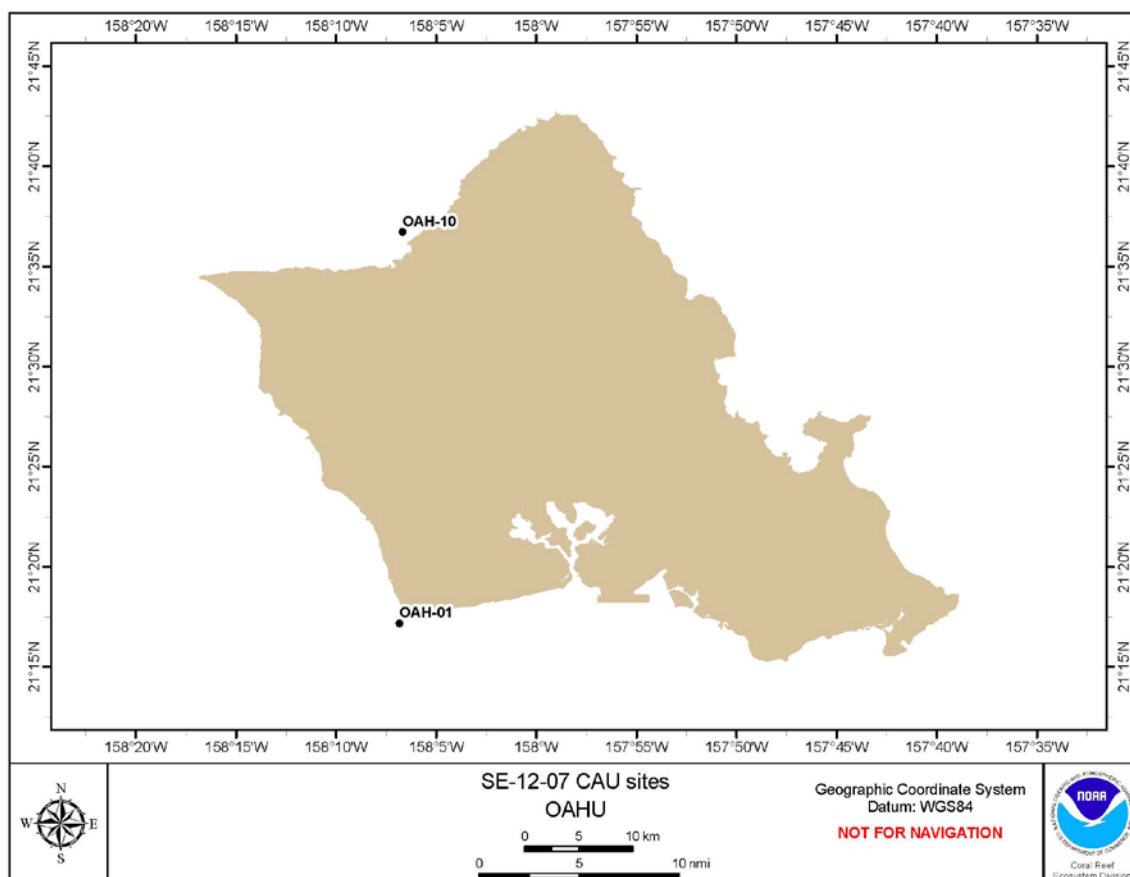
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## APPENDIX B: O`AHU ISLAND

The island of O`ahu, located at 21.44° N, 158.00° W in the North Pacific, is part of the main Hawaiian Islands. For information about the methods used to perform the activities discussed in this appendix, please see Appendix A: “Methods.”

### B.1. Monitoring Installations

CAUs were installed at 2 sites at O`ahu Island, with a total of 10 CAUs and 10 bioerosion blocks installed (Table B.1.1 and Fig. B.1.1).



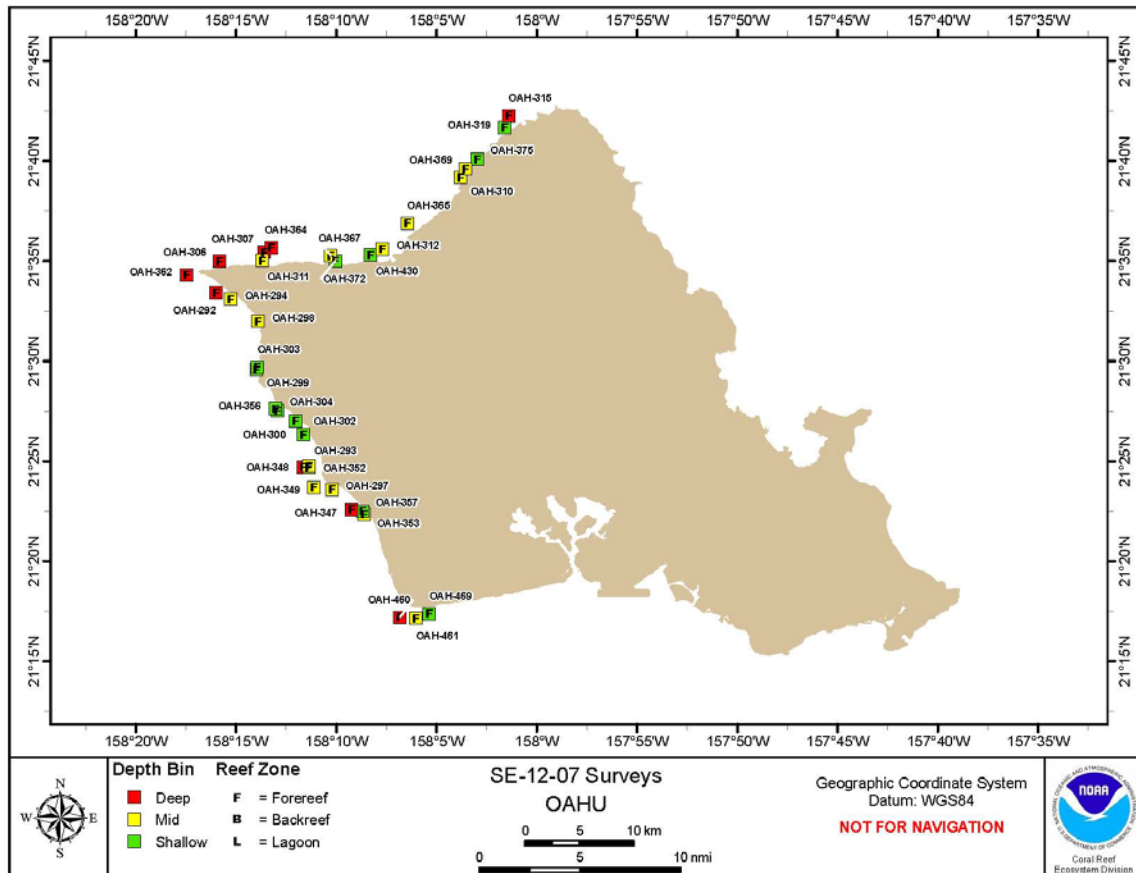
**Figure B.1.1.**—Locations of CAU and bioerosion block installations at O`ahu Island during cruise SE-12-07.

**Table B.1.1.**—Summary of CAU and bioerosion block installations at O`ahu Island during cruise SE-12-07.

Date	Site	Latitude	Longitude	Depth (m)	CAUs deployed	Bioerosion blocks
12-Sep-12	OAH-10	21.61218	−158.111	14.6	5	5
10-Sep-12	OAH-01	21.28658	−158.114	13.1	5	5

## B.2. Diver Surveys of Reef Fishes

Rapid Ecological Assessment (REA) fish survey sites were chosen using a stratified random design. Stationary-point-count surveys were conducted at 35 REA sites at O`ahu Island over 3 different habitat strata: deep forereef, moderate forereef, and shallow forereef (Table B.2.1 and Fig.B.2.1). No fishes were collected during these surveys.



**Figure B.2.1.--**Locations of REA fish sites surveyed at O`ahu Island during cruise SE-12-07. All of these REA sites were selected using a stratified random design.

**Table B.2.1.--**Summary of sites where REA fish surveys were conducted at O`ahu Island during cruise SE-12-07.

Date	Site	Depth Zone	Stratum	Depth (m)	Latitude	Longitude
01-Sep-12	OAH-297	Mid	Forereef	12.7	21.3930119	-158.170439
01-Sep-12	OAH-299	Shallow	Forereef	5.9	21.4931102	-158.232856
01-Sep-12	OAH-302	Shallow	Forereef	6.6	21.4388413	-158.193846
01-Sep-12	OAH-304	Shallow	Forereef	5.3	21.4586228	-158.215937
01-Sep-12	OAH-348	Deep	Forereef	17.7	21.4117161	-158.194159
02-Sep-12	OAH-306	Deep	Forereef	19.8	21.5832904	-158.263915
02-Sep-12	OAH-307	Deep	Forereef	23.4	21.5906467	-158.226536
02-Sep-12	OAH-310	Mid	Forereef	10.1	21.6529620	-158.063383
02-Sep-12	OAH-311	Mid	Forereef	7.9	21.5839162	-158.228642
02-Sep-12	OAH-312	Mid	Forereef	7.2	21.5933540	-158.128329
02-Sep-12	OAH-315	Deep	Forereef	23.4	21.7044788	-158.023389
02-Sep-12	OAH-319	Shallow	Forereef	5.0	21.6945381	-158.026738
02-Sep-12	OAH-364	Deep	Forereef	25.9	21.5945741	-158.220611
02-Sep-12	OAH-365	Mid	Forereef	20.8	21.6149759	-158.107803
02-Sep-12	OAH-367	Mid	Forereef	7.4	21.5879439	-158.171350
02-Sep-12	OAH-369	Mid	Forereef	6.2	21.6598674	-158.059585
02-Sep-12	OAH-372	Shallow	Forereef	3.8	21.5834940	-158.167307
02-Sep-12	OAH-375	Shallow	Forereef	2.9	21.6681562	-158.049299
02-Sep-12	OAH-430	Shallow	Forereef	2.7	21.5885700	-158.138370
12-Sep-12	OAH-292	Deep	Forereef	26.1	21.5568981	-158.266631
12-Sep-12	OAH-293	Mid	Forereef	12.0	21.4114873	-158.189743
12-Sep-12	OAH-294	Mid	Forereef	13.5	21.5516743	-158.254273
12-Sep-12	OAH-298	Mid	Forereef	9.7	21.5331362	-158.231810
12-Sep-12	OAH-300	Shallow	Forereef	4.6	21.4501117	-158.200400
12-Sep-12	OAH-303	Shallow	Forereef	4.3	21.4950505	-158.232424
12-Sep-12	OAH-347	Deep	Forereef	26.5	21.3762180	-158.154226
12-Sep-12	OAH-349	Mid	Forereef	14.7	21.3949391	-158.185188
12-Sep-12	OAH-352	Mid	Forereef	11.0	21.4124970	-158.189275
12-Sep-12	OAH-353	Mid	Forereef	6.5	21.3723359	-158.143517
12-Sep-12	OAH-356	Shallow	Forereef	5.3	21.4602400	-158.217466
12-Sep-12	OAH-357	Shallow	Forereef	5.5	21.3750054	-158.144783
12-Sep-12	OAH-362	Deep	Forereef	24.4	21.5718222	-158.291273
13-Sep-12	OAH-460	Deep	Forereef	26.5	21.2865770	-158.113800
13-Sep-12	OAH-461	Mid	Forereef	6.5	21.2859257	-158.100479
13-Sep-12	OAH-469	Shallow	Forereef	5.0	21.2896389	-158.089304

### B.3. Remote Video Surveys

Baited remote underwater video camera surveys (BRUVS) were deployed at 25 sites around O`ahu Island and are summarized in Table B.3.1.

**Table B.3.1.**--Summary of BRUVS sites at O`ahu Island during cruise SE-12-07.

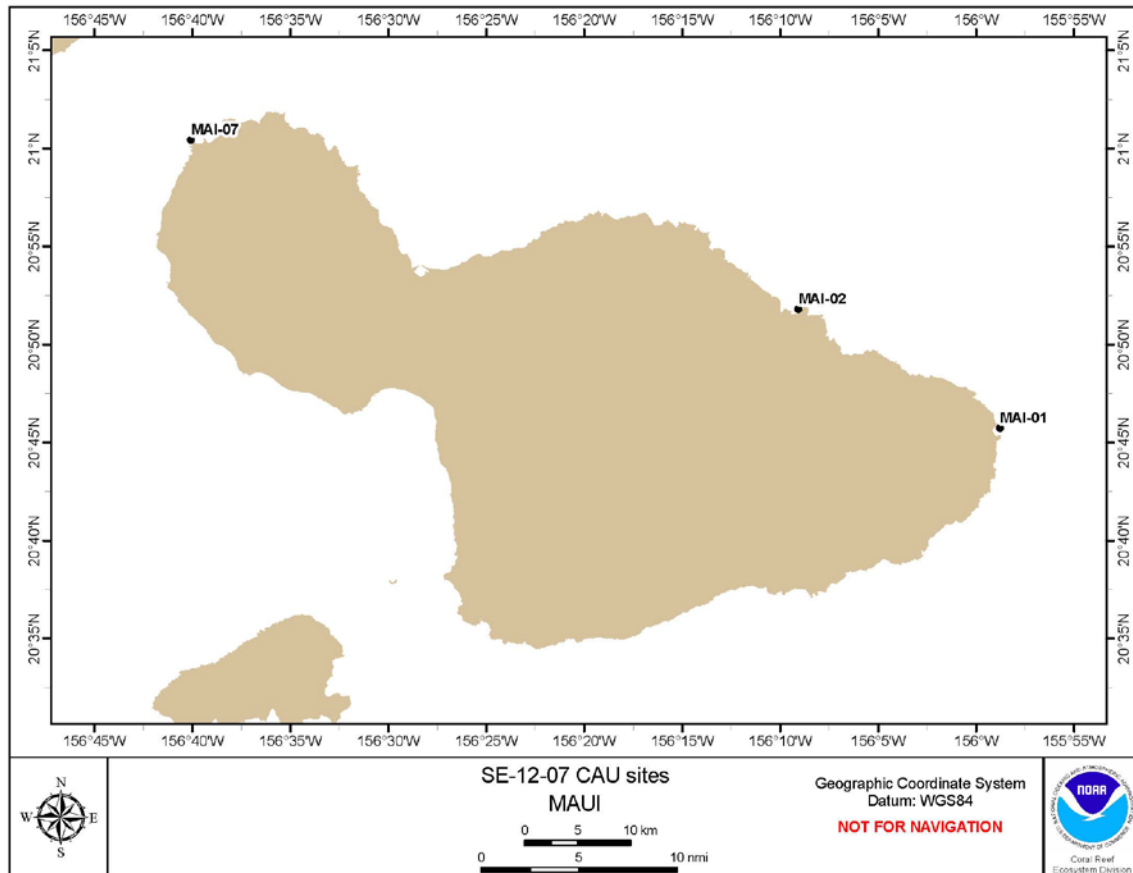
Depth (m)	Baited	Unbaited
0–6	0	3
6–18	2	10
18–30	3	4
30–53	0	3

## APPENDIX C: MAUI ISLAND

The island of Maui is located at 20.80° N, 156.33° W in the North Pacific and is part of the main Hawaiian Islands. For information about the methods used to perform the activities discussed in this appendix, please see Appendix A: “Methods.”

### C.1. Monitoring Installations

CAUs were installed at 3 sites at Maui Island, with a total of 15 CAUs and 15 bioerosion blocks being installed (Table C.1.1 and Fig. C.1.1).



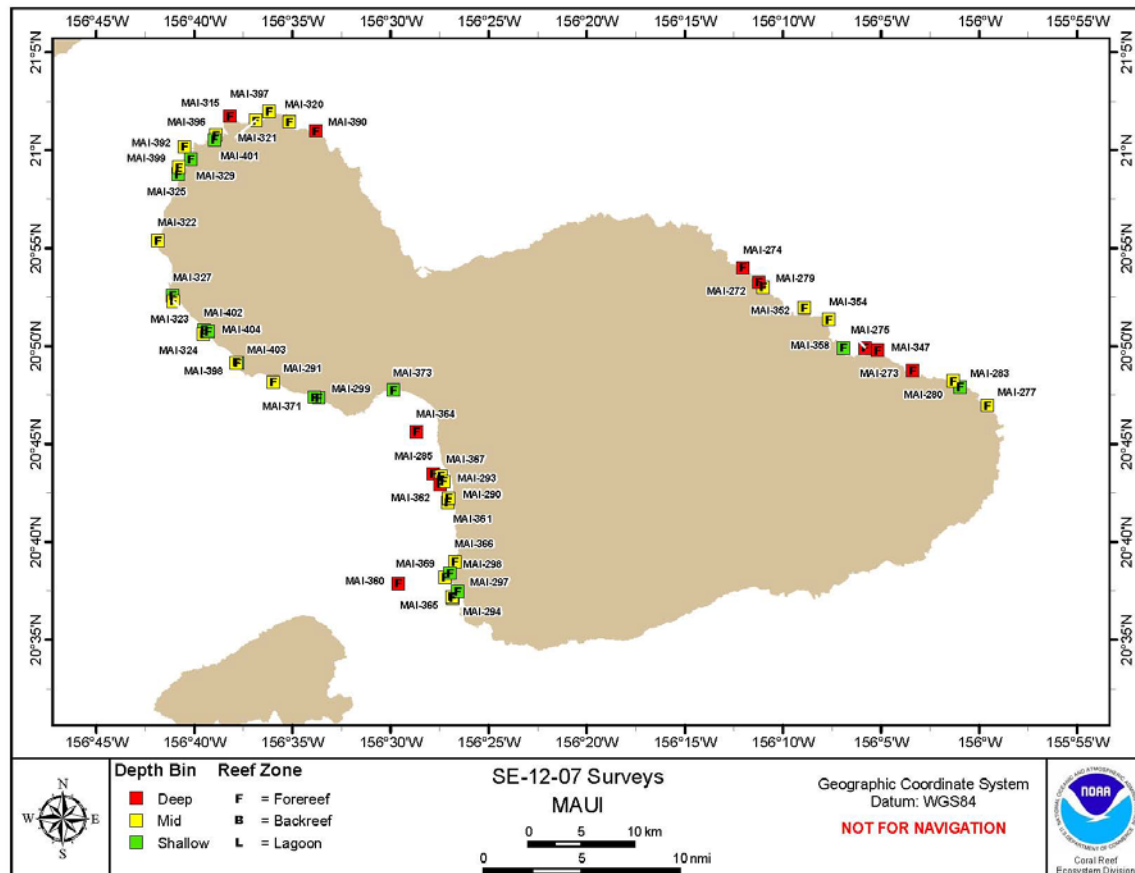
**Figure C.1.1.**—Locations of CAU and bioerosion block installations at O`ahu Island during cruise SE-12-07.

**Table C.1.1.**—Summary of CAU and bioerosion block installations at Maui Island during cruise SE-12-07.

Date	Site	Latitude	Longitude	Depth (m)	CAUs deployed	Bioerosion blocks
08-Sep-12	MAI-01	20.76229	−155.97992	9.8	5	5
08-Sep-12	MAI-02	20.86353	−156.15136	12.8	5	5
09-Sep-12	MAI-07	21.00747	−156.66774	13.7	5	5

## C.2. Diver Surveys of Reef Fishes

Rapid Ecological Assessment (REA) fish survey sites were chosen using a stratified random design. Stationary-point-count surveys were conducted at 49 REA sites at Maui Island over 3 different habitat strata: deep forereef, moderate forereef, and shallow forereef (Table C.2.1 and Fig.C.2.1). No fishes were collected during these surveys.



**Figure C.2.1.**--Locations of REA fish sites surveyed at Maui Island during cruise SE-12-07. All of these REA sites were selected using a stratified random design.

**Table C.2.1.**--Summary of sites where REA fish surveys were conducted at Maui Island during cruise SE-12-07.

Date	Site	Depth Zone	Stratum	Depth (m)	Latitude	Longitude
03-Sep-12	MAI-285	Deep	Forereef	22.9	20.7246662	-156.463878
03-Sep-12	MAI-291	Mid	Forereef	5.8	20.8027201	-156.599765
03-Sep-12	MAI-299	Shallow	Forereef	3.15	20.7891643	-156.561219
03-Sep-12	MAI-322	Mid	Forereef	7.7	20.9232587	-156.697821
03-Sep-12	MAI-323	Mid	Forereef	14.4	20.8715068	-156.684722
03-Sep-12	MAI-324	Mid	Forereef	13.7	20.8435799	-156.659183
03-Sep-12	MAI-327	Shallow	Forereef	5.2	20.8762676	-156.684971
03-Sep-12	MAI-361	Mid	Forereef	17.1	20.7001421	-156.451536



Date	Site	Depth Zone	Stratum	Depth (m)	Latitude	Longitude
03-Sep-12	MAI-364	Deep	Forereef	19.3	20.7603996	-156.478181
03-Sep-12	MAI-366	Mid	Forereef	7	20.6498628	-156.445503
03-Sep-12	MAI-371	Shallow	Forereef	2.1	20.7899383	-156.564613
03-Sep-12	MAI-373	Shallow	Forereef	3.6	20.7958618	-156.497637
03-Sep-12	MAI-398	Mid	Forereef	6.3	20.8192678	-156.631255
03-Sep-12	MAI-402	Shallow	Forereef	3.5	20.8469542	-156.658692
03-Sep-12	MAI-403	Shallow	Forereef	1.8	20.8189620	-156.630150
03-Sep-12	MAI-404	Shallow	Forereef	2	20.8456818	-156.655136
05-Sep-12	MAI-290	Mid	Forereef	11.6	20.7039399	-156.450615
05-Sep-12	MAI-293	Mid	Forereef	14.4	20.7180427	-156.455051
05-Sep-12	MAI-294	Mid	Forereef	16.2	20.6187696	-156.447213
05-Sep-12	MAI-297	Shallow	Forereef	4.4	20.6244786	-156.443363
05-Sep-12	MAI-298	Shallow	Forereef	3.4	20.6399393	-156.449347
05-Sep-12	MAI-360	Deep	Forereef	24.3	20.6312754	-156.493242
05-Sep-12	MAI-362	Deep	Forereef	20.7	20.7158264	-156.458054
05-Sep-12	MAI-365	Mid	Forereef	15.4	20.6201094	-156.448054
05-Sep-12	MAI-367	Mid	Forereef	13.4	20.7226992	-156.457215
05-Sep-12	MAI-369	Mid	Forereef	9.9	20.6365862	-156.453753
08-Sep-12	MAI-272	Deep	Forereef	21.9	20.8877004	-156.187317
08-Sep-12	MAI-273	Deep	Forereef	23	20.8125908	-156.056495
08-Sep-12	MAI-274	Deep	Forereef	23.6	20.9001782	-156.200582
08-Sep-12	MAI-275	Deep	Forereef	26.2	20.8318442	-156.096889
08-Sep-12	MAI-277	Mid	Forereef	7.6	20.7827966	-155.992847
08-Sep-12	MAI-279	Mid	Forereef	7.15	20.8833802	-156.183638
08-Sep-12	MAI-280	Mid	Forereef	13.7	20.8035167	-156.022355
08-Sep-12	MAI-283	Shallow	Forereef	4.8	20.7985012	-156.015987
08-Sep-12	MAI-347	Deep	Forereef	20.5	20.8298345	-156.086307
08-Sep-12	MAI-352	Mid	Forereef	11.3	20.8659623	-156.148790
08-Sep-12	MAI-354	Mid	Forereef	10.6	20.8559657	-156.127737
08-Sep-12	MAI-358	Shallow	Forereef	4.85	20.8316895	-156.115177
09-Sep-12	MAI-315	Deep	Forereef	23.8	21.0288677	-156.636462
09-Sep-12	MAI-320	Mid	Forereef	16.4	21.0242336	-156.585951
09-Sep-12	MAI-321	Mid	Forereef	13.7	21.0254369	-156.614665
09-Sep-12	MAI-325	Shallow	Forereef	2.9	20.9794261	-156.680463
09-Sep-12	MAI-329	Shallow	Forereef	3.8	20.9923969	-156.669625
09-Sep-12	MAI-390	Deep	Forereef	21.5	21.0163879	-156.563809
09-Sep-12	MAI-392	Mid	Forereef	24.1	21.0030588	-156.674884
09-Sep-12	MAI-396	Mid	Forereef	14.6	21.0128523	-156.648303
09-Sep-12	MAI-397	Mid	Forereef	11.6	21.0329193	-156.603070
09-Sep-12	MAI-399	Mid	Forereef	10.9	20.9854556	-156.679760
09-Sep-12	MAI-401	Shallow	Forereef	5.1	21.0088318	-156.649354

### C.3. Remote Video Surveys

Baited remote underwater video camera surveys (BRUVS) were deployed at 27 sites around Maui Island and are summarized in Table C.3.1.

**Table C.3.1.**--Summary of BRUVS sites at Maui Island during cruise SE-12-07.

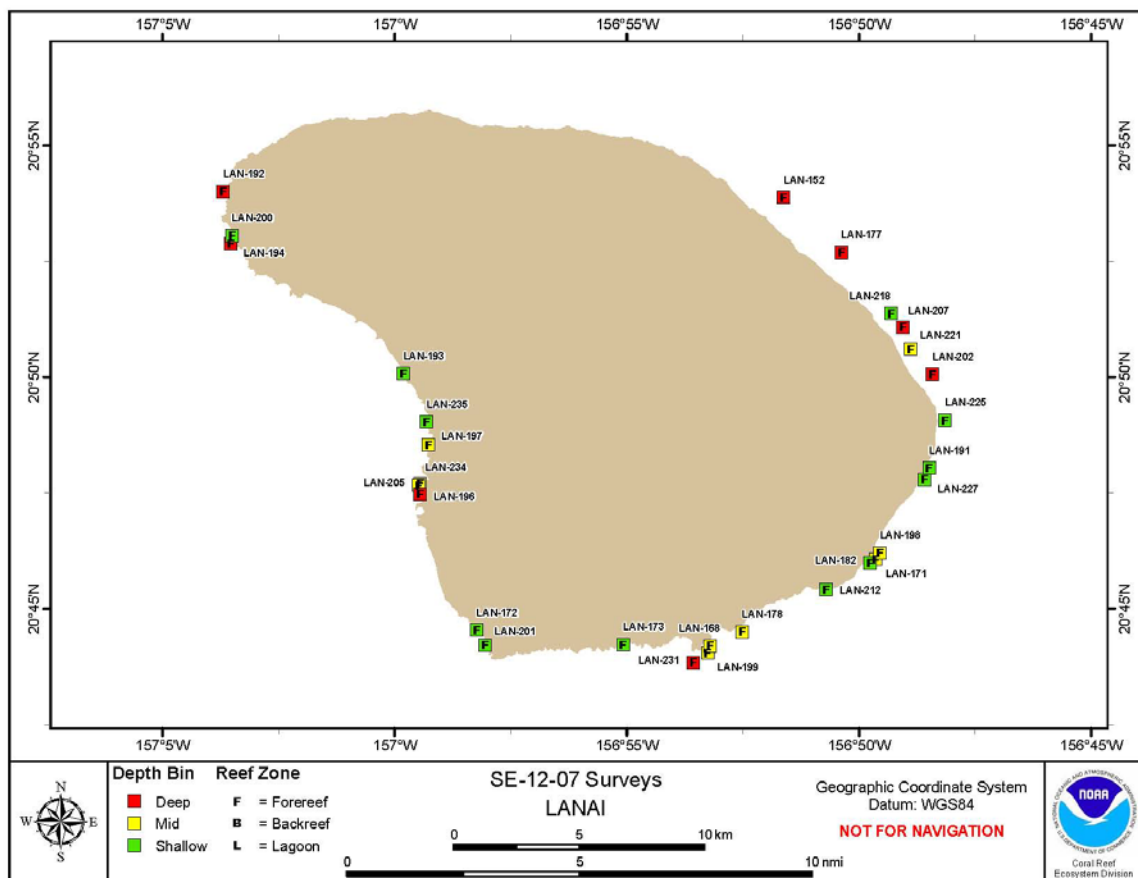
Depth (m)	Baited	Unbaited
0–6	0	3
6–18	1	7
18–30	2	7
30–53	0	5
53–76	0	2

## APPENDIX D: LĀNAʻI ISLAND

The island of Lānaʻi is located at 20.81° N, 156.93° W in the North Pacific and is part of the main Hawaiian Islands. For information about the methods used to perform the activities discussed in this appendix, please see Appendix A: “Methods.”

### D.1. Diver Surveys of Reef Fishes

Rapid Ecological Assessment (REA) fish survey sites were chosen using a stratified random design. Stationary-point-count surveys were conducted at 29 REA sites at Lānaʻi Island over 3 different habitat strata: deep forereef, moderate forereef, and shallow forereef (Table D.1.1 and Fig.D.1.1). No fishes were collected during these surveys.



**Figure D.1.1.**--Locations of REA fish sites surveyed at Lānaʻi Island during cruise SE-12-07. All of these REA sites were selected using a stratified random design.

**Table D.1.1.--**Summary of sites where REA fish surveys were conducted at Lāna`i Island during cruise SE-12-07.

Date	Site	Depth Zone	Stratum	Depth (m)	Latitude	Longitude
04-Sep-12	LAN-171	Mid	Forereef	10.2	20.7677180	-156.8272706
04-Sep-12	LAN-172	Shallow	Forereef	2.9	20.7423421	-156.9706601
04-Sep-12	LAN-173	Shallow	Forereef	5.8	20.7371744	-156.9180317
04-Sep-12	LAN-178	Mid	Forereef	11.7	20.7417707	-156.8753089
04-Sep-12	LAN-192	Deep	Forereef	19.5	20.9000520	-157.0615841
04-Sep-12	LAN-193	Shallow	Forereef	2.6	20.8345780	-156.9969382
04-Sep-12	LAN-194	Deep	Forereef	22.7	20.8813960	-157.0589348
04-Sep-12	LAN-196	Deep	Forereef	19.8	20.7912920	-156.9909638
04-Sep-12	LAN-197	Mid	Forereef	11.8	20.8089371	-156.9878971
04-Sep-12	LAN-199	Mid	Forereef	10.6	20.7340511	-156.8876950
04-Sep-12	LAN-200	Shallow	Forereef	5.3	20.8842266	-157.0583993
04-Sep-12	LAN-201	Shallow	Forereef	5.6	20.7370051	-156.9676673
04-Sep-12	LAN-205	Mid	Forereef	9.4	20.7943768	-156.9913586
04-Sep-12	LAN-231	Deep	Forereef	24.8	20.7306817	-156.8927780
04-Sep-12	LAN-234	Mid	Forereef	11.7	20.7950008	-156.9909980
04-Sep-12	LAN-235	Shallow	Forereef	5.4	20.8173018	-156.9885845
11-Sep-12	LAN-152	Deep	Forereef	21.7	20.8979839	-156.8604393
11-Sep-12	LAN-168	Mid	Forereef	13.1	20.7366513	-156.8868940
11-Sep-12	LAN-177	Deep	Forereef	20.6	20.8782297	-156.8397037
11-Sep-12	LAN-182	Shallow	Forereef	3.2	20.7664520	-156.8292990
11-Sep-12	LAN-191	Shallow	Forereef	2.1	20.8006500	-156.8081800
11-Sep-12	LAN-198	Mid	Forereef	15.3	20.7701000	-156.8258700
11-Sep-12	LAN-202	Deep	Forereef	20.1	20.8343347	-156.8070399
11-Sep-12	LAN-207	Deep	Forereef	20.2	20.8513424	-156.8175924
11-Sep-12	LAN-212	Shallow	Forereef	4.4	20.7569863	-156.8452382
11-Sep-12	LAN-218	Shallow	Forereef	15.3	20.8562513	-156.8218812
11-Sep-12	LAN-221	Mid	Forereef	4.8	20.8434810	-156.8148742
11-Sep-12	LAN-225	Shallow	Forereef	5.8	20.8178500	-156.8024700
11-Sep-12	LAN-227	Shallow	Forereef	3.4	20.7965000	-156.8097400

## D.2. Remote Video Surveys

Baited remote underwater video camera surveys (BRUVS) were deployed at 19 sites around Lāna`i Island and are summarized in Table D.2.1.

**Table D.2.1.**--Summary of BRUVS sites at Lāna`i Island during cruise SE-12-07.

Depth (m)	Baited	Unbaited
0–6	1	3
6–18	2	5
18–30	2	4
30–53	0	2

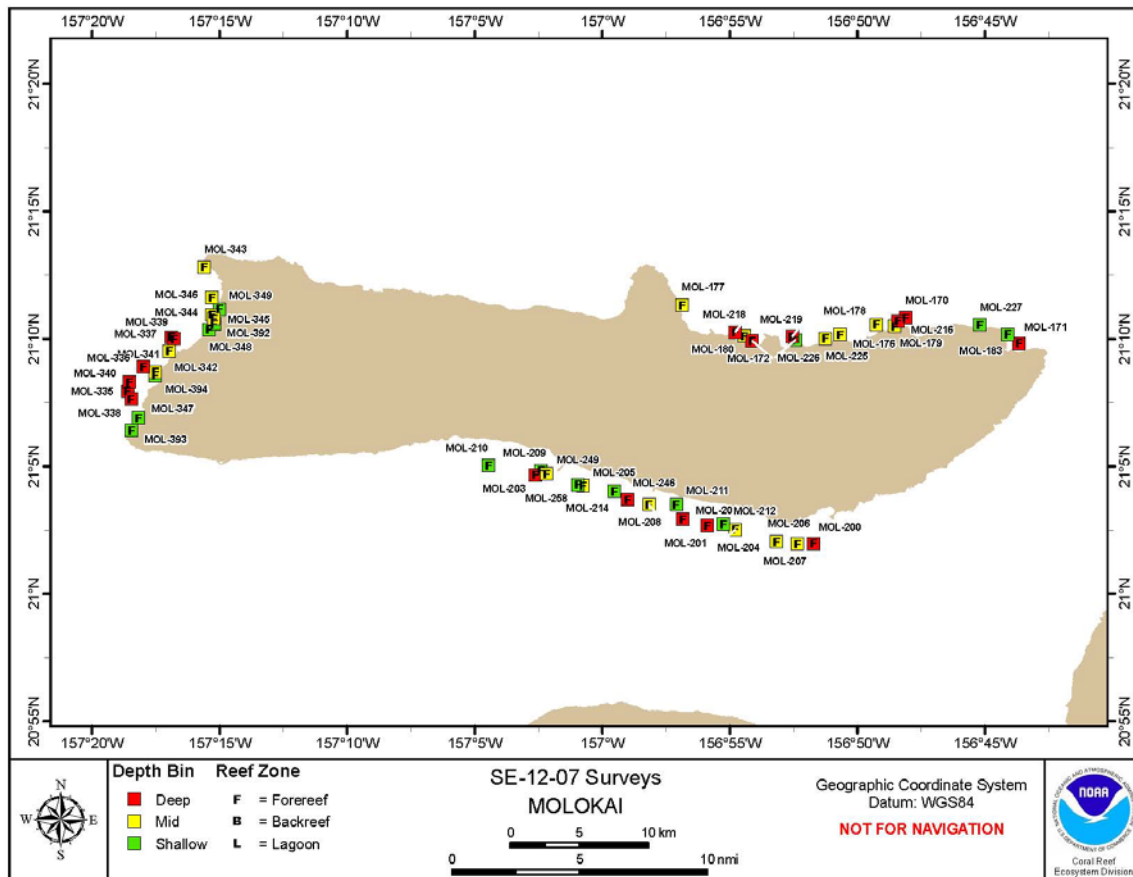
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## APPENDIX E: MOLOKAʻI ISLAND

The island of Molokaʻi, located at 21.14° N, 157.02° W in the North Pacific and is part of the main Hawaiian Islands. For information about the methods used to perform the activities discussed in this appendix, please see Appendix A: “Methods.”

### E.1. Diver Surveys of Reef Fishes

Rapid Ecological Assessment (REA) fish survey sites were chosen using a stratified random design. Stationary-point-count surveys were conducted at 50 REA sites at Molokaʻi Island over 3 different habitat strata: deep forereef, moderate forereef, and shallow forereef (Table E.1.1 and Fig.E.1.1). No fishes were collected during these surveys.



**Figure E.1.1.**--Locations of REA fish sites surveyed at Molokaʻi Island during cruise SE-12-07. All of these REA sites were selected using a stratified random design.

**Table E.1.1.--**Summary of sites where REA fish surveys were conducted at Moloka`i Island during cruise SE-12-07.

Date	Site	Depth Zone	Stratum	Depth (m)	Latitude	Longitude
06-Sep-12	MOL-335	Deep	Forereef	28.9	21.1326467	-157.3101006
06-Sep-12	MOL-336	Deep	Forereef	28.9	21.1483005	-157.2999522
06-Sep-12	MOL-337	Deep	Forereef	24.7	21.1678353	-157.2817954
06-Sep-12	MOL-338	Deep	Forereef	22.8	21.1272546	-157.3078998
06-Sep-12	MOL-339	Deep	Forereef	21.1	21.1668167	-157.2798926
06-Sep-12	MOL-340	Deep	Forereef	29.3	21.1383110	-157.3089883
06-Sep-12	MOL-341	Mid	Forereef	11.8	21.1450552	-157.2923449
06-Sep-12	MOL-342	Mid	Forereef	14.4	21.1586954	-157.2829930
06-Sep-12	MOL-343	Mid	Forereef	15.2	21.2135459	-157.2599227
06-Sep-12	MOL-344	Mid	Forereef	11.5	21.1824258	-157.2549909
06-Sep-12	MOL-345	Mid	Forereef	7.4	21.1798595	-157.2539248
06-Sep-12	MOL-346	Mid	Forereef	12.4	21.1935800	-157.2550131
06-Sep-12	MOL-347	Shallow	Forereef	3.7	21.1150520	-157.3029655
06-Sep-12	MOL-348	Shallow	Forereef	4.5	21.1728775	-157.2568479
06-Sep-12	MOL-349	Shallow	Forereef	5.0	21.1861669	-157.2502475
06-Sep-12	MOL-392	Shallow	Forereef	3.4	21.1763963	-157.2535399
06-Sep-12	MOL-393	Shallow	Forereef	3.1	21.1067207	-157.3077419
06-Sep-12	MOL-394	Shallow	Forereef	3.2	21.1426439	-157.2920089
07-Sep-12	MOL-170	Deep	Forereef	22.3	21.1804843	-156.8019791
07-Sep-12	MOL-171	Deep	Forereef	27.1	21.1637591	-156.7278998
07-Sep-12	MOL-172	Deep	Forereef	20.9	21.1653621	-156.9020813
07-Sep-12	MOL-176	Mid	Forereef	10.7	21.1695439	-156.8449286
07-Sep-12	MOL-177	Mid	Forereef	14.5	21.1887737	-156.9479494
07-Sep-12	MOL-178	Mid	Forereef	16.9	21.1759950	-156.8209477
07-Sep-12	MOL-179	Mid	Forereef	10	21.1748383	-156.8092223
07-Sep-12	MOL-180	Mid	Forereef	13.5	21.1685810	-156.9073026
07-Sep-12	MOL-183	Shallow	Forereef	4.5	21.1696611	-156.7352138
07-Sep-12	MOL-216	Deep	Forereef	21.1	21.1784169	-156.8069219
07-Sep-12	MOL-218	Deep	Forereef	23.7	21.1710482	-156.9132464
07-Sep-12	MOL-219	Deep	Forereef	18.8	21.1679870	-156.8759834
07-Sep-12	MOL-225	Mid	Forereef	11.5	21.1669664	-156.8543447
07-Sep-12	MOL-226	Shallow	Forereef	4.8	21.1658854	-156.8739282
07-Sep-12	MOL-227	Shallow	Forereef	5.5	21.1758051	-156.7534401
10-Sep-12	MOL-200	Deep	Forereef	20.9	21.0329992	-156.8621916
10-Sep-12	MOL-201	Deep	Forereef	21.2	21.0445749	-156.9315406
10-Sep-12	MOL-202	Deep	Forereef	22.6	21.0486943	-156.9475229
10-Sep-12	MOL-203	Deep	Forereef	23.9	21.0776853	-157.0436068
10-Sep-12	MOL-204	Mid	Forereef	8.5	21.0419776	-156.9131085
10-Sep-12	MOL-205	Mid	Forereef	11.6	21.0705538	-157.0127789
10-Sep-12	MOL-206	Mid	Forereef	15.9	21.0341648	-156.8863096



Date	Site	Depth Zone	Stratum	Depth (m)	Latitude	Longitude
10-Sep-12	MOL-207	Mid	Forereef	11	21.0327663	-156.8724010
10-Sep-12	MOL-208	Mid	Forereef	14.8	21.0582617	-156.9695829
10-Sep-12	MOL-209	Shallow	Forereef	4.4	21.0805041	-157.0402523
10-Sep-12	MOL-210	Shallow	Forereef	5.4	21.0839394	-157.0744100
10-Sep-12	MOL-211	Shallow	Forereef	5.1	21.0584061	-156.9517439
10-Sep-12	MOL-212	Shallow	Forereef	5.8	21.0453451	-156.9208832
10-Sep-12	MOL-214	Shallow	Forereef	5.6	21.0670663	-156.9921741
10-Sep-12	MOL-246	Deep	Forereef	23.1	21.0614637	-156.9837209
10-Sep-12	MOL-249	Mid	Forereef	8.6	21.0784753	-157.0364815
10-Sep-12	MOL-258	Shallow	Forereef	6.4	21.0713291	-157.0160745

## E.2. Remote Video Surveys

Baited remote underwater video camera surveys (BRUVS) were deployed at 29 sites around Moloka'i Island and are summarized in Table E.2.1.

**Table E.2.1.**--Summary of BRUVS sites at Moloka'i Island during cruise SE-12-07.

Depth (m)	Baited	Unbaited
0–6	0	2
6–18	1	9
18–30	2	7
30–53	1	4
53–76	0	3