U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Fisheries Science Center
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PROJECT REPORT

VESSEL: NOAA Ship *Oscar Elton Sette*, Project SE-17-06 (HICEAS)

PROJECT PERIOD: 6 July – 10 October, 2017

AREA OF

OPERATION: Hawaii EEZ

TYPE OF
OPERATION: Cetacean and seabird transect survey

ITINERARY:

6 Jul	1500—Departed Ford Island for transit to survey trackline. Began visual and passive acoustic survey.
7 Jul–1 Aug	90 minutes prior to sunrise—recovered towed hydrophone array. CTD was cast to 1000-m depth. Following CTD, deployed towed hydrophone array. Sunrise–Sunset—visual and acoustic survey. Cetacean and seabird shipboard transected within 200 nmi of the main Hawaiian Islands and Northwest Hawaiian Islands. Secured visual survey at sunset, recovered towed array. After sunset—deployed two sonobuoys for baleen whale monitoring 1 mile from CTD station. Conducted CTD cast to 1000 m. After CTD—deployed acoustic array for overnight acoustic survey. As instructed by Chief Scientist, deployed and recovered DASBRs in main Hawaiian Islands Stratum.
10–11 July	Recovered and redeployed Kona HARP. Conducted UAS training and tested flights in the lee of Kona.
16 July	Recovered and redeployed Ocean Noise Reference Station NRS04 north of Oahu.
20 July	Transferred fuel and supplies to French Frigate Shoals by small boat. Conducted nearshore survey.
2 Aug	0900—Arrived Ford Island.

Leg II

8 Aug 1400—Departed Pearl Harbor fuel pier for transit to survey trackline. Began visual and passive acoustic survey.

9 Aug–4 Sep 90 minutes prior to sunrise—Recovered towed hydrophone array. CTD casted to 1000-m depth. Following CTD—Deployed towed hydrophone array. Sunrise-Sunset—Visual and acoustic survey. Cetacean and seabird shipboard transects within 200 nmi of the main Hawaiian Islands and Northwest Hawaiian Islands. Secured visual survey at sunset, recovered towed array. After sunset—Deployed two sonobuoys for baleen whale monitoring 1 mile from CTD station. Conducted CTD cast to 1000 m. After CTD- Deployed acoustic array for overnight acoustic survey. As instructed by Chief Scientist, deployed and recovered DASBRs in main Hawaiian Islands Stratum.

4 Sept 2300—Simultaneously coordinated EK-60 sampling with R/V *Lasker*.

5 Sept 0730—Arrived Ford Island.

Leg III

11 Sept 1030—Departed Ford Island for transit to survey trackline. Began visual and passive acoustic survey.

12 Sep–9 Oct 90 minutes prior to sunrise—Recovered towed hydrophone array. CTD cast to 1000-m depth. Following CTD—Deployed towed hydrophone array. Sunrise–sunset—Visual and acoustic survey. Cetacean and seabird shipboard transects within 200 nmi of the main Hawaiian Islands and Northwest Hawaiian Islands. Secured visual survey at sunset, recovered towed array. After sunset—Deployed two sonobuoys for baleen whale monitoring 1 mile from CTD station. Conducted CTD cast to 1000 m. After CTD—Deployed acoustic array for overnight acoustic survey. As instructed by Chief Scientist, deployed and recovered DASBRs in main Hawaiian Islands Stratum.

13 Sep Recovered and redeployed Kauai HARP.

3–4 Oct Recovered monk seal and marine turtle field camp at French Frigate Shoals.

9 Oct 2200—Simultaneously coordinated EK-60 sampling with R/V *Lasker*.

10 Oct 0900—Arrived Ford Island.

MISSIONS AND RESULTS:

A. Conduct daytime visual line-transect surveys for cetaceans along pre-determined transect lines within the EEZ around the Hawaiian Islands. Search effort was recorded in WinCruz, including information on transect survey speed and

direction, viewing conditions, and observer rotation. When cetaceans were sighted, distance and bearing to the initial sighting location were recorded, as well as species code, group size, and behavior. The visual survey was maintained by a team of 6 cetacean observers. Additional sampling was carried out during select sightings, including collection of species identification and individual identification photographs, collection of tissue samples for genetic and other analyses, and deployment of satellite tags.

1. The cetacean observers aboard the R/V *Sette* portion of HICEAS surveyed 6,212.5 nmi over the course of 87 days carried out in 3 survey legs. The cetacean visual survey team encountered 187 cetacean groups, including 18 species and several groups that could not be identified to species (Table 1). Species identification photographs were collected for most sightings. Biopsy samples were collected from 82 individuals during 20 sightings of 6 species. Samples numbers are indicated in Table 1.

B. Conduct daytime and overnight passive acoustic surveys for cetaceans along pre-determined transect lines within the EEZ around the Hawaiian Islands. Passive acoustic data was recorded simultaneously from 5 hydrophones in 2 array segments, and a depth sensor within each array segment. All acoustic data, effort, and encounter information was recorded in PAMGUARD.

   Daytime passive acoustic surveys were monitored by a team of 3 acousticians. Acoustic encounter information was not conveyed to the visual survey team until the acoustic detection passed the beam of the ship and was therefore missed by the visual survey team. Only high-priority species, including false killer whales, sperm whales, and beaked whales, and those within 3 nmi of the trackline, were chased following acoustic detection if missed by the visual survey team. Towed array data was not monitored at night. All nighttime data were archived in PAMGUARD for later review.

   Sonobuoys were deployed during nighttime CTD stations on a subset of nights. Two sonobuoys were deployed at each station to facilitate estimation of animal location using the bearings generated by each sonobuoy. Sonobuoys were also opportunistically deployed on visually-identified baleen whale sightings to collect acoustic data from known species.

1. The passive acoustic team logged 345 acoustic detections of cetacean groups from the towed hydrophone array during daytime listening effort (Table 2). Of that total, 99 groups were also seen by the visual observers.
2. A total of 104 sonobuoys were deployed, including 2 each at 45 CTD stations, 9 on 5 visual sightings of baleen whales, and 5 that did not work correctly upon deployment.

C. Conduct daytime seabird strip transect surveys along pre-determined transect lines within the EEZ around the Hawaiian Islands. Search effort was recorded in SeeBird, including information on search effort, viewing conditions, and observer rotation. One side of the ship was searched by a single seabird observer, with the observer choosing the side with better viewing conditions at that time. Seabird sightings were recorded when birds were seen within 300 m of the ship and for feeding flocks seen at any distance.

1. The seabird observers aboard the R/V *Sette* portion of HICEAS recorded 40 species of birds during the effort (Table 3).

Conduct twice daily CTD casts to 1000-m depth (1 hour before sunrise and 1 hour after sunset), and continuous collection of active acoustic data using the EK-60.

1. 122 CTDs were conducted during the R/V *Sette* portion of HICEAS. EK-60 data were continuously collected at 38, 70, and 120 kHz.

D. Conduct UAS flights over cetaceans to collect imagery for assessment of school composition and individual animal condition. Potential UAS data collection was focused on a subset of species, including sperm whales, false killer whales, short-finned pilot whales, and Bryde's whales.

1. A total of 21 flights were conducted with the APH-22 hexacopter on 3 days. Seven testing and training flights were conducted in the lee of Kona on 10 July, and 7 flights over groups of short-finned pilot whales on 11 July, also in the Kona lee. During leg 2, 6 flights were conducted over a group of short-finned pilot whales during a single encounter, offshore north of Kauai. Weather conditions were often not suitable for flights during other sightings, or collection of other datasets was a higher priority with the time available.

E. Other passive acoustic operations: Several other passive acoustic projects were carried out during HICEAS, including deployment and recovery of High-Frequency Acoustic Recording Packages at long-term monitoring sites near Kona and Kauai, recovery and redeployment of the Ocean Noise Reference Station NRS04 north of Oahu, and deployment and recovery of Drifting Acoustic Spar Buoy Recorders (DASBRs) to listen for cetaceans within the main Hawaiian

Islands Focus Area. DASBR deployment and recovery operations occurred on both R/V *Sette* and *Lasker*, for a total of 19 DASBR deployments and 13 recoveries (Figure 4). Six DASBRs were not fully recovered, 5 because the Iridium transmitter halted transmission prior to recovery, and 1 because the polypropylene line between the spar float and the recording package parted prior to recovery. The collective drifts from the 13 recovered DASBRs extended well beyond the main Hawaiian Islands Focus Area, with one recovered beyond the Hawaii EEZ boundary after drifting over 240 nmi over 19 days at sea. The acoustics team attempted to field test a new volumetric towed hydrophone array, the Trident, but manufacturing defects and damage during shipping prevented meaningful field tests.

SCIENTIFIC PERSONNEL:

Leg I:

Name (Last, First)	**Title**	**Affiliation**
Oleson, Erin	Chief Scientist, Project Leader	NOAA Fisheries, Pacific Islands Fisheries Science Center (PIFSC)
Olson, Paula	Visual Survey Lead	Ocean Associates, Inc. (OAI)
Vazquez Morquecho, Ernesto	Visual Survey Lead	OAI
Ü, Adam	Visual Survey	OAI
Ligon, Allan	Visual Survey	Contractor
Bendlin, Andrea	Visual Survey	OAI
Van Cise, Amy	Visual Survey	OAI
Breese, Dawn	Seabirds Survey	OAI
Hoefer, Christopher	Seabirds Survey	OAI
Keating, Jennifer	Acoustic Survey Lead	Joint Institute for Marine & Atmospheric Research, University of Hawaii (JIMAR)
Norris, Erik	Acoustic Survey	JIMAR
Coates, Shannon	Acoustic Survey	OAI
Yano, Kym	Project Coordinator, UAS Pilot	JIMAR
Bradford, Amanda	UAS Pilot	PIFSC
DeSchryver, Staci	Teacher-At-Sea	NOAA Teacher-At-Sea Program

Leg II:

Name (Last, First)	Title	Affiliation
Bradford, Amanda	Project Leader, UAS Pilot	PIFSC
Olson, Paula	Visual Survey Lead	OAI
Bendlin, Andrea	Visual Survey Lead	OAI
Ü, Adam	Visual Survey	OAI
Ligon, Allan	Visual Survey	Contractor
Van Cise, Amy	Visual Survey	OAI
Driskell, Rory	Visual Survey, UAS Pilot	PIFSC
Breese, Dawn	Seabird Survey	OAI
Hoefer, Christopher	Seabird Survey	OAI
Keating, Jennifer	Acoustic Survey Lead	JIMAR
Norris, Erik	Acoustic Survey	JIMAR
Bayless, Ali	Acoustic Survey	JIMAR
Fader, Joseph	Visiting Scientist	Duke University

Leg III:

Name (Last, First)	Title	Affiliation
Hill, Marie	Project Leader, UAS Pilot	JIMAR
Olson, Paula	Visual Survey Lead	OAI
Bendlin, Andrea	Visual Survey Lead	OAI
Ü, Adam	Visual Survey	OAI
Ligon, Allan	Visual Survey	Contractor
Sinclair, Carrie	Visual Survey	NOAA Fisheries, Southeast Fisheries Science Center (SEFSC)
Sanders, Greg	Visual Survey	Bureau of Ocean Energy Management (BOEM)
Breese, Dawn	Seabird Survey	OAI
Hoefer, Christopher	Seabird Survey	OAI
Keating, Jennifer	Acoustic Survey Lead	JIMAR
Norris, Erik	Acoustic Survey	JIMAR
Driskell, Rory	Acoustic Survey, UAS Pilot	PIFSC
Allan, Ann	Acoustic Survey	PIFSC

Name (Last, First)	Title	Affiliation
Carpenter, Josh	Monk Seal Staff	JIMAR
Farry, Shawn	Monk Seal Staff	JIMAR
Guerin, Sean	Monk Seal Staff	JIMAR
Northey, Allie	Monk Seal Staff	JIMAR
Reininger, Alex	Marine Turtle Staff	JIMAR

Submitted by: 

Erin Oleson
Chief Scientist
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Approved by: 

Michael P. Seki, Ph.D.
Science Director
Pacific Islands Fisheries Science Center

Attachments

Table 1. Summary of all cetacean sightings during the R/V *Sette* portion of HICEAS 2017. The table includes on and off-effort sightings. There were 4 sightings that included more than one species, such that the sum of the '# of sightings' by species does not equal the total number of sightings.

Species code	Common name	# Sightings	# Tissue Samples	# Telemetry Tags
2	Pantropical spotted dolphin	7	5	
13	Striped dolphin	17		
15	Rough-toothed dolphin	15	17	
18	Bottlenose dolphin	3	3	
21	Risso's dolphin	4		
31	Melon-headed whale	4		
32	Pygmy killer whale	2		
33	False killer whale	13	24	4
36	Short-finned pilot whale	28	32	3
37	Killer whale	1		
46	Sperm whale	13		
47	Pygmy sperm whale	2		
49	unidentified beaked whale	19		
51	unidentified *Mesoplodon*	7		
59	Blainville's beaked whale	7		
61	Cuvier's beaked whale	7		
65	Longman's beaked whale	3		
70	unidentified *Balaenoptera*	1		
72	Bryde's whale	2		
76	Humpback whale	1	1	
77	unidentified dolphin	6		
78	unidentified small whale	2		
79	unidentified large whale	4		
80	unidentified *Kogia*	4		
96	unidentified cetacean	2		
98	unidentified whale	3		
99	Sei/Bryde's whale	3		
102	Spinner dolphin	2		
177	unidentified small dolphin	7		
277	unidentified medium dolphin	1		

Table 2. Summary of all daytime towed hydrophone array cetacean detections during the R/V *Sette* portion of HICEAS 2017. Species ID was determined acoustically in real-time for only a subset of species, including false killer whales and those species that could be automatically classified in real-time based on their echolocation clicks (i.e., sperm whales, beaked whales, and *Kogia*). For other species, ID is assigned only if the group was identified by the visual observer team. All other detections were classified as unidentified dolphin or unidentified cetacean.

Species code	Common name	# Acoustic detection
2	Pantropical spotted dolphin	6
13	Striped dolphin	11
15	Rough-toothed dolphin	9
18	Bottlenose dolphin	3
21	Risso's dolphin	3
31	Melon-headed whale	4
32	Pygmy killer whale	1
33	False killer whale	18
36	Short-finned pilot whale	19
46	Sperm whale	103
49	unidentified beaked whale	5
51	unidentified *Mesoplodon*	2
59	Blainville's beaked whale	7
61	Cuvier's beaked whale	8
65	Longman's beaked whale	6
77	unidentified dolphin	124
80	unidentified *Kogia*	3
96	unidentified cetacean	12
177	unidentified small dolphin	1

Table 3. Seabird species recorded during the R/V *Sette* portion of HICEAS 2017.

List of Recorded Seabird Species		
Laysan Albatross	Flesh-footed Shearwater	South Polar Skua
Black-footed Albatross	Sooty Shearwater	Parasitic Jaeger
Cook's Petrel	Wedge-tailed Shearwater	Pomarine Jaeger
Black-winged Petrel	Newell's Shearwater	Sooty Tern
Bonin Petrel	Christmas Shearwater	Grey-backed Tern
Hawaiian Petrel	Band-rumped Storm Petrel	White Tern
Herald/Henderson's Petrel	White-tailed Tropicbird	Brown Noddy
Kermadec Petrel	Red-tailed Tropicbird	Black Noddy
Bulwer's Petrel	Masked Booby	Pacific Golden Plover
Possible Jouanin's Petrel	Red-footed Booby	Bristle-thighed Curlew
Juan Fernandez Petrel	Brown Booby	Ruddy Turnstone
White-necked Petrel	Great Frigatebird	Wandering Tattler

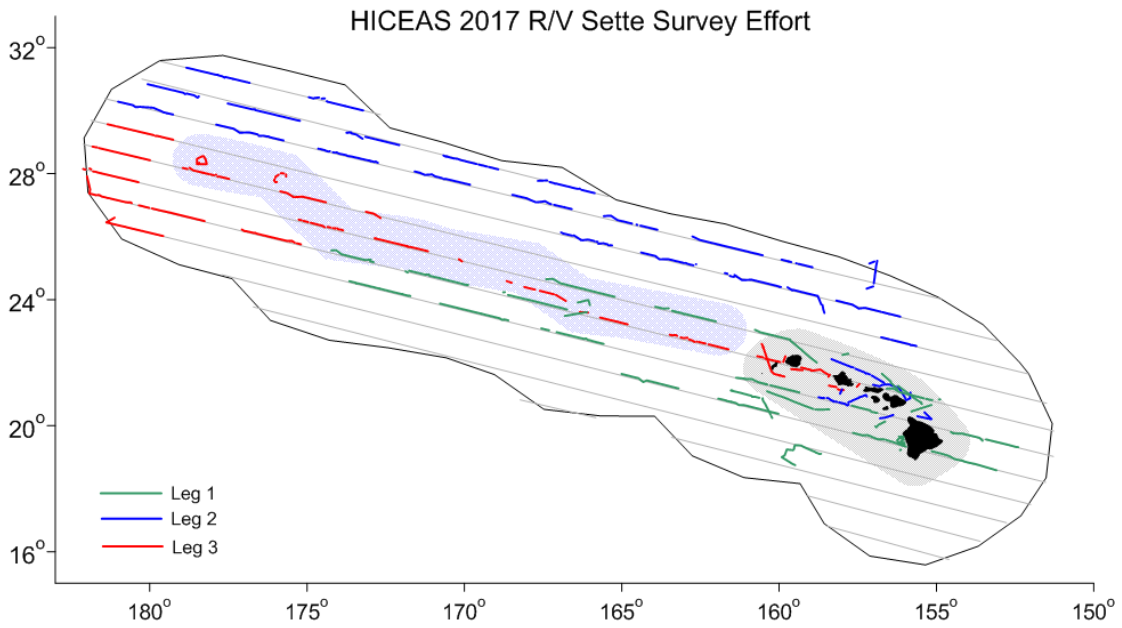

Figure 1. HICEAS 2017 coordinated visual and daytime acoustic search effort aboard R/V *Sette,* color-coded by survey leg (Leg 1 = green, Leg 2 = blue, Leg 3 = red).

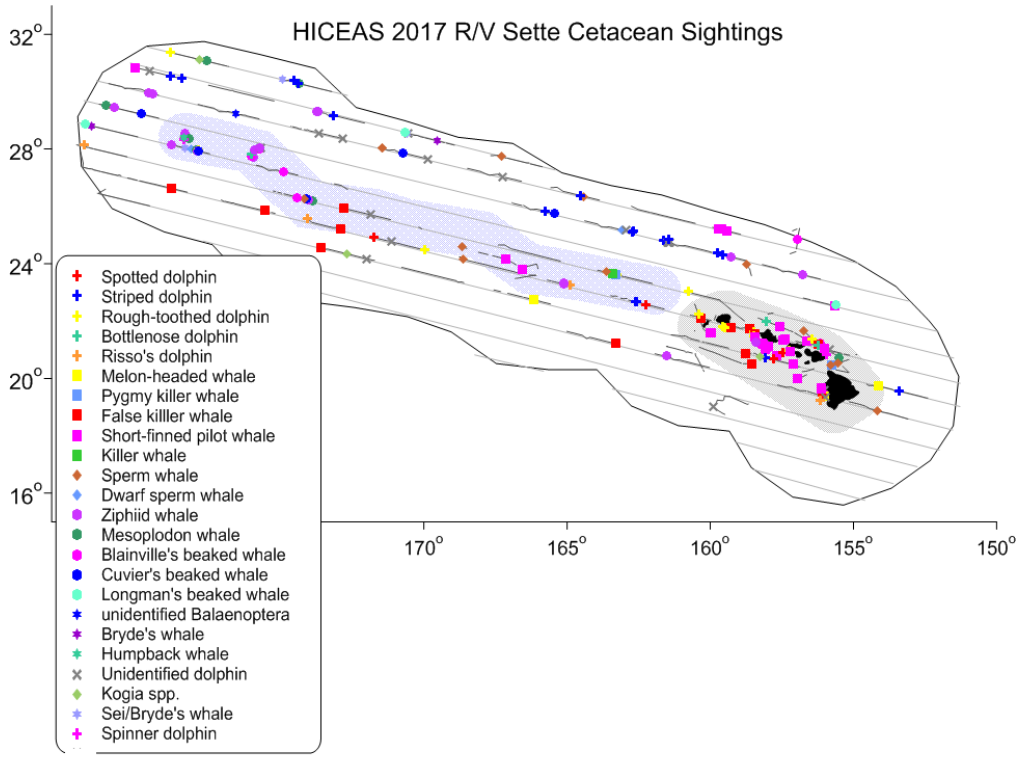

Figure 2. HICEAS 2017 cetacean visual sightings aboard R/V Sette. Species markers are noted in the legend.

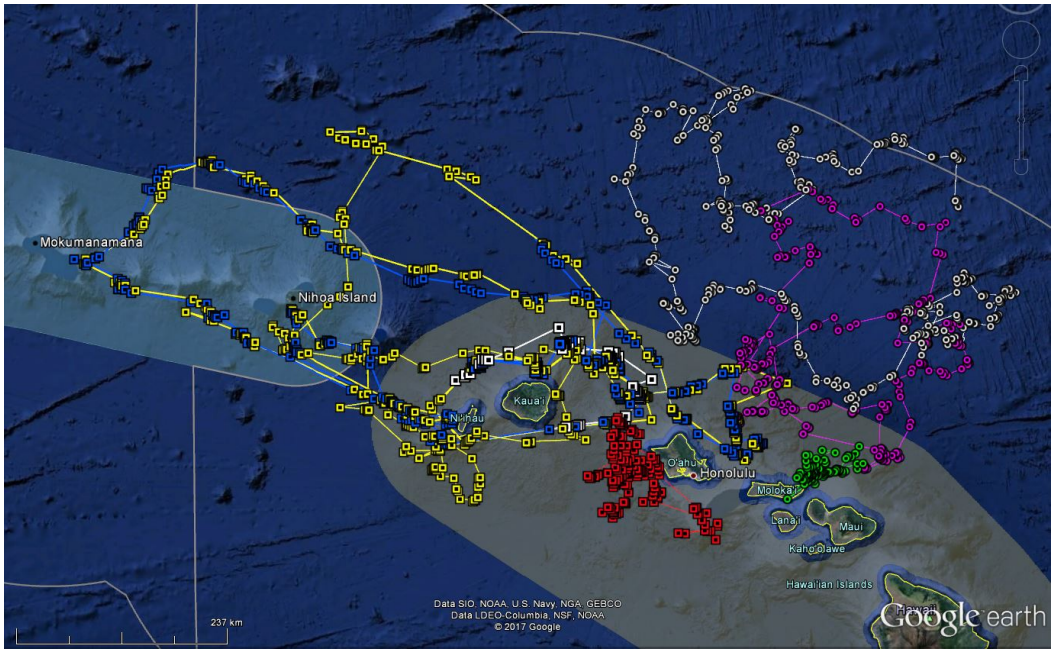

Figure 3. Satellite telemetry tracks through October 18, 2017. False killer whale tracks are shown with square markers and short-finned pilot whale tracks with round markers. Each color indicates the track of a different individual. Two false killer whale transmitters were still active as of this date, noted in red and yellow. The Hawaii EEZ boundary is shown by the gray line and the main Hawaiian Islands Stratum is shaded gray. The original Papahānaumokuākea Marine National Monument boundary is shaded white.

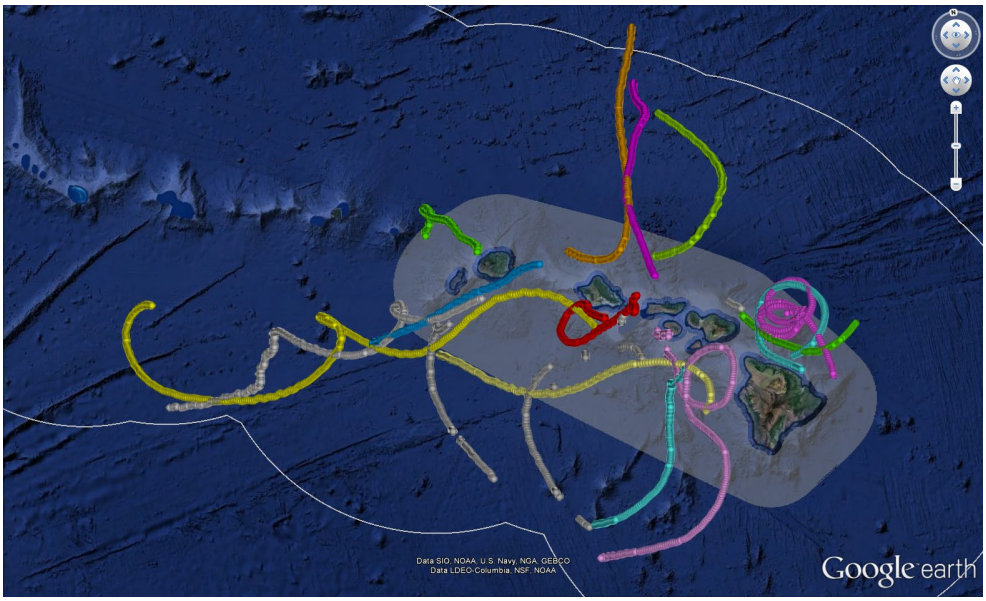

Figure 4. DASBR tracks during HICEAS 2017. Tracks in gray halted transmission prematurely, and therefore were unable to be retrieved. The Hawaii EEZ boundary is shown by the gray line and the main Hawaiian Islands Focus Area is shaded gray.