

Glacier Bay National Park Exploration 2016
17th March – 31st March 2016
(GLBA 00653)



Personnel	3
Cruise Narrative	4
Cruise Summary	7

PERSONNEL

Chief Scientist

Rhian G. Waller

University of Maine

Science Party

Dann Blackwood
Kasey Cantwell
Rod Catanach
Eric Glidden
Guy Cochrane
Mary Cook
Sara Doyle
Lisa Etherington
Amanda Kelley
Cheryl Morrison
Craig Murdoch
Kathy Scanlon
Rowan Sharman
Robert Stone

USGS
NOAA OER
University of Connecticut
University of Maine
USGS
Teacher at Sea
Glacier Bay National Park
Glacier Bay National Park
University of Alaska, Fairbanks
USGS
Glacier Bay National Park
USGS
Glacier Bay National Park
NOAA

ROV Kraken 2 Pilots

Kevin Joy
Michael McKee
Matt Jewell
Jeff Godfrey

University of Connecticut
University of Connecticut
University of Connecticut
University of Connecticut

Norseman II Ships Crew

Mike Hastings
Jim Howerd
Scott Hameister
Kevin Worthington
Jim Wells
Nate Charbonneau
Tommy Reimer
Harry Burnette
Darrin Hallman

Captain
Mate
2nd Mate
Engineer
Bosun
AB
AB
Cook
2nd Cook

CRUISE NARRATIVE

Friday 18th March 2016

ROV Shakedown Day

0700 – left Auke Bay dock to test the ROV at a site near the Shrine. Tests were conducted on recovery and launch, ship holding position and transit to bottom. Sonar head malfunctioned, so took some time to resolve. Did manage one dive to the seafloor (sediment) for a short period before heading back to Auke Bay to load personnel. Arrived in Auke Bay at 2200, left for Glacier Bay National Park around 2300.

Saturday 19th March 2016

Bartlett Cove and East Arm

The day started with an all hands abandon ship drill and arrival in Bartlett Cove for 0900 Boaters Orientation at the Visitor's center. The majority of ship and science crew attended lecture by Ranger Greg. Picked up our final personnel (Ranger Sara Doyle) and left for Muir Inlet in the East Arm at 1000. Arrived on station at White Thunder Ridge in the mid afternoon and did two SCUBA dives in the area, collecting the first set of samples of *Primnoa pacifica*. Did the first CTD station against the wall at White Thunder Ridge and the ROV deployed in the same location at 2100.

Sunday 20th March 2016

East Arm

The ROV came up at 0700, full loaded with *Primnoa pacifica* samples for genetic, isotope and reproductive analysis. Three further SCUBA dives at White Thunder Ridge secured the remaining samples from that location (and cleaned up flagging used to temporarily tag colonies), along with four CTD sites in the area. The ship moved further up to the head of Muir Inlet and conducted a SCUBA dive in the area where further *Primnoa pacifica* was seen. The ROV dive (Station 13) began at 2100 in the White Thunder Ridge area.

Monday 21st March 2016

East Arm

The ROV was recovered early at 0500 as the dive had migrated into a primarily silt environment. A plankton tow was conducted, followed by a shallow and a deep Niskin to collect water from coral sites at White Thunder Ridge. Four SCUBA dives commenced at West Dahl Point and Curtis Hills, seeing corals at the former, but not the later. Two of the dives brought out the scooters, allowing surveying of a greater spatial area. One pair of divers were visited by a sea lion during the safety stop. Two CTDs were conducted in the area and the ROV dive commenced at 0815 across from George Point (Klotz Hills).

Tuesday 22nd March 2016

West Arm and Hopkins Glacier

The ROV was recovered at 0700 and a 5hr transit began to the head of Hopkins Glacier at the top of the West Arm, arriving at noon. Once we arrived, scouting for suitable SCUBA sites began. Due to heavy snow and ice, combined with warm temperatures, many sites were un-diveable due to avalanche potential. A suitable site was found on the north wall of Hopkins inlet, around 2 miles from the glacier front and two dives were conducted there, locating two small colonies of *Primnoa pacifica*, the first to be found in the West Arm. One CTD and one SCUBA dive were

conducted further out from the glacier front, and the ROV dive commenced at 2000 at the same site where corals had been seen earlier.

Wednesday 23rd March 2016

West Arm

The ROV dive ended at 0600, after a successful night observing and collecting *Primnoa pacifica*. Cup corals were also observed in the dive video (the first recorded in Glacier Bay National Park), though none were collected. After a Niskin bottle was taken the ship transited to Gloomy Knob and Tidal Inlet area and commenced SCUBA operations. SCUBA was unable to be done at the Gloomy Knob site because of a sea lion haul out being directly at the chosen site. Instead dives occurred at Blue Mouse Cove and at the Tidal Bulge site. Divers were again visited by sea lions despite the location move. Three CTDs were taken inbetween dives and ROV operations began at 0700 near the Gloomy Knob site (but away from the sea lion haul out).

Thursday 24th March 2016

West Arm and Bartlett Cove

The ROV dive finished at 0700, having collected a full suite of coral samples, including cup coral and a large colony for NPS, and was immediately followed by a Niskin water collection (for Stone's pCO₂ work) and CTD at the same site. We then transited to Bartlett Cove, via the mouth of Glacier Bay National Park to collect more water via Niskin and a further CTD cast. We arrived in Bartlett Cove at 1130. We conducted a park event at the visitors center – over 80 participants from the local town of Gustavus attended and were shown a large *Primnoa pacifica* colony (being given to the interpretation staff), sponges, video and maps, SCUBA equipment, a ships tour and a tour of the ROV. The event finished at 1500 and was followed by a walking tour of Bartlett Cove led by NPS Rangers Emma and Sara. We left Bartlett Cove at 1700 for the outer coast, headed towards the Fault line, just south of Cross Sound. We arrived on station at 2200 and vessel conducted navigation trials, trying to hold position. Sea state was good, though rolling much more than within the bay.

Friday 25th March 2016

Outer Coast/Hopkins Inlet

Started to deploy ROV at 0200, just as the system was lifted off the deck the Norseman II engine failed. Everything was re-secured and engine repairs commenced, drifting off site to the North East. Issue found to be the shaft break had failed (potentially overheated). 0930 engine issue resolved and heading in to Glacier Bay National Park to pick up ROV and SCUBA sites within the bay. Did three CTD sites en-route to Hopkins and commenced St. 43 ROV site around ½ mile away from the original ROV site in Hopkins.

Saturday 26th March 2016

Hopkins and Tarr Inlets

The ROV came up around 7am to rain and snow. The first two SCUBA dives commenced at 8am and 9am, within sight of Hopkins Glacier, finding coral on the first dive. We then transited to Tarr Inlet, doing two more CTD stations while scouting for SCUBA sites within the inlet. Two dives were completed in Tarr Inlet (one finding the first record of *Primnoa*), and the final "Stone" CTD station was completed in the Rendu Inlet while en-route to ROV launch site off Gloomy Knobb.

ROV was launched at 7.30pm. At 8.30pm ship became stuck in gear and began to move backwards onto the wire at 3 knots. ROV was quickly brought up from the seafloor (to a safe distance as the engine was repaired), and recovered back onto the deck (2200), dive aborted. After discussion with Captain and engineer we began transit to central channel area (east of Drake Island) to operate in an area without above water walls, away from hazards.

Sunday 27th March 2016

Central Channel

ROV dive (Station 53) commenced around midnight, dropping onto a low relief sedimented and rock/boulder feature in the central channel just east of Drake Island. Corals were almost immediately seen on boulders. Despite several “off bottom” events due to ship movements, the dive was a success, and engine issues did not persist. Four SCUBA dives were completed off Gilbert Peninsula and Geiki Inlet (no corals found, but high sponge areas were present off of Gilbert Peninsula). The ROV dive was decided to be the same location as last night (east of Drake Island), so as to keep away from wall sites for the time being. The ROV dive commenced at 1930, but was recovered at 2000 for a tracking issue. ROV went back into the water at 2100.

Monday 28th March 2016

Central Channel & Tarr Inlet

ROV dive was aborted early because of increasing winds and waves. A full sample suite of *Primnoa pacifica* was however taken during the short dive. The vessel moved to the West Arm to commence SCUBA operations at the mouth of Tarr Inlet. Three SCUBA dives were completed along the western wall at the entrance Tarr Inlet, good coral habitat, but no corals observed. ROV dive commenced at a glacial sill close to West Dahl Point, as winds were topping 20 knots, so a dive on Gloomy Knobb was not possible. Though no collecting was planned, abundant coral populations were observed, so samples for genetics were collected.

Tuesday 29th March 2016

Muir Inlet & Happy Knobb

The ROV dive finished at 0600 and we moved up to the top of Muir Inlet and did one scuba dive on the corner between the head of the inlet and White Thunder Ridge, where coral colonies were found. We then moved to Klotz Hills and Point George, doing a scuba dive on each, finishing the scuba dives for this project. It was decided to move the ROV location from Gloomy Knobb to the newly named Happy Knobb, about 1 mile north from the original ROV location, where winds may be less and the site is further from the wall. ROV deployed at 2000.

Wednesday 30th March 2016

The final ROV dive (Station 66) was recovered at 0700 and we began to steam into Bartlett Cove.

Thursday 31st March 2016

Unloading, Auke Bay

CRUISE SUMMARY

EQUIPMENT AND SAMPLE SUMMARIES

SCUBA

Divers: Rhian Waller (15 dives), Bob Stone (11 dives), Jeff Godfrey (17 dives), Dann Blackwood (17 dives), Amanda Kelley (13 dives).

Thirty-one total SCUBA dives were conducted in all areas of Glacier Bay National Park. Dives were undertaken off a 13ft RHIB, with the Norseman II as support staying within visual distance. Thirteen dives were accomplished in the East Arm, two in the Main Bay and sixteen in the West Arm. Dives ranged from 18.6m to 31.79m depth, and from 15 to 38 minutes duration. No diving related illness or injuries were reported for this research cruise.

ROV

SAMPLES/DATA

Organism Collections

***Primnoa pacifica* – Genetics (Cheryl Morrison, USGS):** During this expedition in Glacier Bay, extensive *Primnoa pacifica* populations were observed, especially in deeper waters using the remotely operated vehicle. Small pieces of *Primnoa pacifica* were collected from several sites for population genetic analyses. For adequate statistical power, we targeted 30 samples per site. At White Thunder Ridge, approximately 30 samples were obtained from both deep (137-170 m) and shallow water (Scuba depths, 47-72 feet). These samples will allow us to test whether or not *P. pacifica* populations are isolated by depth. One ROV dive on a sill off Westdahl Point produced 18 *P. pacifica* samples. Thirty one *P. pacifica* samples were obtained from two ROV dives in the Central Channel, off Drake Island. In the West Arm, *P. pacifica* samples were obtained from Gloomy Knob and Johns Hopkins Inlet. The *P. pacifica* samples taken for population genetics will be genotyped at nine microsatellite loci. Multi-locus genotypes will be analyzed to determine relationships among individuals within populations, as well as overall population structuring within the Park. Additionally, connectivity among Glacier Bay National Park *P. pacifica* populations and those in other fjords (Tracy and Endicott Arms), plus offshore in the Gulf of Alaska, will be assessed using samples collected previously. This study will be the first to examine population structuring of this dominant habitat-forming coral in Southeastern Alaska, and may provide a framework for effective management of this ecologically important yet vulnerable deep-sea coral ecosystem.

Stable Isotopes (Amanda Demopolous, USGS):

Reproduction (Rhian Waller, UMaine): Snips of *Primnoa pacifica* were saved for reproductive analysis. Waller et al. (2014) looked at reproduction of this species from Tracy Arm fjord, south of Juneau and found high fecundity and non-seasonal reproduction (reproducing at all times of year in abundance). Reproduction is a fundamental ecological process that can also be used as an indicator of stress. Samples of *P. pacifica* from this cruise will be used to both compare reproductive patterns in different locations (samples from the deep Gulf of Alaska are also currently being processed) and to examine the health of various populations within Glacier Bay National Park. This work will also be tied with the population genetics (to examine larval flow) and the dating work (age corals start reproducing) to help inform conservation measures with this species.

Radiocarbon Dating (Nancy Prouty, USGS): Information on growth-rates and life-spans of cold-water corals is important for understanding the vulnerability of these organisms to both natural and anthropogenic perturbations, as well as the likely duration of any observed adverse impacts. The gorgonian corals such as *Primnoa* rely on a surface-derived food source (i.e., particulate organic carbon) rather than sedimentary or dissolved organic carbon (Druffel et al., 1995; Roark et al., 2006). As a result, the ¹⁴C-derived age estimates of gorgonian corals are assumed to be unaffected by feeding upon old resuspended sedimentary carbon because these

organisms acquire their carbon from surface-water organic matter after rapid transport to depth (Roark et al., 2009) Therefore, robust ¹⁴C-derived chronologies and known surface ocean ¹⁴C reservoir age constraints in the Gulf of Alaska provide reliable calendar ages to the collection of gorgonian cold-water corals.

Sponges – Robert Stone (NOAA):

Other Organisms – Rhian Waller (UMaine): Other organisms collected within the park will be identified to species by being provided to experts in the various groups.

VIDEO DATA – Rhian Waller (UMaine) & Glacier Bay National Park

Video and photographic data was collected on all ROV and SCUBA dives and archived on DVD and hard drives. All this video and photographic data is being provided to the National Park Service for use by interpreters within Glacier Bay National Park. A “best of” video and photographs were also created for immediate use by all participants on the cruise.

Video transects in deep and shallow environments will be used for diversity analysis of both invertebrates and fish, examining differences in community structure at each area within the park, as well as depth distributions.

CTD

Standalone – Robert Stone, NOAA Auke Bay Laboratory: Nineteen standalone CTD sites were accomplished during this cruise, down to full depth at their particular locations. Seventeen of these CTD stations were replicating Stone (in preparation) from 2004 CTD data collected within the park, one station was collected at the mouth of Glacier Bay National Park and one station was taken at the head of Tarr Inlet, where new habitat had opened up.

ROV Mounted – Rhian Waller, University of Maine: An ROV mounted CTD collected data during each ROV dive. These data will be paired with biological diversity data generated from the ROV footage to fully characterize each habitat visualized.

NISKIN

Standalone – Robert Stone, NOAA Auke Bay Laboratory: Four standalone niskin samples were taken during the cruise for pCO₂ analysis by Robert Stone (Auke Bay Laboratory). Two were taken at White Thunder Ridge (50m & 160m), one by the Hopkins Glacier (200m) and one at Point Gustavus (68m). Niskins were taken next to *Primnoa pacifica* coral populations to investigate ocean acidification effects on corals in the Southeastern Alaskan region.

ROV Mounted – Amanda Demopolous: The ROV Kraken II collected water samples from 8 locations around Glacier Bay National Park for Particulate Organic Matter analysis

PLANKTON – Diane Adams (Rutgers)

One plankton tow was taken during this cruise to examine for cold-water coral larvae.

ArcGIS DATABASE

Kathy Scanlon (USGS), Guy Cochrane (USGS) and Glacier Bay National Park.

We used ArcGIS software for cruise planning, site selection, and to display preliminary results. Digital navigation charts from NOAA and previously collected and published multibeam bathymetry and backscatter data served as base layers. The multibeam data were processed by Cochrane to highlight areas of high seafloor steepness which was helpful in selecting appropriate ROV sites. Information about rock types on adjacent land areas was also used. Observations made during previous SCUBA dives by Stone (2004), drop camera deployments by Waller (2010), and towed camera video by Cochrane (2004) were distilled and entered into the GIS for use in selecting new sites.

During the cruise, detailed records were kept for each site explored with ROV and SCUBA, as well as observations and collections using a CTD, a Niskin bottle, and a single plankton tow. Navigation files for the ROV tracklines were processed and edited and entered into the GIS. Preliminary observations, such as presence/absence of *Primnoa pacifica*, presence of other species, seafloor characteristics, gear used, divers' names, times and durations of events, etc., were linked to geographic positions and displayed in ArcGIS. This information was valuable for choosing subsequent sites. At the end of the cruise we developed a set of maps showing where we collected each type of data as well as a preliminary map of *P. pacifica* presence/absence for Glacier Bay.

EDUCATION AND OUTREACH

Port Event, Bartlett Cove, GBNP: A short port event was conducted on the 24th March at the Bartlett Cove in collaboration with the National Park Service interpreters. Over 80 people from the local town of Gustavus came to the park to participate between 1pm and 3pm. Scientists, ROV pilots and ships crew put on various events – samples of coral and sponges and ROV footage were shown at the visitor center. A SCUBA equipment display was set up on the dockside, tours of the Norseman II, tours of the ROV set up and displays of the GIS database and mapping were all put on for this highly successful event. After the event the large coral colony for the park service was turned over, along with a large sponge collected by SCUBA divers.

NOAA OE Signature Cruise Website – Kasey Cantwell, NOAA OER

Teacher at Sea – Mary Cook – Scammon Bay School (Lower Yukon School District): As NOAA's Teacher at Sea on board the R/V Norseman II in Glacier Bay, Alaska, my responsibilities have been to observe the science work being conducted and help in any capacity where I was needed and able. I helped with processing biological samples, which mostly consisted of *Primnoa pacifica* preserved for genetic, isotope and reproductive studies. I wrote a daily blog containing descriptions and photos of the work being done, interviews of the scientists and ship's crew, and answering questions submitted from students and blog readers. My fourteen blogs on the NOAA Teacher at Sea web site are intended to be written for the interest and education of the general public and school students in particular. My Teacher at Sea experience has a two-fold purpose. One is to educate and enrich me as a teacher by putting me in touch with cutting-edge research scientists and allowing me to do real fieldwork alongside them. Another is to infuse my classroom with excitement allowing my students to have contact with real scientists doing real research.

NOAA Teacher at Sea Blog link:

<https://teacheratsea.wordpress.com/category/2016/mary-cook-2016/>

STATION LOG

Station	Area	Location	Gear	Local Date	Local Time	Latitude (N)	Longitude (W)	Comments
1	East Arm	White Thunder Ridge	SCUBA	19-Mar-2016	15:55	59 01.523	136 10.453	
2	East Arm	White Thunder Ridge	SCUBA	19-Mar-2016	18:08	59 01.532	136 10.443	
3	East Arm	White Thunder Ridge	CTD	19-Mar-2016	19:48	59 01.582	136 10.381	Stone CTD #4
4	East Arm	White Thunder Ridge	ROV	19-Mar-2016	20:57	59 01.5204	136 10.2206	ROV Dive 01
5	East Arm	White Thunder Ridge	SCUBA	20-Mar-2016	8:33	59 01.522	136 10.449	
6	East Arm	White Thunder Ridge	CTD	20-Mar-2016	10:24	59 03.005	136 11.18	Stone CTD #2, water depth = 210m
7	East Arm	White Thunder Ridge	CTD	20-Mar-2016	11:00	59 01.254	136 08.403	Stone CTD #5
8	East Arm	White Thunder Ridge	CTD	20-Mar-2016	11:15	59 01.58	136 09.830	Stone CTD #3, water depth = 241
9	East Arm	White Thunder Ridge	SCUBA	20-Mar-2016	12:10	59 01.530	136 10.444	
10	East Arm	White Thunder Ridge	SCUBA	20-Mar-2016	14:40	59 01.530	136 10.454	
11	East Arm	Muir Inlet	CTD	20-Mar-2016	16:28	59 04.768	136 21.233	Stone CTD #1, water depth = 202m
12	East Arm	Muir Inlet	SCUBA	20-Mar-2016	17:23	59 05.060	136 21.727	
13	East Arm	White Thunder Ridge/Sill	ROV	20-Mar-2016	20:56	59 02.424	136 11.232	ROV Dive 02
14	East Arm	White Thunder Ridge	Plankton Tow	21-Mar-2016	6:30	59 02.325	136 11.168	
15	East Arm	White Thunder Ridge	Niskin	21-Mar-2016	8:00	59 01.509	136 10.432	
16	East Arm	White Thunder Ridge	Niskin	21-Mar-2016	8:53	59 01.551	136 10.315	water depth = 184m
17	East Arm	Westdahl Point	SCUBA	21-Mar-2016	10:28	58 58.791	136 08.542	
18	East Arm	Curtis Hills	SCUBA	21-Mar-2016	12:27	58 57.209	136 08.976	used scooters
19	East Arm	Westdahl Point	CTD	21-Mar-2016	13:46	58 58.532	136 08.167	Stone CTD #6, water depth = 170m
20	East Arm	Klotz Hills	CTD	21-Mar-2016	14:48	58 52.781	136 05.360	Stone CTD #7, water depth = 317m
21	East Arm	Westdahl Point	SCUBA	21-Mar-2016	16:07	58 58.636	136 08.643	
22	East Arm	Curtis Hills	SCUBA	21-Mar-2016	17:47	58 56.990	136 08.904	used scooters
23	East Arm	across from George Point	ROV	21-Mar-2016	20:13	58 51.5979	136 05.3766	ROV Dive 03
24	West Arm	Johns Hopkins Inlet	SCUBA	22-Mar-2016	12:38	58 51.922	137 05.695	found Primnoa in West Arm!
25	West Arm	Johns Hopkins Inlet	SCUBA	22-Mar-2016	15:10	58 51.923	137 05.707	
26	West Arm	Johns Hopkins Inlet	CTD	22-Mar-2016	16:25	58 53.759	137 02.792	
27	West Arm	Johns Hopkins Inlet	SCUBA	22-Mar-2016	17:30	58 55.273	137 00.049	
28	West Arm	Johns Hopkins Inlet	ROV	22-Mar-2016	20:15	58 51.876	137 5.496	ROV Dive 04
29	West Arm	Johns Hopkins Inlet	Niskin	23-Mar-2016	6:30	58 51.932	137 05.522	cast depth = 98.2m
30	West Arm	Blue Mouse Cove	SCUBA	23-Mar-2016	9:45	58 47.807	136 29.380	
31	West Arm	Blue Mouse Cove	SCUBA	23-Mar-2016	11:14	58 47.035	136 28.409	
32	West Arm		CTD	23-Mar-2016	12:13	58 48.642	136 28.357	Stone CTD #15, Water depth = 381m; Cast depth = 371m
33	West Arm		CTD	23-Mar-2016	13:08	58 45.213	136 21.003	Stone CTD #16, Water depth = 301m; Cast depth = 289m
34	Main Bay	Tlingit Point	SCUBA	23-Mar-2016	15:24	58 45.216	136 15.219	
35	Main Bay	Tlingit Point	SCUBA	23-Mar-2016	16:20	58 45.813	136 16.104	
36	West Arm		CTD	23-Mar-2016	18:37	58 51.931	136 35.496	
37	West Arm	Tidal Bulge	ROV	23-Mar-2016	20:15	58 49.2015	136 27.1449	ROV Dive 05
38	Main Bay	Point Gustavus	Niskin	24-Mar-2016	10:31	58 22.327	135 58.690	
39	Main Bay	Point Gustavus	CTD	24-Mar-2016	10:49	58 22.299	135 58.850	
40	Main Bay	Central Channel	CTD	25-Mar-2016	14:02	58 39.761	136 07.460	Stone CTD #17, water depth = 310m, cast depth = 300m
41	West Arm	Russell Island	CTD	25-Mar-2016	16:53	58 53.808	136 44.171	Stone CTD #12, water depth = 381, cast depth = 371
42	West Arm	Head of Hopkins Glacier	CTD	25-Mar-2016	17:34	58 53.934	136 50.326	water depth = 377, cast depth = 367
43	West Arm	Johns Hopkins Inlet	ROV	25-Mar-2016	19:39	58 52.4128	137 04.4011	ROV dive 06
44	West Arm	Johns Hopkins Inlet mouth	SCUBA	26-Mar-2016	8:01	58 55.128	136 55.870	
45	West Arm	Jaw Point	SCUBA	26-Mar-2016	9:29	58 54.135	137 00.440	
46	West Arm	Tarr Inlet	CTD	26-Mar-2016	11:03	58 58.302	136 55.326	water depth = 234, cast depth = 324, Stone CTD #9
47	West Arm	Tarr Inlet	CTD	26-Mar-2016	11:39	59 00.203	136 59.163	water depth = 310, cast depth = 300, Stone CTD #8
48	West Arm	Tarr Inlet	CTD	26-Mar-2016	12:23	59 03.085	137 02.868	water depth = 220, cast depth = 210, no Stone site
49	West Arm	Tarr Inlet	SCUBA	26-Mar-2016	14:35	59 02.810	137 00.845	
50	West Arm	Tarr Inlet	SCUBA	26-Mar-2016	15:43	59 00.214	137 00.034	
51	West Arm	Rendu Inlet	CTD	26-Mar-2016	18:17	58 55.038	136 36.639	water depth = 172, cast depth = 162, Stone CTD #13
52	West Arm	Tidal Bulge	ROV	26-Mar-2016	19:47	58 49.9589	136 59.3556	Aborted because of ship's engine problem. ROV Dive 07
53	Main Bay	Central Channel	ROV	27-Mar-2016	20:22	58 39.5127	136 09.1157	ROV Dive 08
54	West Arm	Gilbert Peninsula	SCUBA	27-Mar-2016	9:07	58 49.011	136 32.155	
55	West Arm	Gilbert Peninsula	SCUBA	27-Mar-2016	10:38	58 49.408	136 32.920	
56	Main Bay	Geikie Inlet North	SCUBA	27-Mar-2016	14:41	58 41.304	136 21.072	
57	Main Bay	Geikie Inlet South	SCUBA	27-Mar-2016	16:00	58 40.196	136 18.723	
58	Main Bay	Central Channel	ROV	27-Mar-2016	19:30	58 39.044	136 08.4892	ROV Dive 09
59	West Arm	Tarr Inlet	SCUBA	28-Mar-2016	9:12	58 57.055	136 55.215	
60	West Arm	Tarr Inlet	SCUBA	28-Mar-2016	10:40	58 57.104	136 55.212	
61	West Arm	Tarr Inlet	SCUBA	28-Mar-2016	15:12	58 57.301	136 55.513	
62	East Arm	Westdahl Point	ROV	28-Mar-2016	21:20	58 58.386	136 08.056	ROV Dive 10
63	East Arm	Muir Inlet	SCUBA	29-Mar-2016	8:37	59 03.358	136 12.562	
64	East Arm	Klotz Hills	SCUBA	29-Mar-2016	11:30	58 53.148	136 04.099	
65	East Arm	George Point	SCUBA	29-Mar-2016	16:15	58 51.808	136 03.203	
66	West Arm	Happy Knobb	ROV	29-Mar-2016	19:52	58 50.567	136 30.295	ROV Dive 11

SCUBA DIVE LOG MASTER

Station	Area	Location	Date	Time In	Time Out	Bottom Time	Max Depth (ft)	Max Depth (m)	Personnel
1	East Arm	White Thunder Ridge	19-Mar-2016	15:55	16:24	28	72	21.95	Bob Stone, Rhian Waller, Jeff Godfrey
2	East Arm	White Thunder Ridge	19-Mar-2016	18:08	18:34	22	72	21.95	Bob Stone, Dann Blackwood, Amanda Kelley
5	East Arm	White Thunder Ridge	20-Mar-2016	9:03	9:03	29	71	21.65	Bob Stone, Rhian Waller, Dann Blackwood
9	East Arm	White Thunder Ridge	20-Mar-2016	12:10	12:35	24	68	20.73	Bob Stone, Jeff Godfrey, Amanda Kelley
10	East Arm	White Thunder Ridge	20-Mar-2016	15:10	15:10	29	82	25.00	Rhian Waller, Jeff Godfrey, Dann Blackwood
12	East Arm	Muir Inlet	20-Mar-2016	17:23	17:45	21	74	22.56	Bob Stone, Rhian Waller, Amanda Kelley
17	East Arm	Westdahl Point	21-Mar-2016	10:55	10:55	25	90	27.44	Bob Stone, Amanda Kelley, Dann Blackwood
18	East Arm	Curtis Hills	21-Mar-2016	12:27	12:56	29	96	29.27	Rhian Waller, Jeff Godfrey
21	East Arm	Westdahl Point	21-Mar-2016	16:07	16:30	22	89	27.13	Bob Stone, Dann Blackwood, Amanda Kelley
22	East Arm	Curtis Hills	21-Mar-2016	18:16	18:16	25	83	25.30	Rhian Waller, Jeff Godfrey
24	West Arm	Johns Hopkins Inlet	22-Mar-2016	12:38	13:01	22	82	25.00	Bob Stone, Rhian Waller, Dann Blackwood
25	West Arm	Johns Hopkins Inlet	22-Mar-2016	15:34	15:34	23	87	26.52	Amanda Kelley, Jeff Godfrey
27	West Arm	Johns Hopkins Inlet	22-Mar-2016	17:30	17:46	15	77	23.48	Rhian Waller, Bob Stone, Dann Blackwood
30	West Arm	Blue Mouse Cove	23-Mar-2016	10:17	10:17	30	91	27.74	Bob Stone, Rhian Waller, Dann Blackwood
31	West Arm	Blue Mouse Cove	23-Mar-2016	11:14	11:41	26	104	31.71	Amanda Kelley, Jeff Godfrey
34	West Arm	Tidal Bulge	23-Mar-2016	15:43	15:43	16	73	22.26	Rhian Waller, Bob Stone
35	West Arm	Tidal Bulge	23-Mar-2016	16:20	16:52	31	95	28.96	Amanda Kelley, Jeff Godfrey
44	West Arm	Johns Hopkins Inlet mouth	26-Mar-2016	8:25	8:25	23	104	31.71	Rhian Waller, Amanda Kelley
45	West Arm	Jaw Point	26-Mar-2016	9:29	9:54	25	101	30.79	Dann Blackwood, Jeff Godfrey
49	West Arm	Tarr Inlet	26-Mar-2016	14:51	14:51	16	79	24.09	Rhian Waller, Amanda Kelley
50	West Arm	Tarr Inlet	26-Mar-2016	15:43	16:15	31	99	30.18	Dann Blackwood, Jeff Godfrey
54	West Arm	Gilbert Peninsula	27-Mar-2016	9:36	9:36	28	100	30.49	Rhian Waller, Dann Blackwood
55	West Arm	Gilbert Peninsula	27-Mar-2016	10:38	11:13	34	90	27.44	Amanda Kelley, Jeff Godfrey
56	Main Bay	Geikie Inlet North	27-Mar-2016	15:10	15:10	28	91	27.74	Rhian Waller, Dann Blackwood
57	Main Bay	Geikie Inlet South	27-Mar-2016	16:00	16:35	34	79	24.09	Amanda Kelley, Jeff Godfrey
59	West Arm	Tarr Inlet	28-Mar-2016			23	96	29.27	Rhian Waller, Amanda Kelley
60	West Arm	Tarr Inlet	28-Mar-2016			38	97	29.57	Dann Blackwood, Jeff Godfrey
61	West Arm	Tarr Inlet	28-Mar-2016			34	98	29.88	Dann Blackwood, Jeff Godfrey
63	East Arm	Muir Inlet	29-Mar-2016			34	80	24.39	Dann Blackwood, Jeff Godfrey
64	East Arm	Klotz Hills	29-Mar-2016			34	61	18.60	Dann Blackwood, Jeff Godfrey
65	East Arm	Point George	29-Mar-2016			36	98	29.88	Dann Blackwood, Jeff Godfrey

