



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

Pacific Islands Fisheries Science Center
 2570 Dole St. - Honolulu, Hawaii 96822-2396
 (808) 983-5300 - Fax: (808) 983-2902

CRUISE REPORT

VESSEL: *Oscar Elton Sette*, Cruise SE1202

CRUISE PERIOD: April 2 – April 19, 2012

AREA OF OPERATION: Tutuila American Samoa

TYPE OF OPERATION: Comparison of Fishery-Independent Sampling Methods for Coral Reef Fish

ITINERARY:

02 April	Begin cruise. Departed Pago Pago harbor and sampled shallow-water (0-30m) zone on Ta'ema Bank and east of Pago harbor using BRUVS & AUV. AUV main CPU canister floods.
03 April	Sample NW Tutuila (0-30 m depths) using BRUVS
04 April	Sample SW Tutuila (0-30 m depths) using BRUVS
05 April	Sample NE Tutuila (0-30 m depths) using BRUVS, Dr. Kunz arrives & begins working on AUV.
06 April	Sample NE Tutuila (0-30 m depths) using BRUVS
07 April	Sample N Tutuila (0-30 m depths), just E of Cock's Comb pt using BRUVS
08 April	Sample E Tutuila (0-30 m depths) using BRUVS & AUV
09 April	Sample SE Tutuila (0-30 m depths) using BRUVS & AUV
10 April	Sample SE Tutuila (0-30 m depths) using AUV. BRUVS conducts mid-cruise calibration @ Faga'alu.
11 April	Sample W Tutuila (30-100 m depths) using BRUVS & AUV
12 April	Sample NW Tutuila (30-100 m depths) using BRUVS & AUV
13 April	Sample N Tutuila (30-100 m depths) using BRUVS & AUV
14 April	Sample NE Tutuila (30-100 m depths) using BRUVS & AUV
15 April	Sample SE Tutuila (0-30 m depths) using BRUVS. AUV maintenance. Return to Pago Pago Harbor to take on fuel
16 April	Sample E Tutuila (30-100 m depths) using BRUVS & AUV
17 April	Sample NE Tutuila (30-100 m depths) using BRUVS & AUV. Final day of sampling.
18 April	General demobilization and equipment breakdown
19 April	Continue demobilization. Return to Pago Pago Harbor. End of cruise. Depart to airport.

MISSIONS AND RESULTS:

This mission, led by Dr. Benjamin L. Richards of the Pacific Islands Fisheries Science Center (PIFSC) and Dr. John Rooney of the Joint Institute for Marine and Atmospheric Research (JIMAR), was designed to cross-compare fishery-independent methodologies for sampling coral reef fish assemblages surrounding the island of Tutuila, American Samoa. The mission involved the fielding of three separate gear types: SCUBA Stationary Point Count Surveys, Baited and Unbaited Remote Stereo-Video Camera Stations, and a SeaBED Autonomous Underwater Vehicle from two NOAA Ships: the Hi'ialakai and Oscar Elton Sette. The challenge of coordinating between two NOAA ships worked out better than expected and each gear type performed well. Each method is detailed below. Post-mission data analyses, carried out in collaboration with Drs. Jerald Ault and Steve Smith of the University of Miami, Rosenstiel School of Marine and Atmospheric Science, as well as Dr. Euan Harvey from the University of Western Australia to quantify the power of the data generated by each method and to make comparisons among methods. Strengths and weaknesses will be outlined and the usability of each method for stock assessment will be discussed.

Each member of the scientific party and the crew and officers of the NOAA Ship Oscar Elton Sette and R/V Huki Pono performed their required duties exceptionally and should be commended. Significant logistical and scientific challenges were encountered throughout the mission, and each member of the team rose to the occasion.

Methods

Stationary Point Counts

The stationary point count (SPC) method involves a pair of SCUBA divers conducting simultaneous counts in adjacent visually-estimated 15 m-diameter plots extending from the substrate to the limits of vertical visibility. Prior to beginning each SPC pair, a 30 m line is laid across the seafloor. Markings at 7.5 m, 15 m and 22.5 m enabled survey divers to locate the mid-point (7.5 m or 22.5 m) and two edges (0 m and 15 m; or 15 m and 30 m) of the survey plots. Each count consists of two components. The first is a 5-minute species enumeration period in which the diver records all species observed within their cylinder. Following that is a tallying portion, in which the diver systematically works through their species list successively recording the number and size (total length, TL, to nearest cm) of all fishes on the species list. The tallying portions are conducted as a series of rapid visual sweeps of the plot, with one species-grouping counted per sweep. To the extent possible, divers remain at the center of their cylinder throughout the count. However, small and cryptic species, which will tend to be underrepresented in counts made by an observer remaining in the center of a 7.5 m radius cylinder, are left to the end of the tally period, at which time the observer swims through their plot area carefully searching for those species. In cases where a species is observed during the enumeration period but is not present in the cylinder during the tallying period, divers record their best estimates of size and number observed in the first encounter during the enumeration period and mark the data record as 'non-instantaneous'.

BRUVS

Baited remote underwater video stations (BRUVS) are non-destructive baited stereo-video samplers which can provide scientifically rigorous estimates of fish abundance and

size structure. BRUVS were originally developed by the lab of Dr. Euan Harvey at the University of Western Australia. The use of stereo-cameras enables accurate size (and hence length-frequency and biomass) estimates to be obtained. Each of a group of up to 8 units is deployed for approximately 15 minutes and is recovered and redeployed in a "leap frog" fashion throughout the day. This allows for considerable replication in space and time throughout the cruise.

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

Each BRUVS can be left unbaited or can accommodate up to 1 kg of bait which is placed in a plastic-coated wire basket suspended on a bait arm 1.2 m in front of the unit. Alternative baits may be used, depending on supply/local availability. Each BRUVS is deployed by hand (each unit weighs ~ 50kg) from the vessel at predefined GPS locations with a rope and floats attached. Established soak time is 15 to 60 minutes (depending on survey design), after which vessels can retrieve them by grappling surface floats and hauling lines with a hand-powered or electric winch or pot-hauler. Video footage can be reviewed as soon as the camera is retrieved to the vessel and can be archived for later analysis.

AUV

The SeaBED-class AUV, unlike other more traditional AUV's, employs a twin-hull design that provides enhanced stability for low-speed photographic surveys. Designed and built by the lab of Dr. Hanaumant Singh at the Woods Hole Oceanographic Institute (WHOI), SeaBED is designed to autonomously follow the terrain approximately 3 to 4 m above the sea floor, collecting high resolution color and black-and-white imagery while maintaining a forward speed of .25 - .5 m/sec. For this mission, SeaBed was also be outfitted with a forward-looking stereo video camera system as well as a forward-looking imaging SONAR unit. The stereo-video system is similar to that use on the BRUVS and allows for accurate measures of fish abundance and size structure. The imaging SONAR unit is being tested as a means to assess fish assemblage outside the visual range of the cameras and in zero light situations including nocturnal or operations in depths to which light does not reach.

SeaBED is approximately two meters long and weighs nearly 200 kg. It has two main pressure housings, a top hull and a bottom hull. The CPU electronics are located in the top hull, and the batteries, cameras, and sensors are located in the bottom hull, and all are connected by wet cabling that is routed through vertical struts. With a maximum depth range of 2,000 m, and maximum single-dive time of 6 - 8 hours, SeaBED can be used to survey habitats ranging from shallow coral reefs to deep groundfish environments.

The AUV is programmed while still aboard the ship. Programming parameters include navigational waypoints, speed, altitude to maintain above the seafloor, and frequency of photographs. Once submerged, the AUV does not resurface until the end of its mission. An RD Instruments 1200 kHz Doppler Velocity Log, iXSea Octans Inertial Navigation

Unit, and Paroscientific Depth Sensor provide the data necessary for the vehicle's autonomous navigation. The AUV does report its position to the ship periodically in telemetry messages via acoustic MODEM. Additionally USBL tracking shows range and bearing between the ship and AUV during the mission. If any of these telemetry messages indicate an unexpected change in the AUV's planned mission, the mission can be aborted via acoustic MODEM message, resulting in the AUV returning to the surface for recovery.

The SeaBED AUV carries a forward-facing ROS Navigator black-and-white, low-light stereo-video camera system, two 5 megapixel, 12 bit dynamic range Prosilica GigE strobe-lighted cameras, one perpendicularly downward-looking and one forward looking (~35°). Imagery from the downward-looking camera can be analyzed to characterize the benthic communities while the forward-looking cameras are used to collect species-specific abundance and length information. Combined, these 2 imagery data sets can be used to create spatial species-specific abundance, biomass, and length-frequency distributions, along with the benthic communities around which they associate. An onboard Seabird model 49 FastCat CTD records temperature and salinity data along the AUV track, providing further environmental insight.

Results

A. CRED Stationary Point Count Surveys (SPC)

1. SPC surveys went according to plan with 158 sites visited around Tutuila (one SPC replicate was implemented at each site). Three depth strata were sampled shallow (0-6m), mid (6-18m), and deep (18-30m) (Figure 1).
2. The 2012 surveys were the first to test a sampling design which included habitat information from the NOAA Biogeography maps.
3. Three habitat categories were taken into account for site allocation: aggregate reef, pavement, and spur & groove. Overall, the habitat map was generally accurate, especially for large scale features (e.g. a large offshore bank with mostly pavement habitat).

B. Baited and Unbaited Remote Stereo-Video Stations (BRUVS)

1. BRUVS performed very well during SE1202, completing 138 sampling stations across 6 depth strata using baited and unbaited systems (Table 1, Figure 2).
2. Stereo-camera calibrations were a vital component for this mission, with three series completed (pre-cruise/mid-cruise/post-cruise). These values between paired systems will be integral in obtaining length data for all species examined in BRUVS video, using image captured from “off-the-shelf” Sony Handycam systems (several models).
3. Two small boat platforms (SE-4/SE-6) were used to deploy baited/unbaited systems around Tutuila across depth strata, with each vessel completing an average of 4-6 sites/day and up to 33 (unbaited/baited) combined camera station deployments and retrievals/day.
4. Roughly 300 - 350 hours of raw/unprocessed station video (doubled if one considers two cameras/station drop) were collected during the course of the cruise.

C. SeaBED Autonomous Underwater Vehicle (AUV)

1. The SeaBED AUV also preformed well, completing 17 individual dives the covered a total of 29,400 meters (Table 3, Figure 3).
2. The primary sensor on the AUV was a stereo pair of Remote Ocean System's Navigator low light monochrome cameras mounted on the AUV's forward strut and aimed forward to enable the identification, enumeration and sizing of fish encountered along the AUV's path. Each camera recorded more than 78 hours of in-water video during the cruise.
3. A secondary sensor, a downward facing 5 megapixel, 12 bit dynamic range Prosilica GigE camera in a 6,000 m rated titanium Deepsea Power and Light housing collected 52,579 still images of the seafloor just using ambient light. In most cases image spacing was close enough to enable the images to be mosaicked together to create a continuous photographic strip of the seafloor. These data provide information about benthic organisms, some of the more cryptic demersal species, and habitat information linked to the fish observations from the stereo cameras.
4. The electronics housing on the AUV leaked during the first operational dive of the cruise, letting in approximately 0.5 l of seawater, which caused the dive to abort and damaged or destroyed some components.

Collaborators at the Woods Hole Oceanographic Institution flew out a post-doctoral researcher with a replacement, which he modified to accommodate the sensor suite on the AUV. The most likely cause of the leak was due to inadequate sealing between the endcaps on the electronics cannister due to the endcaps having been recently re-anodized. The endcaps had been pressure tested to a depth of 1,500 m using a different cannister body after re-anodizing, and the cannister held vacuum during AUV pre-dive checks. Despite these precautions a leak occurred, leading to the following lessons learned:

- a. Replace, rather than re-machine and re-anodize pitted pressure vessel components.
- b. Pressure test all components of a pressure vessel together. Although they should be interchangeable, testing the re-machined endcaps with a different cannister body may have contributed to the leak.
- c. Early detection of a leak might have enabled the dive to be aborted before components were damaged. Inclusion of a leak detector is being considered in the design of the replacement electronics and their cannister.
- d. The failure of a critical component of the AUV stresses the previously recognized need for a complete backup vehicle to be available on all cruises. The loss of 6 days of AUV dives could have been avoided if a complete set of spares was available.

Fortunately this incident led to emergency funding to construct two replacement electronics cannisters, but funding for spares for other parts of the vehicle has not yet been secured.

SCIENTIFIC PERSONNEL:

	<i>Name</i>	<i>Title</i>	<i>Sex/Nat</i>	<i>Organization</i>
1	Benjamin Richards	Co-Chief Scientist	M/USA	PIFSC
2	John Rooney	Co-Chief Scientist	M/USA	JIMAR
3	Elizabeth Clarke	AUV co-PI	F/USA	NWFSC
4	Jeremy Taylor	AUV Program Manager	M/USA	JIMAR
5	Curt Whitmire	AUV Technician	M/USA	NWFSC
6	Erica Fruh	AUV Technician	F/USA	NWFSC
7	Jacob Asher	BRUVs Project lead	M/USA	JIMAR
8	Louise Giuseffi	BRUVs technician	F/USA	PIFSC
9	Benjamin Saunders	BRUVs technician	M/AUS	UWA
10	Jamie Barlow	Small boat coordinator/BRUVS	M/USA	PIFSC
11	Allen Shimada	OST Observer	M/USA	OST ¹
12	Marie Ferguson	AUV/BRUVS Technician	F/USA	JIMAR
13	Maria Madrigal	NOAA Teacher at Sea	F/USA	

Submitted by: _____

Benjamin L. Richards
Chief Scientist

Approved by: _____

Samuel G. Pooley
Science Director
Pacific Islands Fisheries Science Center

Tables

Table 1. Breakdown of BRUVS sampling stations by depth strata and baiting

Depth Range	Number of BRUVS Sites
0-6 m	18
6-18 m	41
18-30 m	27
30-53 m	34
53-76 m	11
76-100 m	7
Unbaited	138
Baited	109

Table 2. Breakdown of SPC sampling stations by depth strata and baiting

Depth Range	Number of SPC Sites
0-6 m	36
6-18 m	74
18-30 m	48

Table 3. Statistics on AUV dives during SE1202

Dive No.	Date	Distance (m)	Duration (hh:mm)	# Photos	Min. Depth (m)	Max. Depth (m)	Mean Depth (m)
1	4/2	900	1:00	0	8	33	32
2	4/8	2,100	2:30	900	10	41	48
3	4/8	2,250	4:40	6,123	8	62	44
4	4/9	1,180	1:45	2,938	9	40	32
5	4/10	1,400	2:25	3,390	12	69	29
6	4/10	1,250	1:30	2,812	30	48	37
7	4/11	2,000	3:00	3,896	25	48	29
8	4/12	2,050	2:30	3,945			
9	4/12	1,150	1:40	3,830			
10	4/13	1,850	2:15	3,517	23	45	37
11	4/13	1,600	2:00	3,147	24	48	43
12	4/14	1,975	2:25	3,596	38	80	51
13	4/14	2,100	3:00	4,320	39	150	41
14	4/16	2,150	2:50	4,396	22	54	50
15	4/16	1,150	2:00	0	37	89	35
16	4/17	2,250	2:45	4,103	48	81	69
17	4/17	800	1:00	1,666	80	92	40

Figures

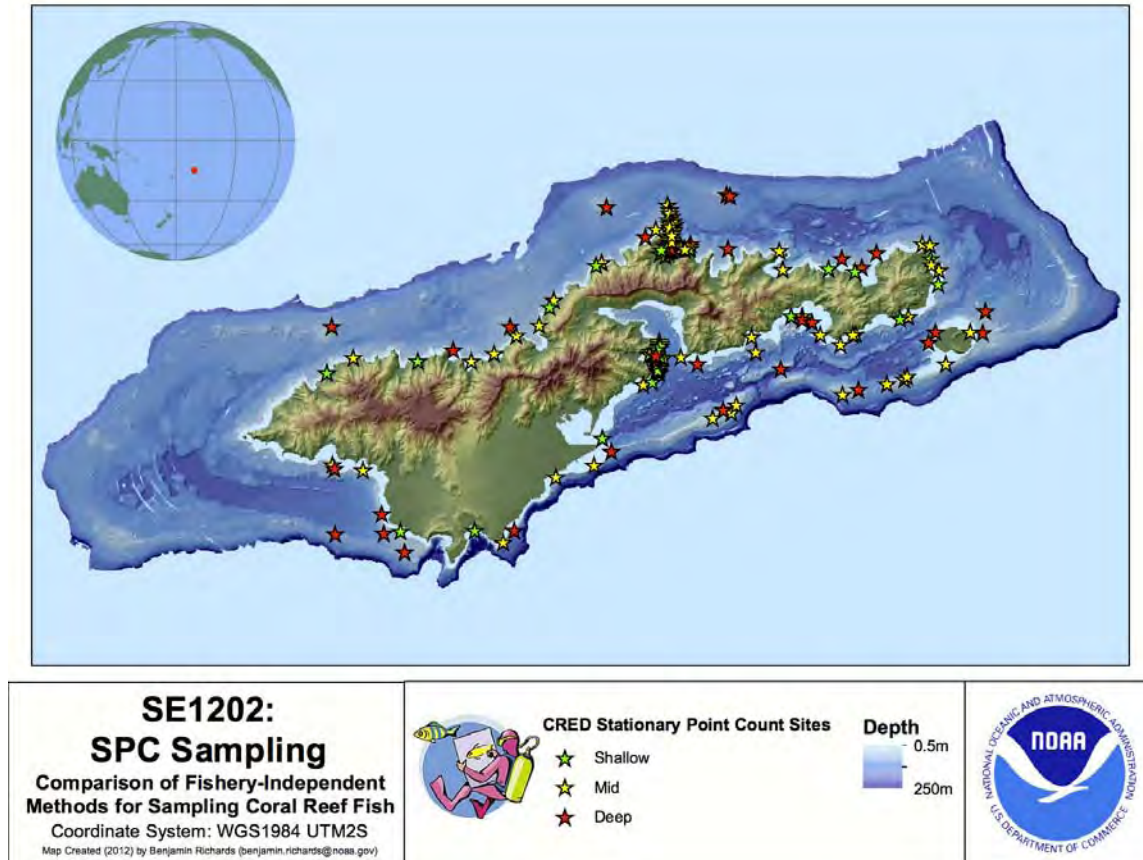


Figure 1 Spatial distribution of the 158 Stationary Point Count deployment locations sampled during SE1202. Each site was sampled by a pair of SCUBA divers from the PIFSC Coral Reef Ecosystem Division..

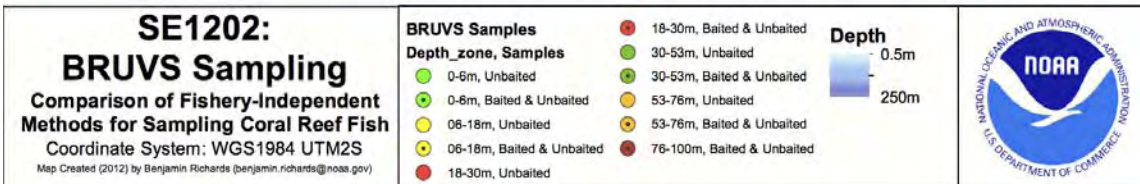
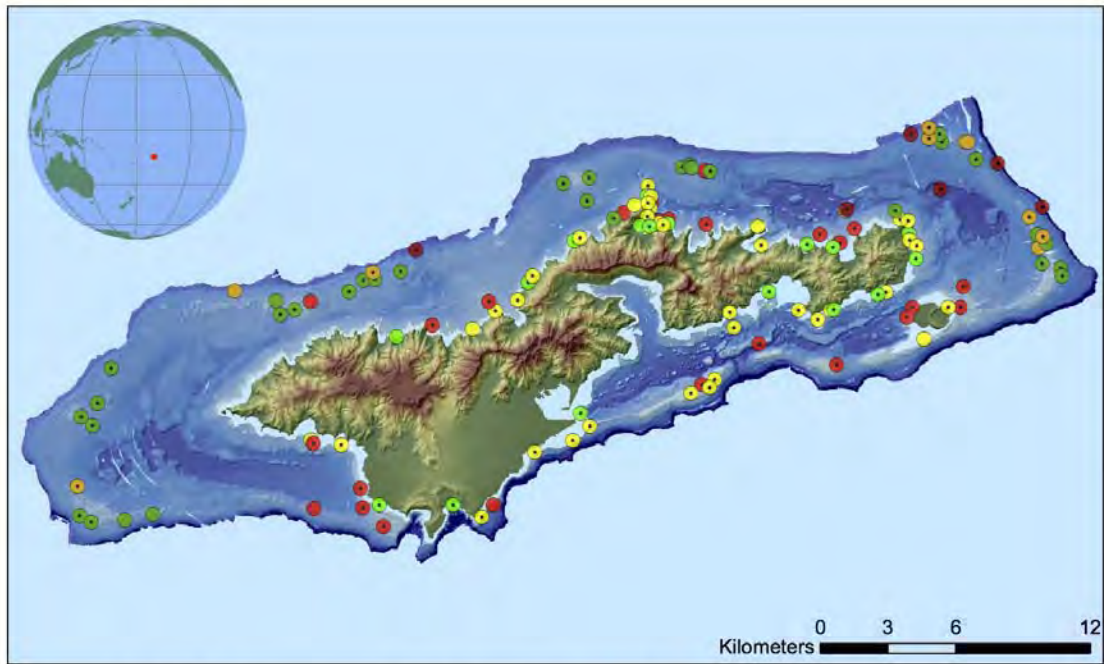
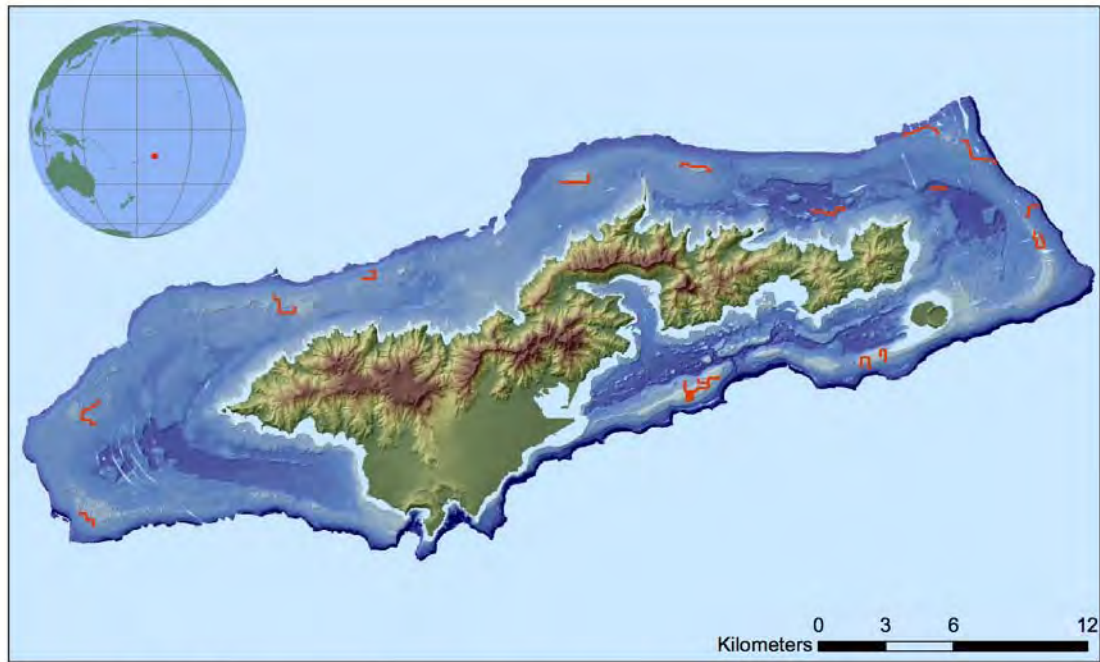


Figure 2 Spatial distribution of the 138 BRUVS deployment locations sampled during SE1202. The majority of sampling locations were sampled using a pair of unbaited BRUVS followed by a pair of baited BRUVS





<p>SE1202: AUV Sampling Comparison of Fishery-Independent Methods for Sampling Coral Reef Fish Coordinate System: WGS1984 UTM2S <small>Map Created (2012) by Benjamin Richards (benjamin.richards@noaa.gov)</small></p>	 <p>AUV Track</p> <p>Depth 0.5m 250m</p>	
--	---	--

Figure 3 Survey tracks of the SeaBED AUV during SE 1202. The 17 separate survey dives had a cumulative length of 29,394 meters. Mean survey length was 1,729 meters.

Daily Reports

Daily Report 4/2/12

General

We made it out of port successfully this morning (4/2/12) to start our joint mission with the NOAA Ship Hi'ialakai, which left port and started their mission yesterday (4/1/12). Our plan is to shadow the HI 1 day behind, sampling the Stationary Point Count (SPC) sites covered by the CRED Fish divers. Thus far, this plan has worked well, with the CRED Fish lead sending a report of the sites surveyed each evening for us to sample on the following day.

Baited Remote Stereo Video Cameras (BRUVS)

Today the BRUVS team sampled 9 SPC sites with paired unbaited BURVS. 2 of those sites were repeat sampled with baited BRUVS a few hours later. The BRUVS team reports that sampling went well with only a few small issues associated with the first day of operations. They are confident that they will be able to continue sampling with increased efficiency in the coming days. They do have some concerns with the efficacy of the hand crank winch (used to recover the BRUVS to the surface) for the deeper 30-100m sites they will be sampling later in the mission. We will continue to work on strategies to improve the retrieval mechanisms for this portion of the cruise.

Autonomous Underwater Vehicle (AUV)

The AUV was successfully deployed for 1 hour, during which time it completed the first leg of its planned track before prematurely aborting its mission and returning to the surface. It surfaced in a location too shallow to be recovered with the Oscar Elton Sette and we implemented our established plan to recover AUV using one of the BRUVS boats. The BRUVS boat towed the AUV at low speed (< 0.5 knot) to a location where it could be safely recovered by the Sette. Upon disassembly approximately 2 cups of water was discovered inside the main CPU canister. There was significant corrosion to the inside of the end caps and minor corrosion to some of the electronic components. The data were recovered from both the digital still camera (422 photos) and the stereo cameras (1 hour). At this time the AUV has been completely disassembled and the CPU electronics and canister are soaking in distilled water. After cleaning and drying, the CPU may be operable but we feel that after such a leak it is too risky for the vehicle to be redeployed without extensive lab testing of both the canister and electronics. Dr. Hanaumant Singh of the Woods Hole Oceanographic Institute (WHOI) has graciously offered to loan us both a spare CPU and canister to integrate into the AUV for the later portion of the mission.

In the mean time, we plan to continue to sample the CRED SPC sites with the BRUVS and will work to rejuvenate the AUV. We are also planning to resume Louise Giuseffi's micro-plastics survey.

Daily Report 4/3/12

General

Today was a relatively quiet and successful day for operations with only the BRUVS team going into the field.

Baited Remote Stereo Video Cameras (BRUVS)

Today the BRUVS team sampled 11 SPC sites with paired unbaited BURVS. 8 of those sites were repeat sampled with baited BRUVS a few hours later. The BRUVS team reports that sampling went well. During their operations they ran across a dead whale floating at the surface near site 548. We are unsure of the species, but have sent pictures and coordinates to Erin Olsen of PIFSC.

One BRUVS at site 520 remains on the seafloor after its surface tether was dropped during the recovery process. The BRUVS team unsuccessfully attempted to catch the BRUVS frame with a small grapple. The BRUVS is in 18-30m of water and can be visualized from the surface. We plan to recover the BRUVS with a short SCUBA dive in the morning before continuing with regular BRUVS OPS. The NOAA Ship Hi'ialakai will serve as primary chamber support during this recovery dive, which is classified as a non-working dive. Our Dive Accident Management Plan is the same as that in effect on the Hi'ialakai and is currently being reviewed by PIFSC and MOC dive safety officers. During this dive we will also attempt to photograph the BRUVS sitting on the seafloor as requested by National Park of American Samoa staff.

Autonomous Underwater Vehicle (AUV)

The AUV team spent the day cleaning and reassembling portions of the CPU canister for later testing, and other AUV components. Liz Clarke, John Rooney and I spent much of last night on the phone with WHOI, who will be sending a replacement CPU canister and post-doctoral researcher to American Samoa to assist with repair to the AUV. Assuming all goes according to plan, the post-doc will be Clay Kunz who sailed aboard the Oscar Elton Sette during SE1107, the main Hawaiian Islands methods comparison mission. Clay is extremely familiar with the AUV, the new CPU canister, and our operations. His involvement will minimize the time needed to integrate the new CPU canister and will provide the greatest margin of safety for subsequent AUV dives during this mission. Clay will arrive in Pago Pago on Thursday (4/5) and will transfer to the Sette via small boat. Sette command has confirmed that berthing is available and all medical clearances have been secured. An amendment to the Final Project Instructions has been submitted. Clay will depart the Sette on Sunday 4/8. This represents significant generosity on the part of Drs. Singh, Kunz and WHOI and is much appreciated.

Daily Report 4/4/12

General

Overall, another good day with spectacular weather and calm seas.

Baited Remote Stereo Video Cameras (BRUVS)

The day started with the successful recovery of the BRUVS at site 520 (NW Tutuila). Richards and Keesee conducted a 9 minute dive to 96 feet to attach a surface line to the BRUVS. They also photographed the BRUVS at the request of the National Park of American Samoa to evaluate potential damage to the benthic environment.

Following that operation, the two BRUVS teams sampled a total of 11 SPC sites with paired unbaited BURVS. 9 of those sites were repeat sampled with baited BRUVS a few hours later. The BRUVS team reports that sampling went well. Attached is a frame grab from one of today's BRUVS video collected at site TUT-595 (~30m depth).

Autonomous Underwater Vehicle (AUV)

It was a quiet day for the AUV team who spent the day preparing the vehicle for the arrival of the new CPU canister and Dr. Clay Kunz from WHOI, who will arrive late tomorrow evening.

Daily Report 4/5/12

General

Another good day working on the northeast side of Tutuila.

Baited Remote Stereo Video Cameras (BRUVS)

Today the BRUVS team sampled a total of 11 sites, dropping two unbaited BRUVS units at each site. 9 of these sites were re-sampled with baited BRUVS a few hours later. That brings the total number of sites sampled by the BRUVS team to 54.

- 12 sites have been shallow (0-6 m),
- 24 have been mid-depth (7-18 m), and
- 18 have been deep sites (19-30 m).
- 35 sites have been sampled using both unbaited and baited BRUVS while 19 have been sampled only with unbaited BRUVS.

Autonomous Underwater Vehicle (AUV)

Last night Dr. Clayton Kunz from Woods Hole Oceanographic Institute arrived in Pago Pago. Richards, Rooney, and Barlow met him at the airport and transported him to the NOAA Ship Oscar Elton Sette via small boat. His flights were long, but relatively uneventful.

Today was spent reassembling the AUV and integrating the new CPU canister into the vehicle. All indications are that this process is going well and, as long as things continue to go well, we plan to start test dives with the AUV in the morning. Wish is luck. Dr. Kunz's expertise has been invaluable in getting the AUV up and running again. With the differences between our CPU housing and the one graciously loaned from WHOI, we would not have been able to do it without him.

Daily Report 4/6/12

General

Another good day working on the northeast side of Tutuila.

Baited Remote Stereo Video Cameras (BRUVS)

Today the BRUVS team sampled a total of 11 sites, dropping two unbaited BRUVS units at each site. 9 of these sites were re-sampled with baited BRUVS a few hours later. That brings the total number of sites sampled by the BRUVS team to 54.

- 12 sites have been shallow (0-6 m),
- 24 have been mid-depth (7-18 m), and
- 18 have been deep sites (19-30 m).
- 35 sites have been sampled using both unbaited and baited BRUVS while 19 have been sampled only with unbaited BRUVS.

Autonomous Underwater Vehicle (AUV)

Last night Dr. Clayton Kunz from Woods Hole Oceanographic Institute arrived in Pago Pago. Richards, Rooney, and Barlow met him at the airport and transported him to the NOAA Ship Oscar Elton Sette via small boat. His flights were long, but relatively uneventful.

Today was spent reassembling the AUV and integrating the new CPU canister into the vehicle. All indications are that this process is going well and, as long as things continue to go well, we plan to start test dives with the AUV in the morning. Wish is luck. Dr. Kunz's expertise has been invaluable in getting the AUV up and running again. With the differences between our CPU housing and the one graciously loaned from WHOI, we would not have been able to do it without him.

Daily Report 4/7/12

General

Another good day working in and around Vatia bay on the northeast side of Tutuila.

Baited Remote Stereo Video Cameras (BRUVS)

Today the BRUVS team, assisted by Allen Shimada, sampled a total of 12 sites, dropping two unbaited BRUVS units at each site. 8 of these sites were re-sampled with baited BRUVS a few hours later. That brings the total number of sites sampled by the BRUVS team to 66.

- 14 sites have been shallow (0-6 m),
- 31 have been mid-depth (7-18 m), and
- 21 have been deep sites (19-30 m).
- 43 sites have been sampled using both unbaited and baited BRUVS while 23 have been sampled only with unbaited BRUVS.

Autonomous Underwater Vehicle (AUV)

The AUV team continued to work on the AUV today, troubleshooting a variety of voltage and ground fault issues. We finally tracked down what appears to be the final problem, which was a ground fault associated with the acoustic modem transducer. The Oscar Elton Sette graciously allowed the AUV team to conduct ballast and depth servo tests after dinner from 1800-1930. The AUV passed all required tests and we are preparing for our first mission dive tomorrow morning in the vicinity of Aunu'u.

Daily Report 4/8/12

General

We have had amazing luck with the weather and had a wonderful day working in the SE sector of Tutuila, near the island of Aunu'u.

Baited Remote Stereo Video Cameras (BRUVS)

The BRUVS team, sampled a total of 14 sites, dropping two unbaited BRUVS units at each site. 11 of these sites were re-sampled with baited BRUVS a few hours later. That brings the total number of sites sampled by the BRUVS team to 80.

- 17 sites have been shallow (0-6 m),
- 39 have been mid-depth (7-18 m), and
- 24 have been deep sites (19-30 m).
- 54 sites have been sampled using both unbaited and baited BRUVS while 26 have been sampled only with unbaited BRUVS.

Autonomous Underwater Vehicle (AUV)

The AUV team had a great day. We had a few minor hiccups on the first deployment that were quickly rectified. We then dropped the AUV in for a second dive that was completely successful. Both dives were located on the reef stretching to the southwest of Aunu'u. The currents were challenging, but the AUV performed well. We look forward to another dive along Taema bank, to the south of Pago Pago harbor tomorrow morning.

We also returned Dr. Clay Kunz to the airport via small boat for his return journey to Woods Hole. I know I have said this many times before, but I cannot overstate how important his participation was to the success of this cruise. I know that many people worked long and hard to make this possible and that has not been overlooked or taken for granted. This portion of the cruise would not have been a success without each of your efforts. Thank you.

Daily Report 4/9/12

General

Today was a calm but rainy day, a welcome rest-bit from the sweltering sun we have had for most of the mission.

Baited Remote Stereo Video Cameras (BRUVS)

The BRUVS team, sampled a total of 9 sites, dropping two unbaited BRUVS units at each site. Each of these sites were re-sampled with baited BRUVS a few hours later. That brings the total number of sites sampled by the BRUVS team to 86. As a correction to yesterday's report, only 11 sites were sampled on 4/8, not 14 as originally stated.

- 18 sites have been shallow (0-6 m),
- 41 have been mid-depth (7-18 m), and
- 27 have been deep sites (19-30 m).
- 60 sites have been sampled using both unbaited and baited BRUVS while 26 have been sampled only with unbaited BRUVS.

Autonomous Underwater Vehicle (AUV)

The fixes Dr. Clayton Kunz and the rest of the team made on the AUV were put to the test again today and a successful dive was completed on Taema Bank. The four hours and 40 minute dive covered approximately 2.25 km of seafloor at an altitude of 4 m above the bank top. Four hours and 40 minutes of forward-looking stereo-video were collected as well as 6123 benthic still images.

Daily Report 4/10/12

General

Another good day here on the Oscar Elton Sette. Last night, with the assistance of the Hi'ialakai deck department, we took on additional gasoline for our small boats. Gasoline was delivered in 3 55-gallon drums to the pier in Pago Pago, where the Hi'ialakai is berthed during her in-port. Russell Reardon kindly took delivery and the drums were craned onto one of our small boats by the Hi'ialakai deck department, allowing us to continue our operations during the day.

At the end of the operation day, the ship broke out the shave-ice machine, giving everyone some much needed refreshment after all the hard work done so far. Tomorrow we break away from the Hi'ialakai and the CRED SCUBA divers as we move out into the mesophotic (30-100m) depth zone to continue our BRUVS and AUV surveys.

Baited Remote Stereo Video Cameras (BRUVS)

The BRUVS team spent today conducting their mid-cruise stereo-camera calibrations in Fanga'alu Bay. This was to check for camera drift, ensure the cameras stayed aligned following extensive shallow-water survey operations, and to prep for deep-water operations over the course of the next several days.

Autonomous Underwater Vehicle (AUV)

The AUV team had another good day and completed 2 dives. The first was on the southwestern end of Taema Bank, was of 2 hours duration, and covered 1180 m. In addition to the stereo video collected during the dive, 2938 still photos of the seafloor were also taken. The second dive was conducted on Nafanua Bank extending to the southwest of Aunu'u Island. It lasted for two hours and 25 minutes, covered 1400 m, and included the collection of 3390 still photos. Another two dives are planned for tomorrow, on the west side of Tutuila.

Daily Report 4/11/12

General

Another good dive with 2 AUV missions and tons of BRUVS drops. The team seems to be doing well and spirits are high. The weather has been wonderful with light winds, calm seas and alternating between baking sun and warm rain.

Baited Remote Stereo Video Cameras (BRUVS)

The two BRUVS boats sampled a total of 9 sites, dropping two unbaited BRUVS units at each site. 7 of these sites were re-sampled with baited BRUVS a few hours later. To-date, the BRUVS team has sampled 95 sites, dropping a pair of BRUVS at each site.

- 18 sites have been sampled in the 0-6 m depth range,
- 41 sites have been sampled in the 6-18 m depth range
- 27 sites have been sampled in the 18-30 m depth range
- 8 sites have been sampled in the 30-53 m depth range
- 1 site has been sampled in the 53-76 m depth range
- 67 sites have been sampled using both unbaited and baited BRUVS while 28 have been sampled only with unbaited BRUVS.

Autonomous Underwater Vehicle (AUV)

Today saw the successful completion of another two AUV dives. The first was near the southwestern corner of the insular shelf, lasted for 1.5 hours, covered 2.2 km, and collected 2812 still photos along with the stereo video. The second dive had almost completed its full mission when the batteries died. It was near the westernmost edge of the shelf, lasted for approximately 3 hours and covered 2 km. A total of 3986 still photos as well as the stereo video were collected. Likewise, I've attached a few screen grabs from the stereo-video for your enjoyment.

Daily Report 4/12/12

General

Another good dive with 2 AUV missions and tons of BRUVS drops. The ocean was flat calm.

Baited Remote Stereo Video Cameras (BRUVS)

The two BRUVS boats sampled a total of 10 sites, dropping two unbaited BRUVS units at each site. 8 of these sites were re-sampled with baited BRUVS a few hours later. To-date, the BRUVS team has sampled 105 sites, dropping a pair of BRUVS at each site.

- 18 sites have been sampled in the 0-6 m depth range,
- 41 sites have been sampled in the 6-18 m depth range
- 27 sites have been sampled in the 18-30 m depth range
- 15 sites have been sampled in the 30-53 m depth range
- 3 sites have been sampled in the 53-76 m depth range
- 1 site has been sampled in the 76-100 m depth range
- 75 sites have been sampled using both unbaited and baited BRUVS while 30 have been sampled only with unbaited BRUVS.

Autonomous Underwater Vehicle (AUV)

The AUV ran well today, with two dives completed along the shelf off Tutuila's north shore. The first dive lasted for 2.5 hours, covered 2,050 m and took 3945 benthic photos in addition to the forward facing stereo video. The second dive was a bit further east than the first, lasted for 1.7 hours, covered 1150 m, and took 2830 photos. The charge on the AUV batteries at the time of the first dive each day has been slowly decreasing. After passing through the 3rd survey point on our second dive today, and expecting to not have sufficient remaining battery voltage to make it to the 4th and final point, the decision was made to abort the dive. That enabled us to test the abort function, which is a critical safety feature, and will give the AUV more time to charge in preparation for tomorrow's dives. A second battery canister was ordered several months ago. Having access to this second canister will enable us to run more and longer dives during future operations.

Daily Report 4/13/12

General

Another good day on the north side of Tutuila with 2 successful AUV missions and tons of BRUVS drops.

Baited Remote Underwater Video Stations (BRUVS)

The two BRUVS boats sampled a total of 9 sites, dropping two unbaited BRUVS units at each site. 6 of these sites were re-sampled with baited BRUVS a few hours later. To-date, the BRUVS team has sampled 114 sites, dropping a pair of BRUVS at each site.

- 18 sites have been sampled in the 0-6 m depth range,
- 41 sites have been sampled in the 6-18 m depth range
- 27 sites have been sampled in the 18-30 m depth range
- 24 sites have been sampled in the 30-53 m depth range
- 3 sites have been sampled in the 53-76 m depth range
- 1 site has been sampled in the 76-100 m depth range
- 81 sites have been sampled using both unbaited and baited BRUVS while 33 have been sampled only with unbaited BRUVS.

Autonomous Underwater Vehicle (AUV)

Once again the AUV completed two dives, again along the shelf off Tutuila's north shore. The calm conditions are spoiling us with easy deployments and recoveries. These aren't the conditions we anticipate off Maui during our September cruise. The first dive of the day lasted for about 2.25 hours, covered 1850 m and collected 3,517 photos. This afternoon's dive was a bit shorter, lasting 2 hours, covering 1600 m and collecting 3,147 photos in addition to the stereo video that is the primary data of interest for the AUV portion of the cruise. A quick scan through the video revealed several schools of barracuda, some tuna, and a few jacks.

Daily Report 4/14/12

General

Another good day sampling the outer reef off the northeast coast of Tutuila. We had another 2 successful AUV missions and tons of BRUVS drops.

Baited Remote Underwater Video Stations (BRUVS)

The two BRUVS boats sampled a total of 10 sites, dropping two unbaited BRUVS units at each site. 8 of these sites were re-sampled with baited BRUVS a few hours later. To-date, the BRUVS team has sampled 124 sites, dropping a pair of BRUVS at each site.

- 18 sites have been sampled in the 0-6 m depth range,
- 41 sites have been sampled in the 6-18 m depth range
- 27 sites have been sampled in the 18-30 m depth range
- 27 sites have been sampled in the 30-53 m depth range
- 7 sites have been sampled in the 53-76 m depth range
- 4 site has been sampled in the 76-100 m depth range
- 89 sites have been sampled using both unbaited and baited BRUVS while 35 have been sampled only with unbaited BRUVS.

Autonomous Underwater Vehicle (AUV)

The AUV ran another two successful missions today, both in the vicinity of the northeastern corner of Tutuila's insular shelf. The first ran for 2 hours and 25 minutes, covered 1,975 m and collected 3,596 photos. On its second dive the AUV was deployed a bit eastward of its planned track and ran for 2 hours and 25 minutes and covered 2,100 m before running over the edge of the shelf and hitting its maximum planned depth of 150 m. A maximum depth is one of the safety parameters built into each mission plan. Once that depth was reached the AUV's mission stopped, as it is designed to, and it floated to the surface by approximately 16:50 and was recovered. Over the course of the two dives, AUV video capture several Napoleon Wrasse (*Cheilinus undulatus*), Blue trevally (*Carangoides ferdau*), Great hammerhead (*Sphyrna mokarran*), and Great Barracuda (*Sphyrna barracuda*).

Daily Report 4/15/12

General

Today was an in-port day with the Sette pulling into Pago Pago Harbor at 0900 to take on fuel.

Baited Remote Underwater Video Stations (BRUVS)

We launched SE6 with one BRUVS team just after entering the harbor for a half day's BRUVS work along the SE coast of Tutuila. The BRUVS team spent half the day conducting baited BRUVS drops at 9 locations where they had previously only been able to deploy unbaited BRUVS. To-date, the BRUVS team has sampled 124 sites, dropping a pair of BRUVS at each site.

- 18 sites have been sampled in the 0-6 m depth range,
- 41 sites have been sampled in the 6-18 m depth range
- 27 sites have been sampled in the 18-30 m depth range
- 27 sites have been sampled in the 30-53 m depth range
- 7 sites have been sampled in the 53-76 m depth range
- 4 site has been sampled in the 76-100 m depth range
- 98 sites have been sampled using both unbaited and baited BRUVS while 26 have been sampled only with unbaited BRUVS.

Autonomous Underwater Vehicle (AUV)

The AUV team spent the day conducting generalized vehicle maintenance, testing vacuum seals, and charging batteries in preparation for tomorrow's dives.

Daily Report 4/16/12

General

We continued our operations along the outer reef off the eastern coast of Tutuila.

Baited Remote Underwater Video Stations (BRUVS)

The two BRUVS boats sampled a total of 10 sites, dropping two unbaited BRUVS units at each site. 7 of these sites were re-sampled with baited BRUVS a few hours later. To-date, the BRUVS team has sampled 134 sites, dropping a pair of BRUVS at each site.

- 18 sites have been sampled in the 0-6 m depth range,
- 41 sites have been sampled in the 6-18 m depth range
- 27 sites have been sampled in the 18-30 m depth range
- 33 sites have been sampled in the 30-53 m depth range
- 10 sites have been sampled in the 53-76 m depth range
- 5 site has been sampled in the 76-100 m depth range
- 105 sites have been sampled using both unbaited and baited BRUVS while 29 have been sampled only with unbaited BRUVS.

Autonomous Underwater Vehicle (AUV)

Today the AUV completed two dives off the eastern side of Tutuila. The first lasted 2 hours and 50 minutes, covered 2,150 m and took 4,396 photos. The second lasted about 2 hours, and covered 1,150 m. However, no photos were taken as the second computer in the electronics canister shut down. Tomorrow we will try running the photographs on the first computer instead.

Daily Report 4/17/12

General

Today we finished our final day of sampling off the north coast of Tutuila. Tomorrow we will conduct our final stereo-video camera calibrations and begin demobilizing gear and equipment for the transit back to Honolulu. In addition to the map of today's operations, I have also included an overview map depicting the work done by the BRUVS and AUV teams. I think you will agree, it is an impressive amount of work for a small group of people over the course of 14 days. I was privileged to work with a terrific team of scientists as well as ship's officers and crew who worked hard and stayed focused through many long hot days. I really can't thank them enough for their dedication to this effort.

Baited Remote Underwater Video Stations (BRUVS)

The two BRUVS boats sampled their final 4 sites, dropping two unbaited and two baited BRUVS units at each site. That brings the final number of BRUVS samples to 138 sites, dropping a pair of BRUVS at each site.

- 18 sites have been sampled in the 0-6 m depth range,
- 41 sites have been sampled in the 6-18 m depth range
- 27 sites have been sampled in the 18-30 m depth range
- 34 sites have been sampled in the 30-53 m depth range
- 11 sites have been sampled in the 53-76 m depth range
- 7 site has been sampled in the 76-100 m depth range
- 109 sites have been sampled using both unbaited and baited BRUVS while 29 have been sampled only with unbaited BRUVS.

Autonomous Underwater Vehicle (AUV)

The AUV successfully completed its last 2 dives today. Despite having to work around small boat deployment and recovery each day we've been able to consistently complete 2 dives, thanks in part to the flexibility and support of the Sette command in allowing overtime work to complete the scientific mission. Today's first dive covered 2,250 m, lasted about 2.75 hours and collected 2,250 photos in addition to the stereo video. The second dive covered 800 m, lasted about one hour, and collected 1,666 photos. I've included a few screen grabs from today's dives for your enjoyment.

Overall, the AUV team conducted 17 dives covering a total of 29,394 m of seafloor. Mean survey length was 1,729 m.