APPENDIX B. Koa Kai-11 Marine Species Monitoring Surveys, Vessel- and Aerial-based Monitoring Surveys, November 2010. Final Report

Koa Kai-11 Marine Species Monitoring Surveys

VESSEL- AND AERIAL-BASED MONITORING SAPPSURVEYS NOVEMBER 2010 FINAL REPORT

Hawaii Range Complex, 2010; NOAA ***permit*** #14451

JUNE 2011

HDR

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ACRONYMS AND ABBREVIATIONS

ASW	Anti-Submarine Warfare
ESA	Endangered Species Act
HDR EOC	HDR Environmental, Operations and Construction, Inc.
HRC	Hawaii Range Complex
km	kilometer(s)
m	meter(s)
MMPA	Marine Mammal Protection Act
NM	Nautical mile(s)
NM^2	Square nautical miles
NOAA	National Oceanic and Atmospheric Administration
RHIB	Rigid Hulled Inflatable Boat
SPUE	Sightings per Unit of Effort

INTRODUCTION

This report presents the results of marine mammal monitoring for the Koa Kai 11-1 training event, and represents the continued monitoring efforts under the U.S. Navy's Marine Species Monitoring Program (Contract # N62470-10-D-3011; Task Order KB05) issued to HDR Environmental, Operations and Construction, Inc. (HDR|EOC).

As part of compliance requirements with the Marine Mammal Protection Act (MMPA) of 1972 and the Endangered Species Act (ESA) of 1973, the U.S. Department of the Navy developed the Hawaii Range Complex (HRC) Monitoring Plan, which provides for monitoring of marine mammals and sea turtles during training exercises (DoN 2008, 2010). Research elements of the plan include visual surveys and passive acoustic monitoring of these animals. To meet the goals outlined in this plan effectively, it was determined that marine mammal and sea turtle monitoring will be conducted during regularly scheduled training events where one or more surface combatants are conducting anti-submarine warfare (ASW) training.

Such a training event was conducted by the U.S. Pacific Fleet during November 12–17, 2010, when the Surface Navy and other combatant units participated in the Koa Kai 11-1 training event in the HRC. The purpose of Koa Kai is to conduct warfare and seamanship evolutions that enable ships to transition from unit-level basic training to more advanced, integrated training; and to exercise in a multi-ship environment that includes submarine and aviation forces with the goal of achieving deployment certificates and training, including ASW.

The marine mammal and sea turtle monitoring, vessel- and aerial-based surveys, were conducted between November 11–23, 2010, before, during, and after the Pacific Fleet training event in the HRC.

The objectives of the vessel-based monitoring effort for Koa Kai 11-1 consisted of the following:

- Perform focal behavioral follows of marine mammals during the course of a training event involving ASW
- Assess the occurrence, distribution, and behavior of target species (marine mammals and sea turtles) using a vessel-based line transect survey within the HRC in waters within or adjacent to the area where ships were training
- Locate individual false killer whales (*Pseudorca crassidens*), pygmy killer whales (*Feresa attenuata*), and short-finned pilot whales (*Globicephala macrorhynchus*) tagged by Dr. Robin Baird with Cascadia Research
- Investigate the occurrence, distribution, and behavior of target species (marine mammals and sea turtles) using vessel-based line transect survey in waters within or adjacent to the area where Navy ships were training.

The objective of the aerial-based monitoring effort for Koa Kai 11-1 was to:

- Assess the occurrence, distribution, and behavior of target species (marine mammals and sea turtles) using a nearshore, aerial-based line transect survey in waters within or adjacent to the area whereNavy ships were training.

METHODS

Study Area

The U.S. Navy's HRC includes the eight main Hawaiian Islands. The marine species monitoring survey was within and adjacent to the area of the training event.

Vessel-Based Monitoring

The vessel-based survey covered an area of approximately 8,000 square nautical miles (NM^2), in an area 80 nautical miles (NM) south of O'ahu, and 60 NM west of the Big Island (Hawai'i). The vessel-based monitoring effort was performed for 12 days over a 14-day period from November 11-23, 2010 (**Tables 1** and **2**). These dates reflect monitoring that occurred before, during, and after the Koa Kai training event that occurred during November 12–17, 2010. Survey methods were consistent with currently accepted Distance Sampling theory (Buckland et al. 2001) and similar to those used in other HRC vessel-based monitoring efforts (Smultea 2008, HDR|e^2M 2010). Focal follow methodology was also similar to those used during other HRC vessel- and aerial-based monitoring efforts (Smultea 2008, HDR|e^2M 2010).

Table 1. Summary of Koa Kai 11-1 Vessel-Based Monitoring Effort.

Date	Sightings	Total hours
11/11/2010	1	8.3
11/12/2010	1	9.6
11/13/2010	2	6.4
11/14/2010	5	9.5
11/15/2010	0	2.3
11/16/2010	4	8.9
11/18/2010	4	10.8
11/19/2010	4	10.2
11/20/2010	0	9.6
11/21/2010	0	8.3
11/22/2010	5	8.1
11/23/2010	0	3.3
TOTAL	**26**	**95.3**

Table 2. Summary of Koa Kai 11-1 Vessel-Based Monitoring Effort by Trackline Coverage.

Date	On-Effort NM (kilometers [km])	Off-Effort NM (km)	Total daily effort NM (km)
11/11/2010	50.11(92.80)	9.97 (18.46)	60.07 (111.26)
11/12/2010	58.07 (107.55)	12.33 (22.84)	70.40 (130.39)
11/13/2010	26.16 (48.44)	13.11 (24.28)	39.27 (72.72)
11/14/2010	56.99 (105.55)	9.59 (17.75)	66.58 (123.30)
11/15/2010	7.97 (14.76)	12.87 (23.85)	20.85 (38.60)
11/16/2010	55.18 (102.20)	14.85 (27.51)	70.03 (129.71)
11/18/2010	69.41 (128.56)	9.61 (17.79)	79.02 (146.35)
11/19/2010	63.17 (116.99)	17.17 (31.79)	80.34 (148.79)
11/20/2010	70.58 (130.71)	0.32 (0.59)	70.89 (131.29)
11/21/2010	68.26 (126.41)	0.20 (0.38)	68.46 (126.79)
11/22/2010	58.34 (108.04)	7.08 (13.11)	65.42 (121.16)
11/23/2010	22.98 (42.57)	0.31 (0.57)	23.29 (43.14)
TOTAL	**607.22 (1,124.58)**	**107.41 (198.93)**	**714.64 (1,323.51)**

The observation platform for the 12-day period was an 85-foot (25.9-meter [m]) Bertram charter vessel, the *MV Aukele*. The survey effort was based on equally spaced lines running roughly NE to SW with no stratification of survey effort (**Figure 1**). Actual lines of effort varied by sea state, and, therefore, do not match the intended effort. When Beaufort sea state reached 7 or higher, the effort was curtailed. See **Table 3** for details regarding effort by sea state.

Table 3. Summary of Koa Kai 11-1 Vessel-Based Monitoring Effort by Beaufort Sea State.

Beaufort sea state	Total Effort NM (km)	Percentage (%)	# Sightings
0	0 (0)	0.00	0
1	52.03 (28.08)	3.93	1
2	663.31 (358.42)	50.12	20
3	380 (205.04)	28.71	2
4	75.46 (40.72)	5.70	1
5	107.46 (57.98)	8.12	1
6	23.99 (12.94)	1.81	1
7	21.26 (11.46)	1.61	0
TOTAL	**1323.51 (714.64)**	**100.00**	**26**

All six marine mammal observers (**Table 4**) were experienced with line-transect survey methodology, had experience in identification of subtropical Pacific marine mammal and sea turtle species, were knowledgeable of marine mammal biology and behavior, and had previous experience conducting marine mammal observations from vessels. Each observer rotated through three stations at 40-minute intervals: left observer, data recorder, and right observer, followed by a 2-hour rest break. Observers scanned from directly in front to 90 degrees on each side using mounted 25x "Big Eye" reticled binoculars, hand-held 7x reticled binoculars (when ocean swells rendered Big Eye binoculars impractical), or naked eye (when ocean swells rendered hand-held binoculars impractical). When a sighting occurred, the observer noted the horizontal angle to the sighting, the number of reticles down from the horizon, and the sighting cue. The number corresponding to the reticle was used to calculate the distance to the animal based on the height of the platform (6.4 m; 21 feet) and was recorded using WinCruz software (available from the National Oceanic and Atmospheric Administration [NOAA]) and on data sheets). Species identity and diagnostic cues were recorded, and digital photographs obtained when possible. After a sighting occurred, all three observers on duty were assigned the task of projecting independent estimates of group composition using a minimum, maximum, and best estimate approach. The average of the "best" estimates from the three observer team members was then recorded for group size.

Table 4. Observers and Roles for Vessel-Based Monitoring.

Observer	Role(s)
Greg Fulling	Chief Scientist/Observer
Craig Hawkinson	Lead Observer
Tom Kieckhefer	Lead Observer
Mark Cotter	Observer
Tara Leota	Observer
Keri Lestyk	Observer

Aerial-Based Monitoring

Aerial surveys of the shorelines of the Hawaiian islands and islets within the vicinity of the November 2010 Koa Kai-11 training event were performed on November 18 and 22, 2010. Specifically, a Robinson R44 helicopter was flown at an average altitude of 676 feet (206 m) and an average speed of 89 knots, carrying two observers, a pilot, and copilot (**Table 5**). The mission was to survey the coastlines of the four-island region (Maui, Molokai, Kahoolawe, and Lanai and associated islets) and west coast of Hawaii (Big Island) to detect presence and assess behaviors of marine mammals and sea turtles. Special attention was paid to detecting any marine mammals that appeared to be distressed, injured, stranded, or dead.

Table 5. Observers and roles for Aerial-Based Monitoring.

Observer	Role(s)
Joe Mobley	Observer/Data Recorder
Aliza Milette	Observer

The survey protocol consisted of following within 0.6 to 1.2 miles (1 to 2 km) offshore of Molokai, Maui, Molokini, Kahoolawe, Lanai, and the west coast of Hawaii (Big Island) (**Figures 2-5**). GPS locations and altitudes were automatically recorded every 5 seconds using a Garmin WAAS-enabled GPS 296. The two observers watched off their respective sides (i.e., coastal, offshore) with the offshore observer also serving as data recorder. When a sighting occurred, the following data were recorded:

a) Sighting angle (using Suunto handheld clinometers)
b) Species identity (with photos if needed)
c) Composition (e.g., number of adults and number of calves)
d) Reaction to aircraft (i.e., based on changes in behavior upon approach)
e) Behavioral description
f) Direction of travel.

Environmental data, including Beaufort sea state and visibility, were recorded, and changes in sighting conditions were noted. Photographs were taken when species identity or number of individuals was uncertain. A Canon 5D with 200-400 mm Canon telephoto lens was used in such cases. Additionally, a Canon HD digital video camera was available to record any unusual behaviors.

RESULTS

Part 1. Vessel-Based Monitoring

Survey effort

Observers surveyed 714.64 nm (1,323.51 kilometers [km]) of trackline during 12 days for a total of approximately 95.3 hours during the Koa Kai 11-1 monitoring effort. Beaufort sea states ranged from 1 to 7. Sightings were made in all Beaufort sea states except 7 (**Table 6**). Marine mammal sightings per unit of effort (SPUE) was calculated as the total survey effort (hours/nm/km) divided by the total number of marine mammal sightings (n=26). For this monitoring effort, the SPUE was equal to 1 sighting per 3.67 hours, 27.49 nm, or 50.90 km.

Sightings

Twenty-six marine mammal sightings representing 11 species were recorded during approximately 95.3 hours of effort (**Table 6** and **Figure 1**). No sea turtles were sighted during the entire survey. Marine mammal sightings consisted of eight groups of short-finned pilot whales, six groups of humpback whales (*Megaptera novaeangliae*), one group of pygmy killer whales (*Feresa attenuata*), one group of beaked whales (*Mesoplodon* spp.), one group of pantropical spotted dolphins (*Stenella attenuata*), one group of rough-toothed dolphins (*Steno bredanensis*), one group of bottlenose dolphins (*Tursiops truncatus*), one minke whale (*Balaenoptera acutorostrata*), one dwarf sperm whale (*Kogia breviceps*), one sei whale (*Balaenoptera borealis*), one false killer whale (*Pseudorca crassidens*), and three sightings of unidentified cetaceans (**Figures 1** and **2; Table 6**). Whenever possible, photographs were taken for species identification and photo-identification purposes during focal follows. A total of 1,567 photographs were taken for 25 sightings. See **Appendix B** for representative photographs.

Table 6. Summary of Sightings During Vessel-Based Monitoring Efforts for Koa Kai 11-1, November 2010.

Sighting number	Date	Species	Group size best/high/low			Calves	Time	Beaufort sea state	Latitude	Longitude	Bottom depth (m)	Bearing	Distance (NM)	Behavioral summary*
1	11/11/10	MN	2	2	2	-	10:29	6	21°17.34'N	157°37.18'W	77	315	0.25	Diving.
2	11/12/10	MN	1	1	1	-	15:10	5	20°58.16'N	157°28.07'W	344	270	0.5	Diving; breached once and did three chin slaps.
3	11/13/10	GM	16	23	11	1	9:23	2	20°46.99'N	157°04.11'W	660	345	2.08	**Focal follow details in Appendix A.** Animals logging at surface or slow traveling.
4	11/13/10	GM	14	25	13	-	10:50	2	20°44.92'N	157°06.36'W	708	30	1.33	Slow traveling.
5	11/14/10	GM	9	13	7	1	8:13	2	20°46.42'N	157°05.72'W	726	335	0.2	**Focal follow details in Appendix A.** Slow traveling, group widely spaced apart.
6	11/14/10	PC	1	1	1	-	9:23	2	20°48.08'N	157°08.44'W	1,072	35	0.3	**Focal follow details in Appendix A.** Fast traveling.
7	11/14/10	GM	21	27	16	2-4	10:48	2	20°45.05'N	157°05.67'W	700	50	1.0	**Focal follow details in Appendix A.** Slow traveling; logging at surface.
8	11/14/10	GM	5	8	3	1	11:16	2	20°43.96'N	157°06.12'W	662	340	0.51	**Focal follow details in Appendix A.** Surface active behavior (spyhop, lobtail); changed direction close to vessel.
9	11/14/10	GM	24	30	17	4-6	12:10	2	20°41.08'N	157°08.21'W	1,055	275	0.86	**Focal follow details in Appendix A.** Multiple groupings of animals; slow traveling.
10	11/16/10	GM	4	7	4	1-2	7:33	2	20°44.38'N	157°03.08'W	622	10	0.51	Slow traveling; widely dispersed group.
11	11/16/10	SA	71	104	51	7-10	7:53	2	20°43.46'N	157°06.03'W	667	0	0.28	**Focal follow details in Appendix A.** Approached vessel to bowride; surface active (jumping); moderate to fast traveling.
12	11/16/10	GM	6	9	5	1-2	8:40	2	20°43.09'N	157°06.72'W	681	355	0.32	Slow traveling.
13	11/16/10	USW	1	1	1	-	11:54	4	20°49.03'N	157°38.81'W	1,119	15	0.86	Breached (no resight).

Sighting number	Date	Species	Group size best/high/low			Calves	Time	Beaufort sea state	Latitude	Longitude	Bottom depth (m)	Bearing	Distance (NM)	Behavioral summary*
14	11/18/10	SB	32	39	24	2-3	9:29	2	19°35.51'N	157°04.75'W	4,347	25	0.11	**Focal follow details in Appendix A.** Approached vessel to bowride; fast traveling.
15	11/18/10	BA	1	1	1	-	12:01	2	19°26.92'N	157°13.41'W	3,745	60	0.13	Fast traveling.
16	11/18/10	ULW	1	1	1	-	12:44	2	19°22.34'N	157°18.01'W	3,209	22	0.86	Only saw blow (no resight).
17	11/18/10	BB	1	1	1	-	13:25	2	19°21.97'N	157°20.88'W	3,106	0	0.71	**Focal follow details in Appendix A.** Evasive behavior; underwater blows; multiple changes of direction.
18	11/19/10	ULW	1	1	1	-	9:19	2	19°24.96'N	157°12.85'W	3,688	90	2.29	Only saw blow (no resight).
19	11/19/10	MS	3	3	3	-	9:37	2	19°24.51'N	157°15.43'W	3,679	10	2.7	Diving.
20	11/19/10	KB	1	1	1	-	12:47	2	19°18.04'N	157°13.43'W	3,469	320	1.46	Logging at surface; diving.
21	11/19/10	FA	20	26	16	1-2	15:20	1	19°25.54'N	157°01.74'W	1,969	40	3.29	**Focal follow details in Appendix A.** Slow travel/logging until vessel approached then evasive behavior; turned and dispersed when vessel was in gear.
22	11/22/10	TT	20	25	17	2-4	10:14	3	20°59.04'N	157°17.42'W	1,047	28	3.29	**Focal follow details in Appendix A.** Approached vessel to bowride; moderate to fast traveling.
23	11/22/10	MN	1	1	1	-	11:06	2	21°02.16'N	157°22.31'W	119	28	2.7	Diving.
24	11/22/10	MN	2	2	2	-	11:36	2	21°05.47'N	157°25.00'W	58	315	0.1	Slow traveling; tail-slap; diving.
25	11/22/10	MN	1	1	1	-	12:01	2	21°06.04'N	157°26.07'W	63	35	1.5	Diving.
26	11/22/10	MN	1	1	1	-	16:09	2	21°16.97'N	157°16.16'W	176	340	2.29	Diving.

Key:
BA = minke whale (*Balaenoptera acutorostrata*)
BB = sei whale (*Balaenoptera borealis*)
FA = pygmy killer whale (*Feresa attenuata*)
GM = short-finned pilot whale (*Globicephala macrorhynchus*)
KB = dwarf sperm whale (*Kogia breviceps*)
MN = humpback whale (*Megaptera novaeangliae*)
MS = *Mesoplodon* spp.
PC = false killer whale (*Pseudorca crassidens*)
SB = rough-toothed dolphin (*Steno bredanensis*)
SA = pantropical spotted dolphin (*Stenella attenuata*)
TT = bottlenose dolphin (*Tursiops truncatus*)
ULW = unidentified large whale
USW = unidentified small whale
* Behavioral summaries compiled from WinCruz comments and sighting sheets

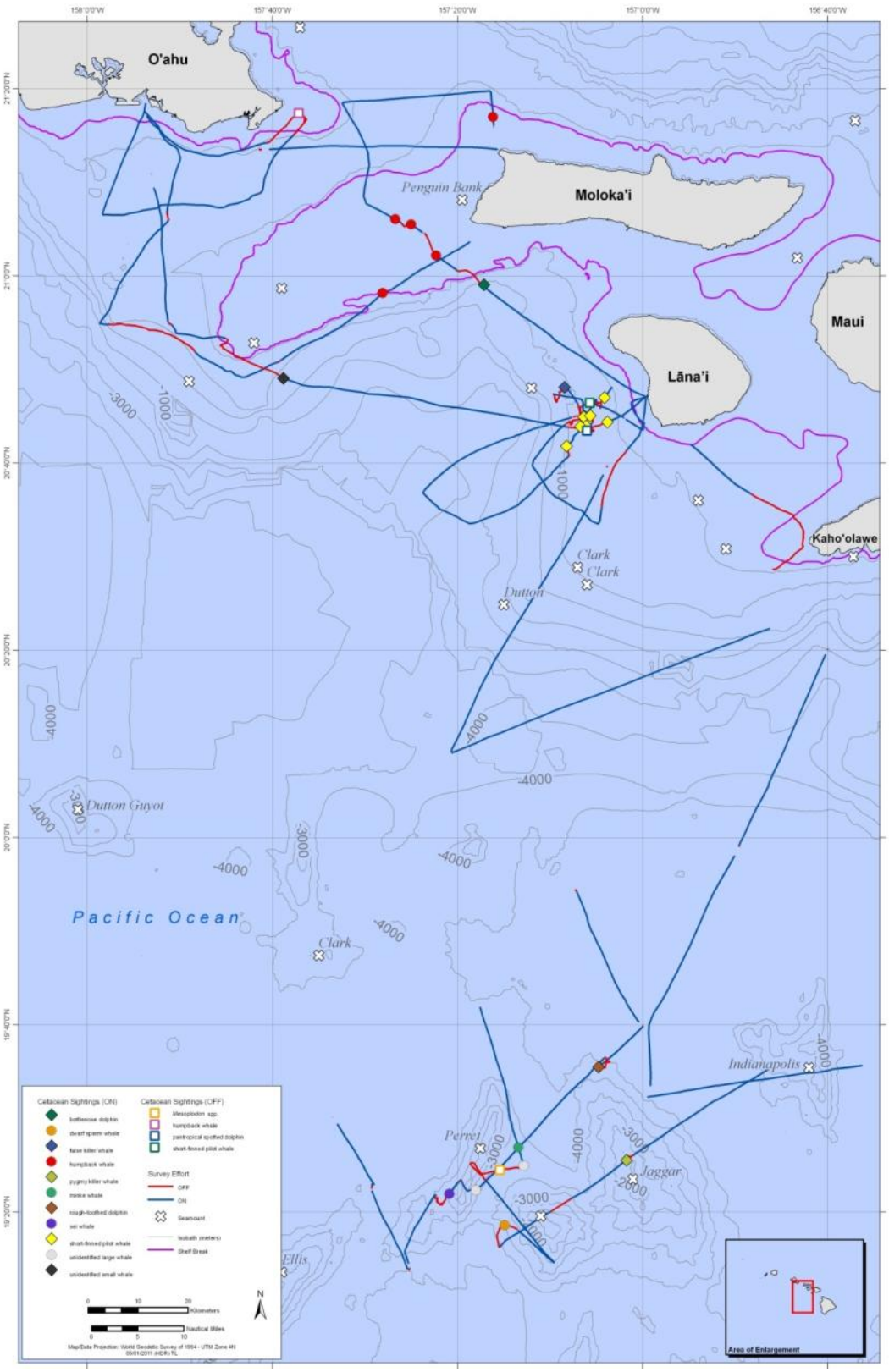

Figure 1. Locations of marine mammal sightings and tracklines during vessel-based monitoring efforts for Koa Kai 11-1, November 2010.

Figure 2. Sei whale (Balaenoptera borealis) sighted on November 18, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Navy vessels were observed twice during the survey (on 11/12/10 and 11/22/10); however, no marine mammal sightings occurred while these vessels were within sight.

Attempts were made to locate individual false killer whales, pygmy killer whales, and short-finned pilot whales that had been tagged by Dr. Robin Baird with Cascadia Research. None of those individuals were seen.

Behavior

The team was able to conduct five focal follows of short-finned pilot whales (Sightings 3, 5, 7, 8, and 9), one focal follow on a false killer whale (Sighting 6), one focal follow on pantropical spotted dolphins (Sighting 11), one focal follow on rough-toothed dolphins (Sighting 14), one focal follow on a sei whale (Sighting 17), one focal follow on pygmy killer whales (Sighting 21), and one focal follow on bottlenose dolphins (Sighting 22). During the majority of sightings the animals did not react to the survey vessel and continued their original course and speed. However, there were some cases where animals appeared to react to the vessel or were evasive (Sightings 6, 7, 17, and 21). Detailed behavioral observations made during the focal follows are presented in **Appendix A**.

Part 2. Aerial-Based Monitoring

Survey effort

A linear distance of 1,443 miles (2,322 km) was surveyed during 2 days for a total of 14.1 hours during and after the Koa Kai 11-1 training event (**Figures 3-6**). Beaufort sea states ranged from 2 to 4, with a mean of 3 (**Table 7**).

Table 7. Summary of Shoreline Aerial Survey Effort During Koa Kai-11 in November 2010.

Date	Start Time (depart HNL)	End Time (return to HNL)	Effort (hrs)*	Effort (km)	Mean Beaufort Sea State
Nov. 18	0739	1558	7.1	1172	3.0
Nov. 22	0740	1543	7.0	1150	3.0
TOTAL			**14.1 hrs**	**2322 km**	**3.0**

Note: * excludes down time for refueling

Sightings

A total of 125 sightings were recorded of four identified cetacean species (spinner dolphin, bottlenose dolphin, false killer whale, humpback whale), and unidentified delphinids and turtles during 14.1 hours of effort (**Tables 7-9**). The majority of groups sighted were unidentified sea turtle species (81%; *n*=101) followed by spinner dolphins (11%; *n*=14). No instances of distressed, injured, stranded, or dead marine mammals were observed (**Tables 7** and **8**).

Table 8. Summary of Species Sighted During Koa Kai-11 Aerial Surveys in November 2010.

Species	Number groups	Number individuals (best estimate)	Sightings/km surveyed
Bottlenose dolphin	1	1	.0004
False killer whale	1	5	.0004
Humpback whale	2	2	.0009
Spinner dolphin	14	607	.0060
Unidentified delphinid	6	77	.0026
Unidentified turtle spp.	101	162	.0435
TOTAL	**125**		

Photos were only taken for one sighting: a pod of false killer whales (*Pseudorca crassidens*). Most photos of this sighting were unfortunately of poor quality, and in only one photo are the animals clearly distinguishable (Sighting 122, **Appendix B).**

Table 9. Detailed List of Sightings during Aerial-Based Surveys During Koa Kai-11, November 2010.

Sighting Number	Date	Species	Group Size Best/High/Low			Calves	Time	Beaufort Sea State	Latitude	Longitude	Altitude (ft)	Direction	Angle	Reaction	Behavior
1	11/18/10	UT	1	1	1	-	7:47:34	2	21.2673	157.8323	447	90	45	N	
2	11/18/10	UT	1	1	1	-	7:50:28	2	21.2681	157.766	538	270	50	N	
3	11/18/10	SL	23	28	15	2	7:51:23	2	21.2722	157.715	472	--	10	N	milling; slow swimming
4	11/18/10	UT	2	2	2	-	7:54:43	2	21.2565	157.7035	715	45	50	N	
5	11/18/10	UD	50	60	40	-	8:10:58	2	21.2182	157.2878	904	--	50	N	milling
6	11/18/10	UT	8	8	8	-	8:15:23	2	21.1756	157.2634	896	135	30	N	
7	11/18/10	UT	1	1	1	-	8:19:28	2	21.0897	157.2989	920	90	45	N	
8	11/18/10	UT	1	1	1	-	8:21:28	2	21.0793	157.2547	798	90	60	N	
9	11/18/10	UT	2	2	2	-	8:35:38	2	20.9608	157.0095	849	270	25	N	
10	11/18/10	SL	110	120	100	-	8:58:13	4	20.7471	156.8523	1037	270	55	N	slow swimming
11	11/18/10	UT	1	1	1	-	9:01:38	4	20.7694	156.824	962	45	30	N	
12	11/18/10	UT	3	3	3	-	9:02:08	4	20.7802	156.817	956	270	50	N	
13	11/18/10	UT	1	1	1	-	9:02:33	4	20.7892	156.8106	956	270	55	N	
14	11/18/10	UT	5	5	5	-	9:02:48	4	20.7948	156.8071	969	90	60	N	
15	11/18/10	UT	1	1	1	-	9:07:48	4	20.9006	156.8721	724	180	40	N	
16	11/18/10	UT	1	1	1	-	9:10:08	4	20.9267	156.9322	1063	90	40	N	
17	11/18/10	UT	1	1	1	-	9:12:43	4	20.9463	157.0073	819	270	50	N	
18	11/18/10	UT	1	1	1	-	9:18:03	2	21.0713	157.0001	786	315	60	N	
19	11/18/10	UT	1	1	1	-	9:28:28	2	21.1045	156.7413	655	90	40	N	
20	11/18/10	UT	1	1	1	-	9:29:33	2	21.1246	156.7207	688	225	40	N	
21	11/18/10	UT	1	1	1	-	9:35:08	2	21.013	156.6507	593	225	40	N	
22	11/18/10	UT	6	6	6	-	9:36:43	2	20.9815	156.6797	735	90	55	N	
23	11/18/10	UT	2	2	2	-	9:37:53	2	20.951	156.694	696	90	55	N	
24	11/18/10	UT	3	3	3	-	9:38:48	2	20.9338	156.7014	713	135	55	N	
25	11/18/10	UT	1	1	1	-	9:40:08	2	20.922	156.6989	647	180	60	N	
26	11/18/10	UT	1	1	1	-	9:42:43	2	20.864	156.6782	1000	270	35	N	
27	11/18/10	UT	1	1	1	-	9:44:48	2	20.8201	156.6374	912	90	45	N	
28	11/18/10	UT	2	2	2	-	9:48:58	2	20.7897	156.5815	920	90	55	N	
29	11/18/10	UT	1	1	1	-	9:51:28	2	20.7816	156.5135	929	270	40	N	
30	11/18/10	SL	24	30	19	-	9:59:44	2	20.5926	156.6099	746	270	60	N	milling

Sighting Number	Date	Species	Group Size Best/High/Low			Calves	Time	Beaufort Sea State	Latitude	Longitude	Altitude (ft)	Direction	Angle	Reaction	Behavior
31	11/18/10	SL	35	40	30	-	10:01:55	2	20.5902	156.6096	251	--	90	N	2 groups separated; milling
32	11/18/10	UT	5	5	5	-	11:23:47	2	20.7299	156.457	579	90	40	N	
33	11/18/10	SL	100	120	80	-	11:24:08	2	20.7211	156.4538	500	--	50	N	milling; spinning
34	11/18/10	UT	2	2	2	-	11:27:48	4	20.6925	156.4479	619	135	45	N	
35	11/18/10	UT	1	1	1	-	11:29:36	4	20.6501	156.4474	560	90	40	N	
36	11/18/10	UD	12	12	12	-	11:40:42	4	20.605	156.2407	718	270	50	N	slow swimming; not resighted
37	11/18/10	UT	1	1	1	-	12:02:24	2	20.264	155.9035	538	90	40	N	
38	11/18/10	UT	1	1	1	-	12:10:26	2	20.1203	155.8898	614	315	50	N	
39	11/18/10	SL	36	40	30	-	12:45:25	3	19.478	155.9306	485	--	50	N	milling
40	11/18/10	SL	15	18	12	-	14:20:32	3	20.6447	156.0766	608	90	45	N	slow swimming
41	11/18/10	UT	1	1	1	-	14:27:30	3	20.7407	155.98	543	135	30	N	
42	11/18/10	UT	6	6	6	-	14:48:02	5	20.9202	156.3907	510	90	25	N	
43	11/18/10	UT	1	1	1	-	14:51:38	2	20.9081	156.4765	562	270	28	N	
44	11/18/10	TT	1	1	1	-	15:27:32	3	21.2224	157.2387	606	90	25	N	jumped then slow swimming
45	11/22/10	SL	40	50	30	-	7:44:24	2	21.2663	157.8317	543	--	50	N	milling
46	11/22/10	UT	1	1	1	-	7:46:19	2	21.2697	157.838	401	90	55	N	
47	11/22/10	UT	1	1	1	-	7:56:28	2	21.281	157.6708	461	135	55	N	
48	11/22/10	UT	1	1	1	-	7:56:38	2	21.2839	157.667	467	270	55	N	
49	11/22/10	UT	1	1	1	-	7:56:58	2	21.289	157.6592	497	90	55	N	
50	11/22/10	UT	1	1	1	-	7:57:08	3	21.2916	157.6555	513	90	55	N	
51	11/22/10	SL	28	32	24	-	8:22:03	2	21.0807	157.2602	866	270	45	N	slow swimming
52	11/22/10	UT	2	2	2	-	8:31:18	2	21.0767	157.028	858	90	50	N	
53	11/22/10	UD	6	6	6	-	8:49:08	2	20.7399	156.9727	440	--	55	C	milling by cliff face
54	11/22/10	SL	42	50	35	-	8:51:13	2	20.7306	156.9448	839	--	60	N	milling, two groups
55	11/22/10	UT	1	1	1	-	9:07:48	2	20.9006	156.8721	724	90	55	N	
56	11/22/10	UT	2	2	2	-	9:08:53	3	20.9179	156.8969	868	270	55	N	
57	11/22/10	UT	1	1	1	-	9:08:58	3	20.919	156.8992	852	270	50	N	
58	11/22/10	UT	1	1	1	-	9:09:53	3	20.9259	156.9251	1035	90	50	N	
59	11/22/10	UT	2	2	2	-	9:10:18	3	20.9273	156.9372	1054	135	50	N	
60	11/22/10	UT	1	1	1	-	9:11:13	3	20.9301	156.9665	951	270	50	N	
61	11/22/10	UT	1	1	1	-	9:11:18	3	20.9306	156.9692	918	90	50	N	

Sighting Number	Date	Species	Group Size Best/High/Low			Calves	Time	Beaufort Sea State	Latitude	Longitude	Altitude (ft)	Direction	Angle	Reaction	Behavior
62	11/22/10	UT	1	1	1	-	9:17:18	2	21.0724	157.0216	902	225	50	N	
63	11/22/10	UT	1	1	1	-	9:18:58	2	21.0645	156.9755	863	90	45	N	
64	11/22/10	UT	5	5	5	-	9:19:23	2	21.0618	156.9648	861	90	40	N	
65	11/22/10	UT	1	1	1	-	9:25:48	4	21.0644	156.799	718	90	50	N	
66	11/22/10	UT	1	1	1	-	9:25:53	4	21.0653	156.7971	726	180	55	N	
67	11/22/10	UT	2	2	2	-	9:26:53	4	21.0787	156.7749	671	270	55	N	
68	11/22/10	UT	1	1	1	-	9:27:23	3	21.0868	156.7642	666	180	40	N	
69	11/22/10	UT	3	3	3	-	9:27:53	3	21.0947	156.7535	628	315	40	N	
70	11/22/10	UT	1	1	1	-	9:28:13	3	21.1	156.7463	631	90	35	N	
71	11/22/10	UT	1	1	1	-	9:28:48	3	21.1107	156.7351	669	270	65	N	
72	11/22/10	UT	2	2	2	-	9:29:03	2	21.1157	156.7309	658	270	80	N	
73	11/22/10	UT	1	1	1	-	9:37:53	2	20.951	156.694	696	270	50	N	
74	11/22/10	SL	12	14	10	-	9:38:28	2	20.9349	156.6975	708	--	10	N	milling
75	11/22/10	UT	2	2	2	-	9:39:53	2	20.9273	156.6974	641	90	60	N	
76	11/22/10	UT	1	1	1	-	9:40:43	2	20.9096	156.6948	732	90	45	N	
77	11/22/10	UT	1	1	1	-	9:40:58	2	20.9047	156.6915	748	270	45	N	
78	11/22/10	UT	1	1	1	-	9:41:03	2	20.9027	156.6909	764	315	35	N	
79	11/22/10	UT	1	1	1	-	9:41:08	2	20.9008	156.6902	803	270	40	N	
80	11/22/10	UT	3	3	3	-	9:41:48	2	20.8843	156.6906	917	45	55	N	
81	11/22/10	UT	1	1	1	-	9:43:13	2	20.8535	156.6681	967	90	50	N	
82	11/22/10	UT	2	2	2	-	9:44:28	2	20.8269	156.6446	962	270	50	N	
83	11/22/10	UT	1	1	1	-	9:44:38	2	20.8236	156.6409	939	270	40	N	
84	11/22/10	UD	1	1	1	-	9:45:08	2	20.8124	156.6315	863	45	30	N	dove
85	11/22/10	UT	1	1	1	-	9:46:58	2	20.8134	156.6324	641	180	45	N	
86	11/22/10	UT	1	1	1	-	9:47:53	2	20.8037	156.61	776	45	50	N	
87	11/22/10	UT	5	5	5	-	9:48:03	2	20.8018	156.6054	762	45	45	N	
88	11/22/10	UT	1	1	1	-	9:50:18	2	20.7746	156.544	928	90	30	N	
89	11/22/10	UT	1	1	1	-	9:50:33	2	20.7718	156.537	912	90	40	N	
90	11/22/10	UT	1	1	1	-	9:51:33	2	20.7832	156.5119	925	90	40	N	
91	11/22/10	UT	2	2	2	-	9:51:48	2	20.7883	156.5072	907	90	60	N	
92	11/22/10	UT	1	1	1	-	10:33:13	2	20.7865	156.4762	578	135	30	N	
93	11/22/10	UT	1	1	1	-	10:33:48	2	20.7756	156.4634	504	225	50	N	
94	11/22/10	UT	1	1	1	-	10:34:18	2	20.7615	156.4627	537	180	30	N	

Sighting Number	Date	Species	Group Size Best/High/Low			Calves	Time	Beaufort Sea State	Latitude	Longitude	Altitude (ft)	Direction	Angle	Reaction	Behavior
95	11/22/10	UT	3	3	3	-	10:34:58	2	20.7434	156.4607	593	45	45	N	
96	11/22/10	UT	4	4	4	-	10:35:23	2	20.7321	156.4571	598	90	30	N	
97	11/22/10	UT	1	1	1	-	10:35:43	2	20.7237	156.4518	565	90	35	N	
98	11/22/10	UT	1	1	1	-	10:36:18	2	20.708	156.4495	606	135	50	N	
99	11/22/10	UT	1	1	1	-	10:36:28	2	20.7034	156.4494	606	180	35	N	
100	11/22/10	UT	1	1	1	-	10:36:38	2	20.6991	156.4494	641	270	45	N	
101	11/22/10	UT	1	1	1	-	10:36:58	2	20.6903	156.4481	619	90	35	N	
102	11/22/10	UT	1	1	1	-	10:37:08	2	20.6858	156.4477	614	90	40	N	
103	11/22/10	UT	1	1	1	-	10:37:13	2	20.6835	156.4478	617	90	40	N	
104	11/22/10	UT	1	1	1	-	10:37:18	2	20.6813	156.4478	622	90	45	N	
105	11/22/10	UT	1	1	1	-	10:37:33	2	20.6746	156.4479	631	225	55	N	
106	11/22/10	UT	1	1	1	-	10:37:38	2	20.6723	156.4479	628	225	45	N	
107	11/22/10	UT	1	1	1	-	10:38:18	2	20.6545	156.4471	661	135	45	N	
108	11/22/10	UT	1	1	1	-	10:38:23	2	20.6524	156.4474	669	90	55	N	
109	11/22/10	UT	1	1	1	-	10:39:03	2	20.6366	156.4549	608	45	45	N	
110	11/22/10	UT	1	1	1	-	10:40:03	2	20.6148	156.4433	664	225	25	N	
111	11/22/10	SL	50	55	45	-	10:44:18	2	20.5935	156.549	568	--	40	N	close inshore, tight milling, heading offshore
112	11/22/10	MN	1	1	1	-	10:48:43	2	20.607	156.5781	559	135	45	N	
113	11/22/10	SL	52	56	45	-	10:51:13	3	20.5903	156.6123	720	--	30	N	milling inside bay, spinning
114	11/22/10	UT	1	1	1	-	11:04:48	3	20.5121	156.5422	537	180	45	N	
115	11/22/10	UT	1	1	1	-	11:05:43	2	20.5295	156.5301	507	360	50	N	
116	11/22/10	UT	2	2	2	-	11:11:38	2	20.5927	156.434	750	270	30	N	
117	11/22/10	UT	1	1	1	-	11:11:43	2	20.5929	156.4316	746	270	40	N	
118	11/22/10	UT	1	1	1	-	11:11:58	2	20.5926	156.4245	705	270	40	N	
119	11/22/10	UD	3	3	3	-	12:09:58	3	19.7348	156.0583	330	270	30	N	near Kona approach area; quick surfacing and dives
120	11/22/10	SL	40	45	35	-	12:17:03	3	19.637	155.9977	469	270	12	N	slow swimming
121	11/22/10	UD	5	5	5	-	12:43:28	4	19.4798	155.9282	598	??	20	N	not resighted

Sighting Number	Date	Species	Group Size Best/High/Low			Calves	Time	Beaufort Sea State	Latitude	Longitude	Altitude (ft)	Direction	Angle	Reaction	Behavior
122	11/22/10	PC	5	5	5	-	13:40:30	4	19.918	156.0132	795	270	20	N	breaching 2+2+1 line astern (photos)
123	11/22/10	UT	1	1	1	-	14:40:11	4	20.9404	156.3488	410	270	35	N	
124	11/22/10	UT	2	2	2	-	14:41:06	4	20.9316	156.373	565	270	45	N	
125	11/22/10	MN	1	1	1	-	14:57:31	3	21.1597	156.7079	663	45	25	N	slow swimming then dive

Species Key:
TT = bottlenose dolphin
PC = false killer whale
MN = humpback whale
SL = spinner dolphin
UD = unidentified delphinid species
UT = unidentified sea turtle species

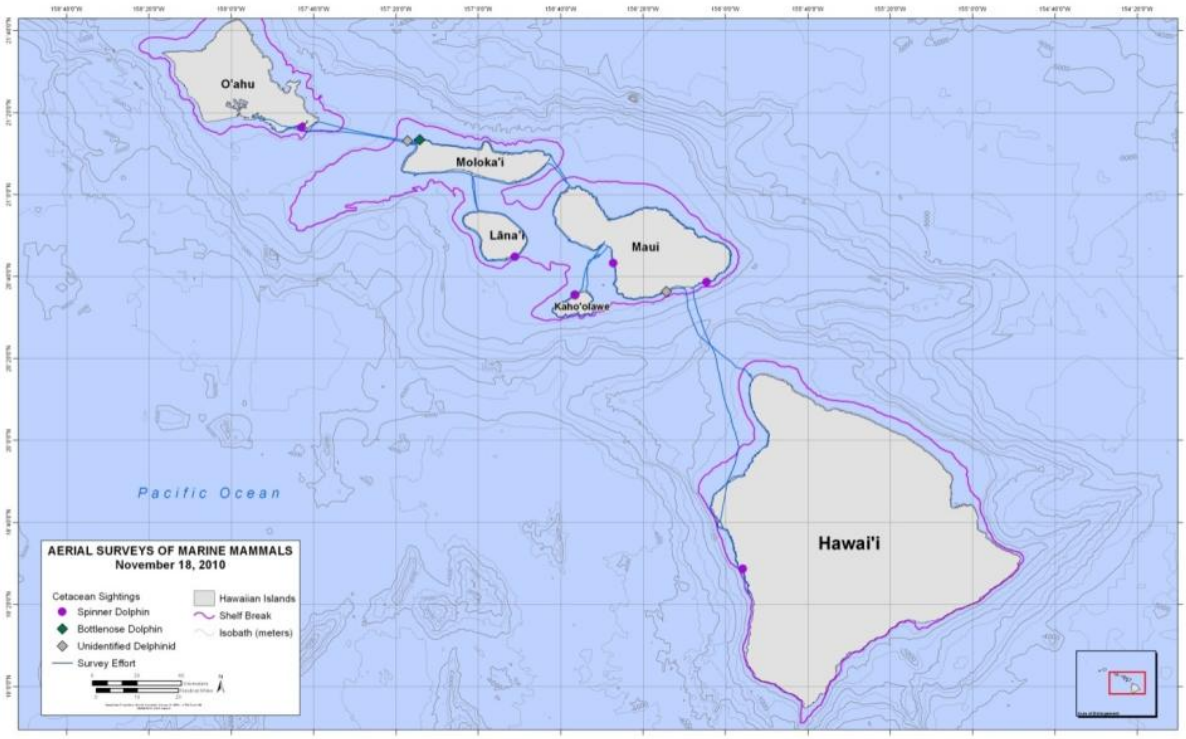

Figure 3. Locations of marine mammal sightings and tracklines during aerial-based monitoring efforts for Koa Kai 11-1, November 18, 2010.

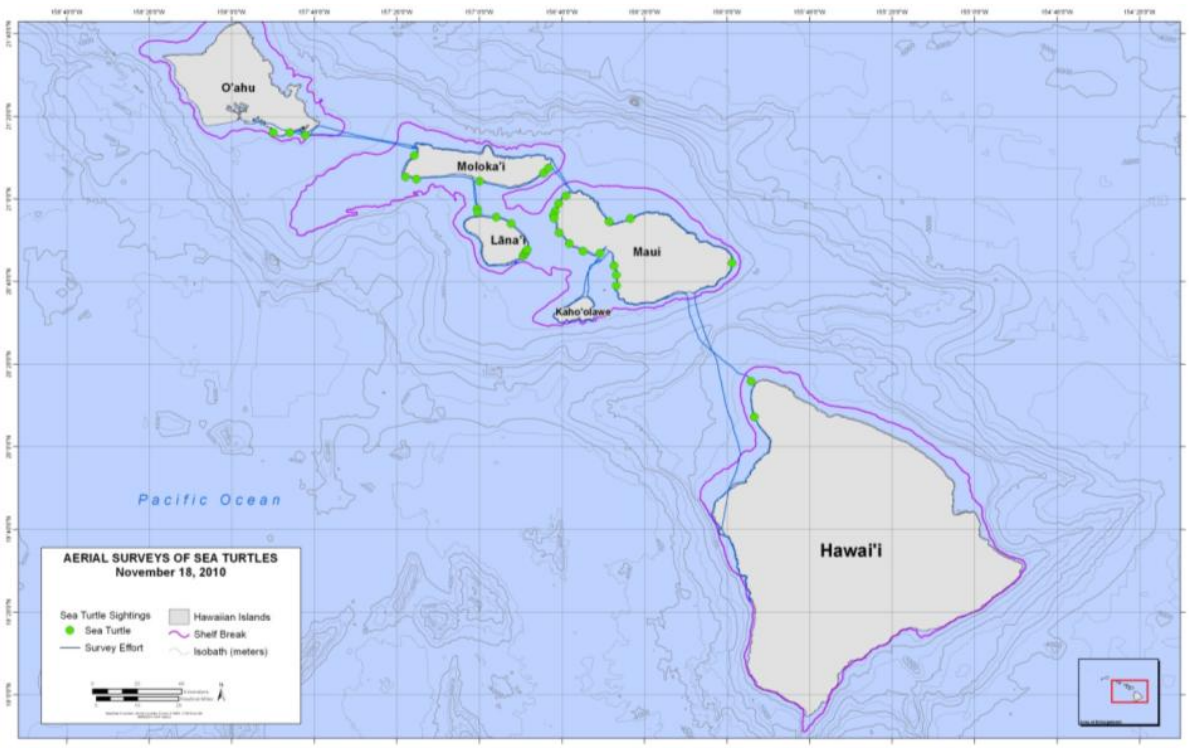

Figure 4. Locations of sea turtle sightings and tracklines during aerial-based monitoring efforts for Koa Kai 11-1, November 18, 2010.

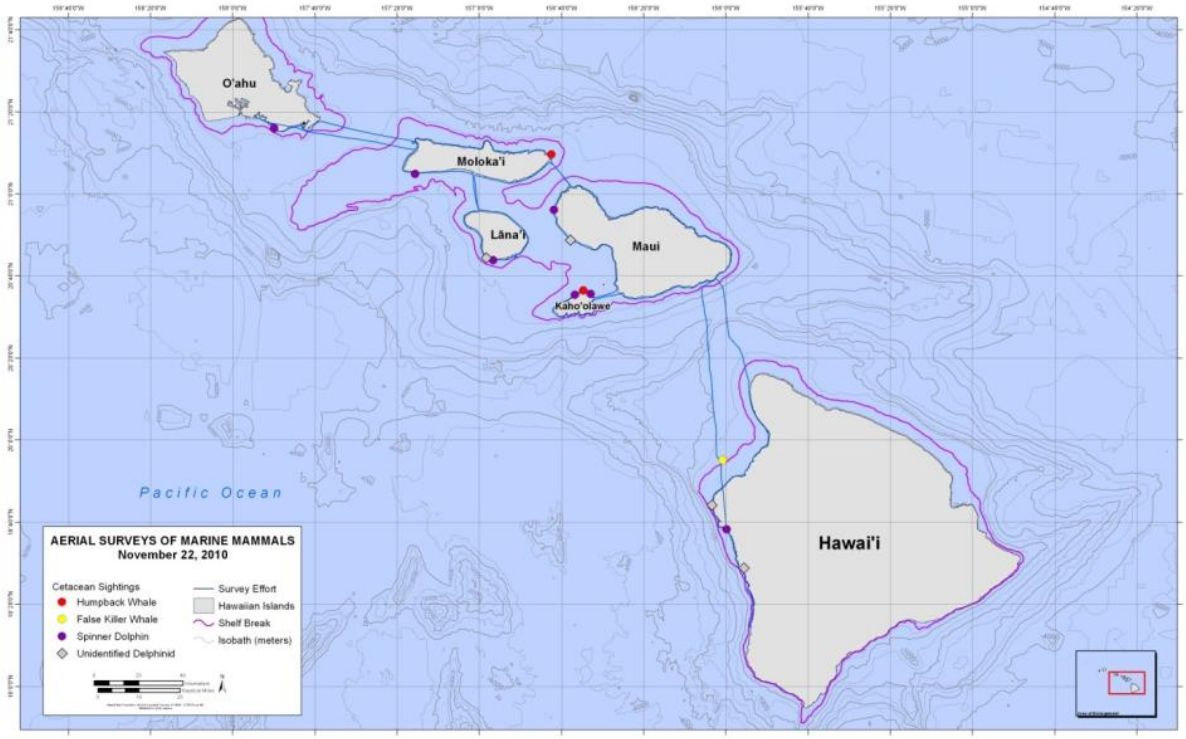

Figure 5. Locations of marine mammal sightings and tracklines during aerial-based monitoring efforts for Koa Kai 11-1, November 22, 2010.

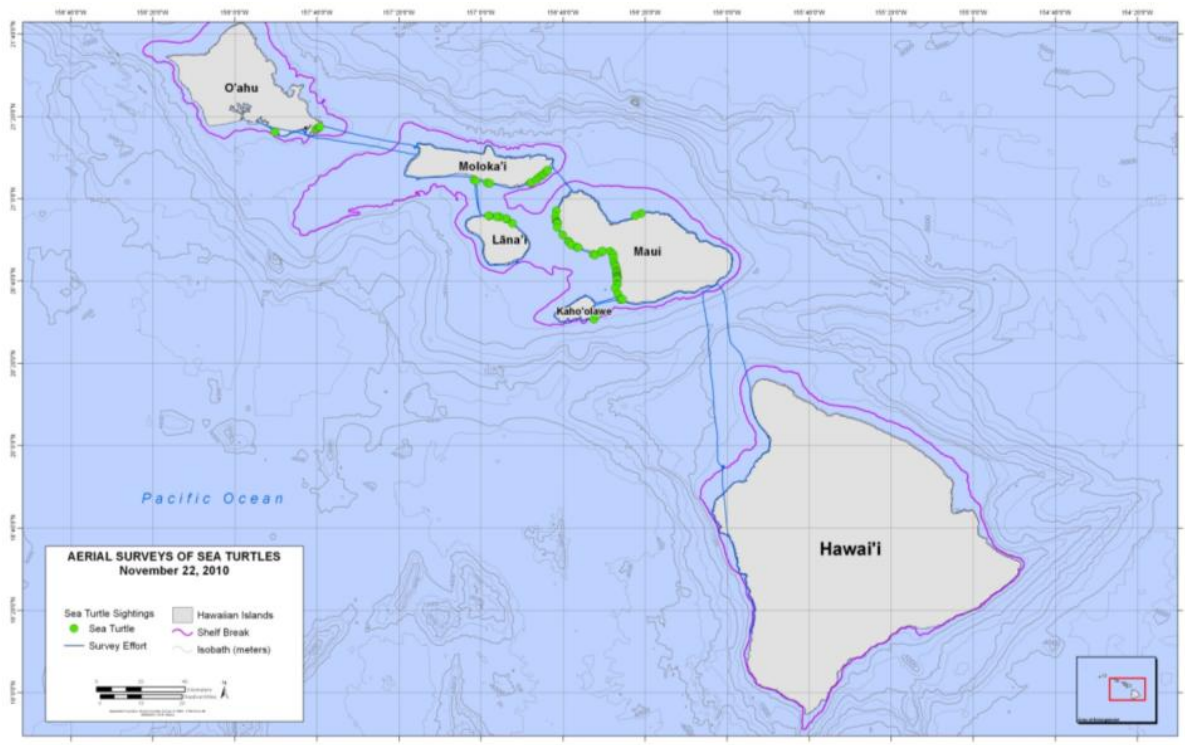

Figure 6. Locations of sea turtle sightings and tracklines during vessel-based monitoring efforts for Koa Kai 11-1, November 22, 2010.

4. RECOMMENDATIONS

Future surveys could benefit from use of a directional hydrophone on the vessel, which would potentially increase the number of focal follows. During time periods when winds are calm and sighting conditions are more optimal, the directional hydrophone could allow the observers to visually locate those animals detected acoustically.

Future monitoring events would be enhanced with the addition of satellite tagging efforts 2 to 3 months in advance of the vessel survey. This would allow more opportunities to establish movement patterns of the animals in the region before, during, and after the training exercise to attain the goals of the HRC Monitoring Plan.

The vessel-based monitoring survey benefited from the decision to remain in the lee of the larger islands during high sea states. In general, this allows more opportunities to observe cetaceans and is preferable to expending time and energy battling sea state. However, caution should be used by future surveys not to depend completely on this effort since it might be quite far from where the actual exercises will be conducted.

This survey benefited from having alternative tracklines planned in advance (e.g., lines over seamounts) and allowed a greater encounter rate for the survey. Again, caution should be used in choosing alternative lines. Our survey encountered unusually low sea states (BSS < 2) while we were in the area of the seamounts. While fortuitous, these opportunities do not happen often.

Future monitoring surveys need to focus on the actual purpose of the monitoring. If the desire is to encounter animals for tagging or focal follows, then it is beneficial to seek out areas of higher density of animals. However, if the purpose is to determine distribution, species richness, or abundance, strict line-transect techniques should be used. That is not to say that a combination of the two approaches can't be used.

The utility of the *Aukele* for future surveys depends on what the actual question/goal of the survey is. The *Aukele* crew was dependable and willing to do anything to assist with the survey. The vessel was not as stable as we had hoped, but did have a flying bridge that served as an excellent vantage point for sightings. The owner of this vessel has agreed to add stabilizers to the vessel for future surveys and the vessel has an adequate rear deck to allow the launching of a small Rigid-Hulled Inflatable Boat (RHIB).

Future surveys, when it is expected to work within sight of the Navy vessels, should incorporate more interaction with the actual vessels in some way to ensure the monitoring vessel is kept up to date on daily maneuvering and other information. Unless this is done, the likelihood of the survey vessel finding the Navy vessels is not good.

5. ACKNOWLEDGEMENTS

We would like to thank Captain Randy Cates of the *Aukele*, and the ship's deckhands Kaipo Miller and Brennan Paakaula for their able assistance during this survey effort. Mahalo to Richard Schuman and Mike Stroup of Makani Kai Helicopters for their superb piloting. These data were obtained under NOAA permit no. 14451 issued to Joseph R. Mobley, Jr., Ph.D.

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KOA KAI-11: APPENDIX A

Focal Follow Data

Table A-1 shows the focal follow behavioral data from the Koa Kai 11-1 vessel monitoring efforts. Behavioral data are a compilation of comments recorded in WinCruz and sighting sheets.

Table A-1. Focal follow behavior data

Record number	Time	Date	Latitude	Longitude	Recorded behavior
Sighting Number 3					
Species: *Globicephala macrorhynchus*					
1	9:47:17	11/13/10	N20:46.11	W157:04.81	Animals sitting at surface/logging.
2	9:48:43	11/13/10	N20:46.13	W157:04.93	Definitely a calf in the group.
3	9:51:03	11/13/10	N20:46.17	W157:04.97	Two separate groups approximately 100 m apart.
4	9:51:37	11/13/10	N20:46.20	W157:04.98	Farther group approaching vessel.
5	9:52;11	11/13/10	N20:46.22	W157:04.99	Majority of group dove.
6	9:56:55	11/13/10	N20:46.33	W157:04.94	Group appeared behind vessel.
7	9:58:37	11/13/10	N20:46.32	W157:04.90	Animals approaching vessel; slow traveling.
8	10:10:11	11/13/10	N20:46.52	W157:04.97	Two groups of animals that are 30 m apart.
9	10:17:02	11/13/10	N20:46.45	W157:05.17	Animals slow moving, short dives of ~5 minutes.
10	10:17:29	11/13/10	N20:46.44	W157:05.16	Groups now spaced 200 m apart.
11	10;20:55	11/13/10	N20:46.66	W157:05.03	Side display from one animal; all logging at surface.
12	10:25:25	11/13/10	N20:46.72	W157:05.02	Animals diving and milling, several changing directions.
13	10:29:09	11/13/10	N20:46.73	W157:05.03	Leaving group.
Sighting Number 5					
Species: *Globicephala macrorhynchus*					
1	8:32:40	11/14/10	N20:45.91	W157:06.75	Two groups widely spaced apart and several single animals with lots of distance in between.
2	8:34:27	11/14/10	N20:45.83	W157:06.75	Animals are low swimming; slow traveling; no large blows.
3	8:36:03	11/14/10	N20:45.77	W157:06.82	Smaller animal appears to be a calf.
4	8:41:04	11/14/10	N20:45.68	W157:06.76	Slow traveling animals; appears to be one group now.
5	8:42:51	11/14/10	N20:45.62	W157:06.76	Group changed directions and dove.

Record number	Time	Date	Latitude	Longitude	Recorded behavior
Sighting Number 5 (continued)					
6	8:55:32	11/14/10	N20:45.25	W157:06.77	Slow traveling; animals widely spaced except for cow/calf pair.
7	8:59:06	11/14/10	N20:45.53	W157:06.81	End of sighting.
Sighting Number 6					
Species: *Pseudorca crassidens*					
1	9:32:21	11/14/10	N20:47.76	W157:08.62	Animal fast traveling; ~4 knots.
2	9:33:01	11/14/10	N20:47.70	W157:08.67	Animal fast traveling and splashing.
3	9:35:47	11/14/10	N20:47.58	W157:08.99	Animal arched and performed a lateral tail display.
4	9:41:36	11/14/10	N20:47.47	W157:08.96	Animal moving fast.
5	9:56:47	11/14/10	N20:46.53	W157:09.28	Animal is being evasive.
6	10:04:15	11/14/10	N20:46.90	W157:09.49	End of sighting.
Sighting Number 7					
Species: *Globicephala macrorhynchus*					
1	10:57:15	11/14/10	N20:44.78	W157:05.54	Evasive behavior; changed direction 180 degrees as vessel approached.
2	10:57:15	11/14/10	N20:44.78	W157:05.54	Several juveniles/young animals in group.
3	10:57:49	11/14/10	N20:44.78	W157:05.53	Slow traveling.
4	10:58:53	11/14/10	N20:44.77	W157:05.52	Closest approach ~100 yards off of stern.
5	11:04:18	11/14/10	N20:44.69	W157:05.44	End of sighting.
Sighting Number 8					
Species: *Globicephala macrorhynchus*					
1	11:32:00	11/14/10	N20:43.67	W157:06.27	Spyhop.
2	11:34:49	11/14/10	N20:43.59	W157:06.23	Changed direction near vessel.
3	11:35:02	11/14/10	N20:43.61	W157:06.23	Closest approach ~20 m.
4	11:38:33	11/14/10	N20:43.61	W157:06.31	Lobtail.
5	11:42:21	11/14/10	N20:43.68	W157:06.47	End of sighting.
Sighting Number 9					
Species: *Globicephala macrorhynchus*					
1	12:17:40	11/14/10	N20:41.07	W157:08.00	Slow traveling and logging; small individuals.
2	12:22:00	11/14/10	N20:40.99	W157:08.03	Three subgroups; echelon near vessel.
3	12:22:37	11/14/10	N20:40.99	W157:08.02	Subgroups off of bow were within three body lengths of each other.
4	12:23:18	11/14/10	N20:40.99	W157:08.02	Separation between groups on stern and bow > 50–100 m.

Record number	Time	Date	Latitude	Longitude	Recorded behavior
Sighting Number 9 (continued)					
5	12:23:50	11/14/10	N20:40.99	W157:08.02	Vessel in neutral; animals slow travel/logging near vessel.
6	12:24:10	11/14/10	N20:40.99	W157:08.01	Group off of bow has small calf.
7	12:24:59	11/14/10	N20:40.97	W157:08.00	Spyhop in bow group; bow and stern groups appear to be coalescing .
8	12:27:05	11/14/10	N20:40.85	W157:07.93	Slow travel by both groups.
9	12:32:38	11/14/10	N20:40.71	W157:08.03	End of sighting.
Sighting Number 11					
Species: *Stenella attenuata*					
1	7:54:07	11/16/10	N20:43.41	W157:06.01	Dolphins ~ 400 m off of bow.
2	8:00:45	11/16/10	N20:43.29	W157:05.64	Several calves; animals jumping and bowriding.
3	8:04:22	11/16/10	N20:43.32	W157:05.54	Several animals are bowriding and coming into contact with the vessel; no evasive behavior.
4	8:14:39	11/16/10	N20:43.55	W157:05.40	School was widely dispersed.
5	8:27:24	11/16/10	N20:43.81	W157:05.52	End of sighting.
Sighting Number 14					
Species: *Steno bredanensis*					
1	9:57:26	11/18/10	N19:36.09	W157:03.84	Potentially two separate groups of animals near float.
2	10:03:30	11/18/10	N19:36.12	W157:03.59	Loosely aggregated group; approaching vessel.
3	10:03:39	11/18/10	N19:36.13	W157:03.60	Several animals bowriding.
4	10:08:04	11/18/10	N19:36.08	W157:03.79	No juveniles in group.
5	10:09:45	11/18/10	N19:36.02	W157:03.86	Animals have converged into one group.
6	10:10:24	11/18/10	N19:35.98	W157:03.78	Some cookiecutter scars; one animal has several entanglement scars.
7	10:11:51	11/18/10	N19:36.06	W157:03.68	Animals have been staying within 200 m of floating debris.
8	10:20:37	11/18/10	N19:36.21	W157:03.91	End of sighting.
Sighting Number 17					
Species: *Balaenoptera borealis*					
1	13:43:54	11/18/10	N19:20.98	W157:21.59	Whale performed two blows then dove ~10 minutes.
2	14:03:43	11/18/10	N19:20.99	W157:22.06	Animal is being evasive; underwater blows.

Record number	Time	Date	Latitude	Longitude	Recorded behavior
Sighting Number 17 (continued)					
3	14:07:49	11/18/10	N19:21.22	W157:22.25	Continuing evasive behavior; low swimming and changing directions.
4	14:08:34	11/18/10	N19:21.19	W157:22.17	Footprints visible; underwater blows.
5	14:24:44	11/18/10	N19:21.60	W157:22.47	End of sighting.
Sighting Number 21					
Species: *Feresa attenuata*					
1	15:29:06	11/19/10	N19:25.63	W157:01.62	Animals are being evasive.
2	15:37:01	11/19/10	N19:25.91	W157:01.43	Group split.
3	15:37:35	11/19/10	N19:25.95	W157:01.49	Group increasing speed.
4	15:44:05	11/19/10	N19:25.94	W157:01.23	Animals are reacting to vessel; when vessel increases speed, animals turn and disperse; when vessel returns to neutral, animals return to slow travel/logging and closely group together.
5	15:48:14	11/19/10	N19:26.02	W157:01.11	End of sighting.
Sighting Number 22					
Species: *Tursiops truncatus*					
1	10:21:36	11/22/10	N20:59.83	W157:18.06	Many small blows.
2	10:30:19	11/22/10	N21:00.57	W157:19.16	Slow traveling.
3	10:32:36	11/22/10	N21:00.54	W157:19.41	Group approaching vessel to bowride.
4	10:32:49	11/22/10	N21:00.54	W157:19.43	Several calves.
5	10:34:49	11/22/10	N21:00.51	W157:19.57	Staying within close proximity to vessel.
6	10:37:16	11/22/10	N21:00.50	W157:19.82	End of sighting.

KOA KAI-11: APPENDIX B

Representative photographs from sightings made during Koa-Kai 11-1 vessel and aerial surveys, November 2010

Sighting 1: Humpback whale (Megaptera novaeangliae) sighted on November 11, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 3: Short-finned pilot whale (Globicephala macrorhynchus) sighted on November 13, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 4: Short-finned pilot whales (Globicephala macrorhynchus) sighted on November 13, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 5: Short-finned pilot whales (Globicephala macrorhynchus) sighted on November 14, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 6: False killer whale (Pseudorca crassidens) with cookie cutter shark bite. Sighted on November 14, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 7: Short-finned pilot whales (Globicephala macrorhynchus) sighted on November 13, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 8: Short-finned pilot whale (Globicephala macrorhynchus) sighted on November 14, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 9: Short-finned pilot whale (Globicephala macrorhynchus) sighted on November 14, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 11: Pantropical spotted dolphin (Stenella attenuata) with calf, sighted on November 16, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 12: Short-finned pilot whales (Globicephala macrorhynchus) sighted on November 16, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 14: Rough-toothed dolphins (Steno bredanensis) sighted on November 18, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 17: Sei whale (Balaenoptera borealis) sighted on November 18, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 21: Pygmy killer whales (Feresa attenuata) sighted on November 19, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 22: Bottlenose dolphins (Tursiops truncatus) sighted on November 22, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 24: Humpback whale (Megaptera novaeangliae) sighted on November 22, 2010, during the Koa Kai 11-1 vessel-based monitoring effort.

Sighting 122: Two of a pod of five false killer whales (Pseudorca crassidens) sighted on November 22, 2010, during the Koa Kai 11-1 aerial-based monitoring effort. Photo taken through the bubble window of a Robinson 44 helicopter.