

**APPENDIX E. Aerial Survey Monitoring for Marine Mammals and Sea Turtles in the Hawaii Range Complex in Conjunction with Two Navy Training Events. SCC and USWEX February 16 - March 5, 2011. Final Field Report.**

**Aerial Survey Monitoring for  
Marine Mammals and Sea  
Turtles in the Hawaii Range  
Complex in Conjunction with  
two Navy Training Events**

SCC and USWEX February 16 – March 5,  
2011



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***Author:***

**Joseph R. Mobley, Jr., PhD**

**HDR**

**[jmobley@hdrinc.com](mailto:jmobley@hdrinc.com)**

*Submitted to*  
**NAVFAC Pacific**  
**EV2 Environmental Planning**  
**258 Makalapa Dr., Ste 100**  
**Pearl Harbor, HI 96860-3134**

*Submitted by*  
**HDR Inc.**

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**ACRONYMS AND ABBREVIATIONS**

DDG	missile destroyer
HD	high-definition
HRC	Hawaii Range Complex
km	kilometer
kt	knots
MFAS	Mid-frequency Active Sonar
MM/ST	Marine mammals and sea turtles
NM	Nautical Miles
NPAL	North Pacific Acoustics Laboratory
NTR	Navy Technical Representative
PMRF	Pacific Missile Range Facility
SCC	Submarine Commander's Course
SOW	statement of work
USWEX	Undersea Warfare Exercise

## SECTION 1 INTRODUCTION

Aerial surveys to monitor marine mammals and sea turtles (MM/ST) were conducted in conjunction with two training events during the period February 16 to March 5, 2011, including (a) U.S. Navy Submarine Commander's Course (SCC) naval training event in the Hawaii Range Complex (HRC) on the Pacific Missile Range Facility (PMRF) instrumented range between Kauai and Niihau, Hawaii; and (b) Undersea Warfare Exercise (USWEX) training event south of Oahu and Molokai (**Figure 1**). Surveys in support of the SCC event occurred on 4 consecutive days from February 16 to 19, 2011, in waters adjoining Kauai and Niihau where the missile destroyer (DDG) and other ships were operating, followed by shoreline surveys of Kauai and Niihau on 2 separate days thereafter: February 24 and 26, 2011. This was followed by shoreline surveys of the Four Islands region in support of the USWEX event on 2 separate days, February 28 and March 5, 2011. The survey methods and sampling design were submitted and approved in advance, per the statement of work (SOW), to the Navy Technical Representative (NTR) and followed previously established protocol (Mobley and Milette 2010; Smultea et al. 2009a,b).

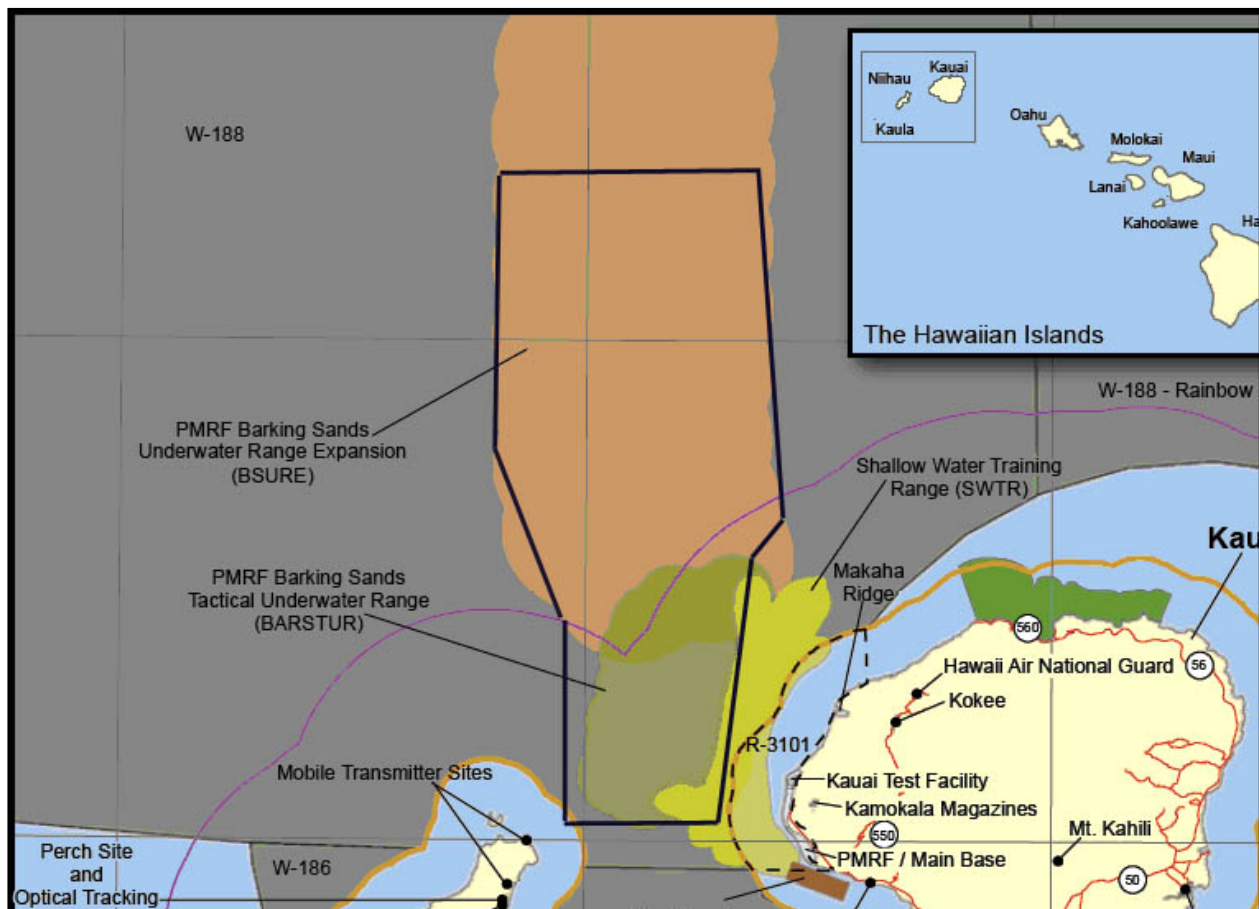


Figure 20. Location of the aerial survey monitoring area in and near the U.S. Navy PMRF Range west and northwest of Kauai, Hawaii.

Prior to the training event, the Principal Investigator (Joe Mobley) and pilot (John Sharkey) attended pre-planning sessions with the NTR and other Navy staff at Pearl Harbor, Honolulu,

Oahu, Hawaii, to coordinate survey efforts with the SCC February 2011 operations. Per the SOW, the goal of the aerial survey was to monitor and report the presence/absence, distribution/redistribution, reaction/no reaction, injury, and mortality of MM/ST before, during and after the training event. This involved monitoring and reporting the surface behavior of MM/ST. In particular, we were to monitor for any changes in the near-surface behavior, orientation, occurrence, and location of animals relative to the DDG's activities using a systematic search and focal follow method.

Since mid-frequency active sonar (MFAS) locations and transmission times were unknown to the observers during this field survey effort, no effort was made to determine types or level of response of MM/ST to these transmissions. Rather, as stated in the SOW, survey data collected during this monitoring effort will be compiled with previous (Mobley and Milette 2010) and subsequent data, and analyzed by the Navy.

Survey effort during this training event was of three types (**Table 1**): (a) ship follows (February 16–18): flying elliptical orbits in front of the DDG per previous training events (Mobley and Milette 2010; Smultea et al. 2009a,b), (b) transects (February 19): flying in sawtooth pattern north of Kauai during the tagging support portion of effort, and (c) circumnavigation of islands: flying along the coastlines of Kauai and Niihau (February 24 and 26) and Four Island Region and Kona coast (February 28 and March 5) to search for stranded or near-stranded MM/STs. In all cases the mission was to document the presence of MM/STs including species identity, group composition, behavior, and any obvious reactions.

*Table 1. Summary of Effort Type, Hours, and Seastate by Date.*

Date	Type of Effort	No. Hrs Effort	Mean Beaufort Sea State
2/16/11	With DDG	7.8 hrs	4.4
2/17/11	With DDG	5.4 hrs	5.2
2/18/11	With DDG*	4.9 hrs	3.6
2/19/11	Transects--tag support (Cascadia)	6.4 hrs	2.9
2/24/11	Shoreline survey—Kauai/Niihau	4.2 hrs	4.0
2/26/11	Shoreline survey—Kauai/Niihau	3.8 hrs	2.4
2/28/11	Shoreline survey—Four island region and Kona coast	6.7 hrs	2.9
3/5/11	Shoreline survey—Four island region and Kona coast	4.4 hrs	2.6
<b>TOTAL:</b>		<b>46.1 hrs</b>	

Note: \* afternoon leg on 2/18/11 cancelled due to IFR conditions (low visibility)

## SECTION 2 METHODS

Monitoring effort followed protocol implemented in previous SCC training events (Mobley and Milette 2010). The approach involved flying elliptical-shaped patterns in advance of the Navy vessel (DDG) that extended from the front of the ship (~200 meters) out to ~2,500 meters) over a width of ~4 kilometers (km).

Surveys were conducted from a small fixed-wing Aero Commander flying at 100 knots groundspeed and an altitude of ~305 meters (1,000 feet), unless the pilot was directed to fly at alternate altitudes by flight controllers for safety reasons. Observations from the monitoring aircraft involved four personnel including the pilot and copilot, plus two biologist observers with one also acting as data recorder/videographer. Survey crew and pilot were not informed as to the status of MFAS transmissions, which minimized potential for observational bias. When animals were detected, the angle to the sighting was recorded using hand-held Suunto clinometers, typically followed by orbiting to identify species and in the case of marine mammals, to characterize behavior and direction of travel. Photographs were taken opportunistically by the data recorder to assist in species identification using a Canon 5D digital camera with Canon 100-400mm telephoto lens with image stabilizer. Environmental data (Beaufort seastate, glare, visibility) were recorded at the start of effort and when conditions changed. Positional data via GPS were automatically recorded every 5 seconds and manually when sightings occurred.

When pods were suitable (i.e., were visible at the surface for extended periods) focal follows were performed using accepted methods (Altmann 1974). The aircraft ascended to 457 meters (1,500 feet), an altitude shown to minimize reactivity to fixed-wing aircraft (Smultea et al. 1995), and the pod was orbited and behavior videotaped for as long as possible. A high-definition (HD) Canon Vixia HF10 camcorder with 12-power optical zoom was used to videotape focal follows. The intercom system of the aircraft inputted to the audio port of the digital camcorder so that all behavioral observations could be recorded with a minimum of ambient noise. Time stamps on the Canon camcorder were synchronized with those from the Garmin GPS receiver. The resultant digital audio/video file and digital photos will be made available to the Navy for subsequent behavioral analysis.

Overall survey effort was divided into four parts as summarized below:

- (a) Ship follows, SCC event (February 16–18, 2011): involved flying elliptical orbits in front of the DDG (**Figure 2**) with the goal of finding target species in the vicinity of the DDG and observing and recording their behavior using focal follow methods (Altmann 1974)
- (b) Transect surveys (February 19, 2011): to search for marine mammals in support of tagging effort by Cascadia Research Collective (**Figure 3**). Note: More detailed description of tagging effort provided in Baird et al. (2011)
- (c) Circumnavigation surveys, post-SCC event (February 24 and 26, 2011): following the SCC event, the aircraft flew along the coastlines of Kauai, Niihau, and Ka'ula islands (**Figure 3**) looking for target species along the shoreline and any stranded or near-stranded marine mammals
- (d) Circumnavigation surveys, post-USWEX event (February 28 and March 5, 2011): following the USWEX training event, the aircraft flew along the coastlines of Oahu, the Four Island Region (Maui, Molokai, Lanai, and Kahoolawe), and the Kona coast of the island of Hawaii (**Figure 4**).

Most sightings during the 3-day SCC event occurred during transits between Lihue, Kauai, and the ship's position (**Figure 2**). Four sightings of humpback whales occurred in the vicinity of the DDG (four squares shown in elliptical plots), one of which became the target of a focal follow session with videotape.

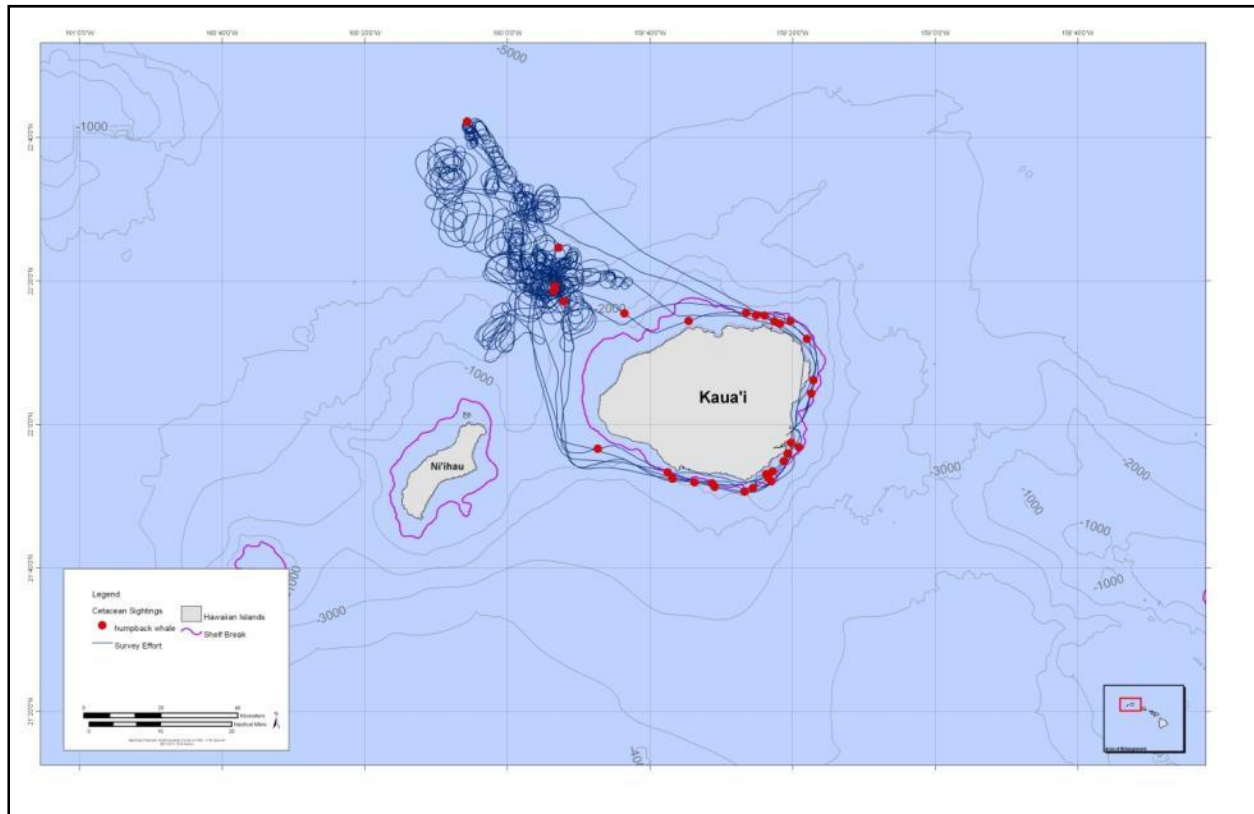


Figure 2. Effort and sighting locations during days involving ship follows with the DDG (February 16–18, 2011). All marine mammal sightings are of humpback whales.

Aerial support of the tagging effort followed a sawtooth transect pattern north of Kauai (Figure 3). The shoreline survey effort involved circumnavigating the islands of Kauai and Niihau approximately 1 to 2 km offshore.

## Communications

Communications were reliably established between the survey aircraft and the DDG using aviation-band VHF radios broadcasting on 123.45 MHz. Observers onboard the DDG used a handheld aviation VHF radio while on the bridge wing of the DDG. This system proved to be reliable whenever the aircraft was in the vicinity of the ship (i.e., < 10 km); whereas communications at greater distances were possible via radio communications with PMRF Range Control or Outrider Bravo. Daily locations of the DDG were usually communicated via onboard VHF radio once in the air via PMRF Range Control or Outrider Bravo.

## Range Control Interventions

Range safety during training events is of paramount importance. Range control interventions during the SCC training event occurred more frequently than in past SCC observation missions (Table 2).

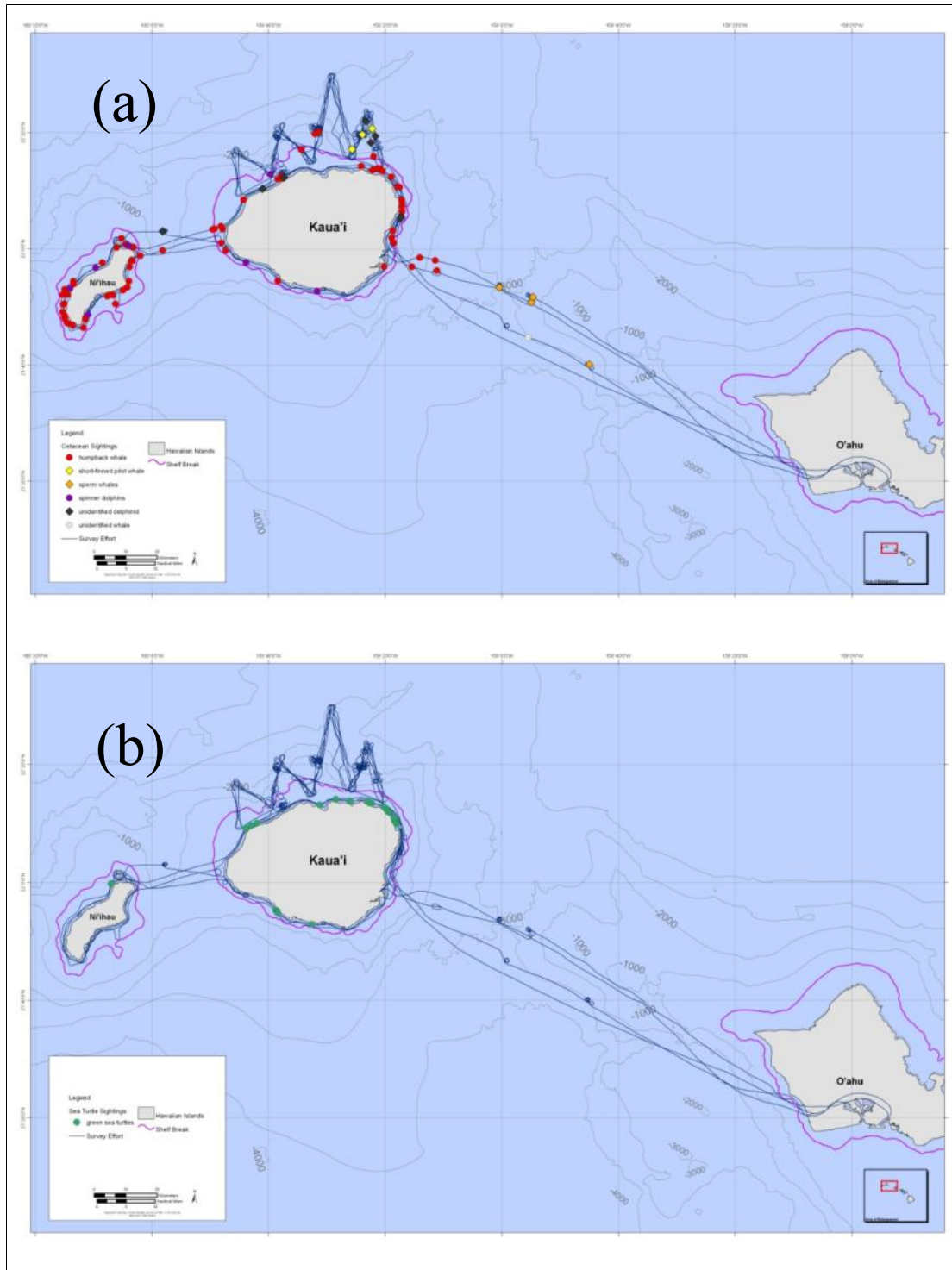


Figure 3. Post-SCC event. Effort and sighting locations during spotting assist for tagging effort (Feb. 19) and circumnavigation of Kauai and Niihau (February 24 and 26, 2011). Marine mammal sightings are shown in (a) and sea turtle sightings are shown in (b).

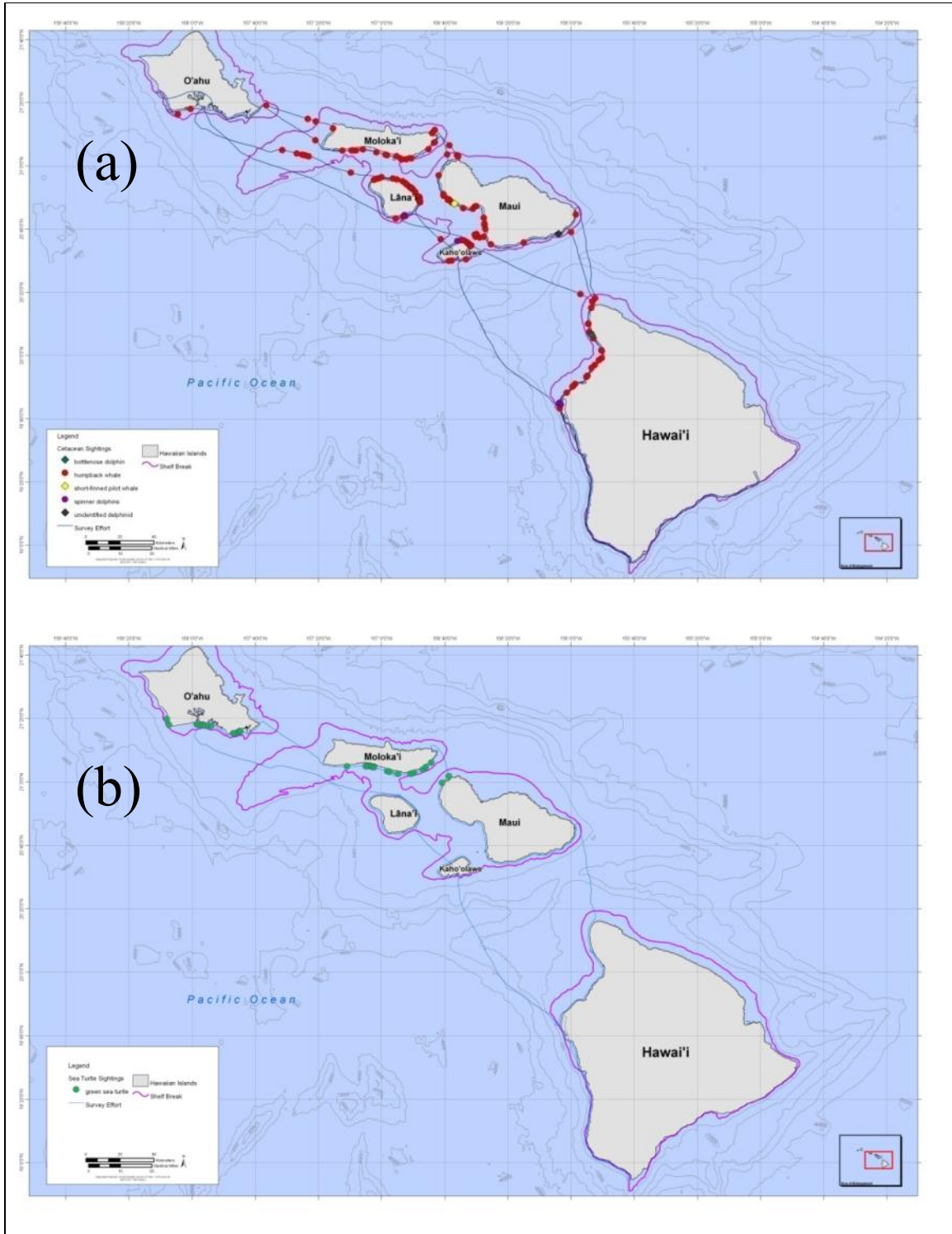


Figure 4. Post USWEX event. Effort and sighting locations during shoreline surveys of Oahu, Molokai, Maui, Lanai, Kahoolawe, and Kona coasts. Marine mammal sightings are shown in (a) and sea turtle sightings are shown in (b).



*Table 2. Summary of Range Control Interventions*

Date	Time	Instruction
Feb 16	15:06	Directed away from DDG by Range Control; returned 26 minutes later at 15:32.
Feb 17	08:02	Instructed to stay within 2 Nautical Miles (NM) of DDG location at all times. This did not permit focal follows since they frequently requires moving more than 2 NM away from DDG
Feb 17	09:15	Instructed to orbit south of DDG location; allowed to return 1 hour 20 minutes later (called twice during intervening period but no reply).
Feb 18	11:00	Instructed to stay south of 22°26' latitude which required leaving DDG. Were able to return to DDG at 11:33 and remained in contact until 14:18.

## SECTION 3 RESULTS

### Effort

During the SCC event (February 16–18), the survey aircraft accompanied the DDG for 13.25 hours (66%) of the total 19.95 hrs of SCC-related flight time (**Table 3**). The remaining 6.7 hours (34%) while not with the DDG primarily involved transiting between the DDG's location and Lihue, Kauai, and maintaining a holding pattern per the instructions of PMRF Range Control (**Figure 2**). The aircraft was considered “with the DDG” upon commencement of elliptical orbits around the ship's location (**Figure 2**).

On February 19, the mission was to provide aerial spotting services to support a tagging operation (Cascadia Research Collective aboard the M/V Searcher) north of Kauai. Effort followed a sawtooth transect pattern (**Figure 3**) Note: More detail of tagging effort is provided in Baird et al. (2011).

Shoreline surveys were conducted as part of the SCC event in the waters surrounding Kauai/Niihau (February 24 and 26) (**Figure 3**) and in conjunction with the USWEX event in waters south of the eastern portion of the main Hawaiian Island chain (February 28 and March 5) (**Figure 4**).

### Sea State

The majority of overall effort (70%) was spent in good sea state conditions (i.e., Beaufort 1-3) (**Figure 5**). The majority of sightings (57%) occurred in these more favorable conditions, with most in Beaufort 2. This pattern is consistent with known effects of sea state on sighting probabilities (Buckland et al. 2001).

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Table 3. Survey Effort (with and not with DDG).

Date	Time Wheels Up	Time Wheels Down	Total Flight Hours	Period not with DDG	Total Hours not with DDG	Period with DDG	Total Hours with DDG	No. Sightings With DDG	No. Sightings Away from DDG
2/16/2011	7:35 13:15	12:03 16:25	4.28 3.10	7:35-8:05 11:32-12:03 13:15-13:37 15:06-15:32 16:00-16:25	2:14	8:05-11:32 13:37-15:06 15:32-16:00	5:24	2	12
2/17/2011	7:41 13:32	11:55 16:44	4:14 3:12	7:41-8:02 9:15-10:40 11:30-11:55 13:32-13:45 16:15-16:44	2:53	8:02-9:15 10:40-11:30 13:45-16:15	4:33	1	11
2/18/2011	9:55	14:48	4:53	9:55-10:27 11:00-11:33 14:18-14:48	1:35	10:27-11:00 11:33-14:18	3:18	1	5
2/19/2011	7:47 13:18	11:50 15:51	4:03 2:33	7:47-11:50 13:18-15:51	6:36	n/a	n/a	n/a	18
2/24/2011	8:07 12:10	11:32 13:04	3:25 0:54	8:07-11:32 12:10-13:04	4:19	n/a	n/a	n/a	41
2/26/2011	7:50 12:04	10:34 13:00	2:44 0:56	7:50-10:34 12:04-13:00	3:40	n/a	n/a	n/a	60
2/28/2011	7:54 13:34	12:22 15:40	4:28 2:06	7:54-12:22 13:34-15:40	6:34	n/a	n/a	n/a	91
3/5/2011	7:37 12:00	10:45 13:53	3:08 1:53	7:37-10:45 12:00-13:53	5:01	n/a	n/a	n/a	63
<b>Total</b>			<b>46:07</b>		<b>32:52</b>		<b>13:15</b>	<b>4</b>	<b>301</b>

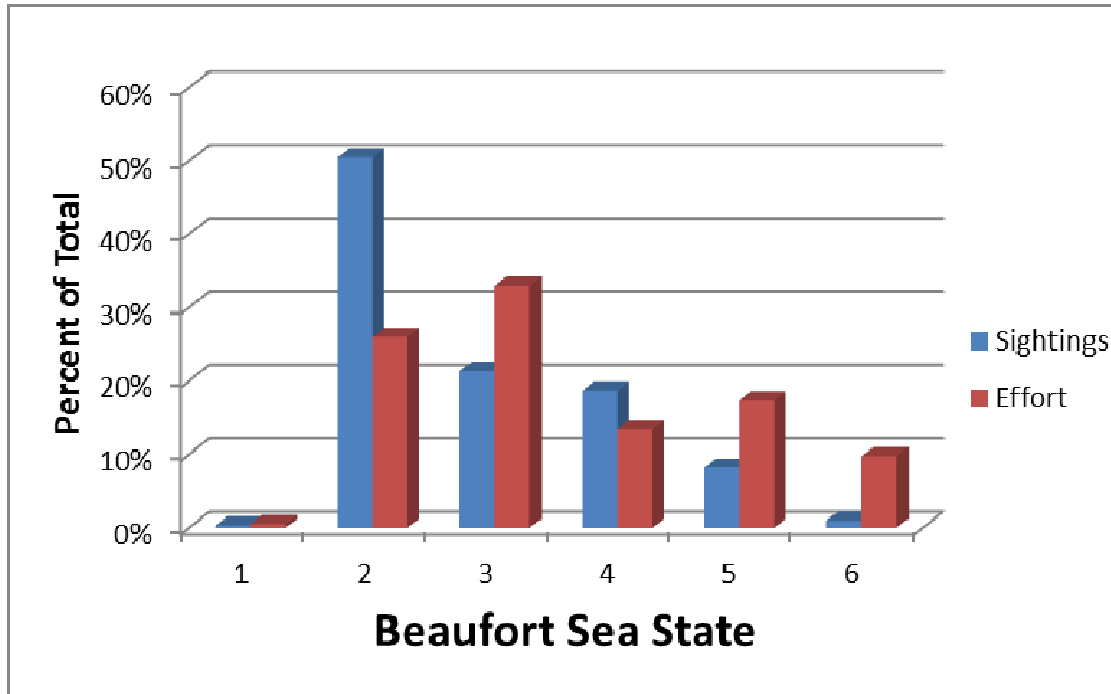


Figure 5. Beaufort sea state conditions for total effort and for sightings.

### Sightings

There were 305 sightings made during the 8 days of surveys (**Table 4**). The majority (74%) of these sightings were of humpback whales observed in shallow areas (< 1,000 fathoms), known to be preferred habitat of humpbacks based on past survey results (Mobley 2004). Of the 227 sightings of humpback whales, 195 were seen during the transect and shoreline surveys (i.e., not including those seen during ship follows). When converted to sighting rates, the result is 0.040 humpback sightings/km effort. This represents twice the sighting rate for humpbacks seen north of Kauai during the 2006 North Pacific Acoustics Laboratory (NPAL) surveys—0.020 humpback sightings/km effort (Mobley 2006). The greater rate of humpback whale sightings recorded during the present surveys is consistent with previous reports of increases in the Hawaii wintering population (Mobley et al. 1999, Mobley 2004, Calambokidis et al. 2008).

The remaining sightings with confirmed species identifications consisted of odontocete species, specifically spinner dolphins, bottlenose dolphins, short-finned pilot whales, and sperm whales. All of these are typically found in Hawaiian waters (Mobley et al. 2000, Barlow 2006). Twenty-nine odontocete sightings were recorded during all of the non-ship follow surveys combined and this converts to a sighting rate of 0.004 odontocete sightings/km effort. This is less than the sighting rate of 0.006 odontocetes/km effort reported for transect surveys of the main Hawaiian Islands conducted in 2000 (Mobley 2004). However, when restricted to the 22 odontocete sightings that occurred during non-ship follow surveys in the Kauai/Niihau area (February 19, 24, and 26), this results in a sighting rate of 0.008 odontocete sightings/km effort. This is more than the 0.006 sightings/km effort reported for the Kauai region during 2002 surveys on the PMRF instrumented range (Mobley 2004).

*Table 4. Summary of Sightings for Kauai-Niihau Shoreline surveys (Feb. 19, 24, 26).*

Species	Region	No. Groups	No. indiv's
Green sea turtles	Kauai	20	35
	Niihau	1	1
Humpback whales	Kauai	37	71
	Niihau	39	60
Short-finned pilot whales	Kauai	4	35
Sperm whales	Kauai Channel	4	14
Spinner dolphins	Kauai	3	132
	Niihau	4	360
Unid. delphinid spp.	Kauai	5	33
	Niihau	1	11
Unid. whale spp.	Channel	1	3
<b>Total:</b>		<b>119</b>	<b>755</b>

We recorded 48 sightings of green sea turtles, all of which were observed in the shallow coastal waters where the animals were highlighted against the light sandy bottom (**Figures 3 and 4**). Thus, these numbers are likely an undercount of sea turtle species given the limited range of conditions under which they were observed. The 48 sightings of sea turtles recorded during the non-ship follow surveys produces a sighting rate of 0.010 sea turtle sightings/km effort. Since this is the first encounter rate estimate for this species as part of HRC monitoring, there is no basis for comparison.

Although Hawaiian monk seals were recorded on previous surveys in this region (Smultea et al. 2009a), no monk seals were seen during this survey series either swimming or hauled out onshore. Given the relatively low numbers of monk seals in the main Hawaiian Islands (Baker and Thompson 2007), the absence of this species likely reflects a random sampling artifact rather than a systematic effect.

Observations across the 8 days of survey effort revealed no evidence of injury or mortality among target species before, during, and after the event. There were no behavioral indications of distress (e.g., tight aggregations of pod members) or unusual nearshore aggregations of marine mammals. The circumnavigation of islands (February 24, 26, and 28; and March 5) similarly revealed no stranded or near-stranded animals. Evidence regarding possible effects is further summarized in the next section.

Four sightings of humpback whales occurred in the vicinity of the DDG (**Table 5; Figure 1**). One of these pods became the subject of a focal follow session described in the next section.

*Table 5. Summary of Sightings for Post-USWEX Event Shoreline Surveys (Feb 28, Mar 5)—No. Groups (No. Indiv's).*

Region	Species					
	Green sea turtles	Bottlenose dolphins	Humpback Whales	Short-finned pilot whales	Spinner dolphins	Unid. Delphinid spp.
Oahu	11 (20)		3 (7)			
Penguin Bank			10 (14)			
Molokai	14 (37)		17 (31)			
Lanai			26 (38)		1 (50)	
Kahoolawe			14 (21)		3 (92)	1 (3)
Maui	2 (2)	1 (5)	26 (36)	1 (2)		
Big Island			24 (40)			
<b>Total: 154 (398)</b>	<b>27 (59)</b>	<b>1 (5)</b>	<b>120 (187)</b>	<b>1 (2)</b>	<b>4 (142)</b>	<b>1 (3)</b>

### Behavioral Focal Follows

Behavioral focal follows were conducted during the SCC event (February 16–18) while circling at an altitude of ~1,400 to 1,500 feet and a lateral distance of ~1 km (summarized in **Table 6**). The higher altitude for focal follows was designed to reduce the potential for reactivity to plane engine noise, thereby permitting naturalistic observation of whales in the vicinity of the DDG (Smultea et al. 1995).

Humpback whale pods were seen within the vicinity of the DDG ( $\leq 5$  km) on four occasions during the SCC event (**Table 6**) but a focal follow was initiated in only one instance. In two of the other three instances the target pod was not resighted after initial detection and in one instance, the observation plane was directed away from the sighting by Outrider Bravo control to deconflict aircraft operations in the area.

The one behavioral focal follow session conducted while monitoring near the DDG (February 18; **Appendix C**) involved a pod of two humpback whales. At closest proximity, the pod was found within 1 to 2 km of the ship, and was observed for a total period of approximately 32 minutes; however, the whales were not in view the entire time due to the orientation of the plane or when the pod was traveling underwater. During surface observations, no obvious indications of stress were seen, i.e., the animals did not assume a defensive posture nor did they dive quickly, though, as noted earlier, any specific response to MFAS could not be determined since the observers were unaware of sonar transmission status throughout the event. However, the animals remained within 2 to 4 km of the DDG for most of the 32-minute observation period, suggesting that the activities and presence of the ship were not overly disturbing.

During the focal follow, behavior was called out in real time and recorded onto the audio of the digital videocam. The digital video files and the still photos will be made available to the Navy for subsequent behavioral analysis.

Table 6. Summary of Sightings by Species—All Surveys Combined.

Species	No. Groups	No. Individ.	Ave. Pod Size
Humpback Whales ( <i>Megaptera novaeangliae</i> )	227	370	1.63
Green Sea Turtle ( <i>Chelonia mydas</i> )	48	95	1.98
Spinner Dolphins ( <i>Stenella longirostris</i> )	11	634	57.64
Unidentified Dolphin	8	54	6.75
Short-finned Pilot Whale ( <i>Globicephala macrorhynchus</i> )	5	37	7.40
Sperm Whale ( <i>Physeter macrocephalus</i> )	4	14	3.50
Unidentified Whale	1	3	3.00
Bottlenose Dolphin ( <i>Tursiops truncatus</i> )	1	5	5.00
<b>Total</b>	<b>305</b>	<b>1,212</b>	-

Table 7. Summary of sightings with and away from the DDG--All Surveys Combined.

Species	With the DDG		Away from the DDG		Total	
	No. Grps	No. Individ.	No. Grps	No Individ.	No. Grps	No. Individ.
Humpback Whale ( <i>Megaptera novaeangliae</i> )	4	5	223	365 (16 calves)	227	370 (16 calves)
Bottlenose Dolphin ( <i>Tursiops truncatus</i> )	0	0	1	5	1	5
Short-finned Pilot Whale ( <i>Globicephala macrorhynchus</i> )	0	0	5	37 (1 calf)	5	37 (1 calf)
Spinner Dolphin ( <i>Stenella longirostris</i> )	0	0	11	634 (1 calf)	11	634 (1 calf)
Sperm whale ( <i>Physeter macrocephalus</i> )	0	0	4	14 (4 calves)	4	14 (4 calves)
Unidentified Dolphin (Delphinidae)	0	0	8	54	8	54
Unidentified Whale	0	0	1	3	1	3
Green Sea Turtle ( <i>Chelonia mydas</i> )	0	0	48	95	48	95
<b>Total</b>	<b>4</b>	<b>5</b>	<b>301</b>	<b>1,207</b>	<b>305</b>	<b>1,212</b>

*Table 8. Summary of Pods Observed within 5 km of DDG (February 16–18)*

Date	Time Sighted	Species	No. Individuals	Video? (Y/N)	If No, Reason Video not Initiated
Feb 16	14:05	Humpback Whale (MN)	1	N	Not resighted*
Feb 16	14:12	MN	1	N	Not resighted*
Feb 17	08:11	MN	1	N	Directed away from location by Outrider Bravo
Feb 18	13:14	MN	2	Y	

Note: \*Also sighted by observers onboard DDG.

## SECTION 4 DISCUSSION

As stated in the SOW, the survey mission was to “monitor and report the presence/absence, distribution/redistribution, reaction/no reaction, injury, and/or mortality of marine mammals and sea turtles before, during and after the event.” Evidence regarding each of these points is summarized below:

- (a) Presence/absence. This category is best assessed using an aggregate index such as “overall sightings per km” reported earlier. The observed sighting rates for humpbacks (0.040 sightings/km) suggest that humpbacks were present in the target area at higher densities than previously reported for this area (0.020 sightings/km) (Mobley 2006 for period mid-Feb through late-March), consistent with reports of an increasing winter population (Calambokidis et al. 2008, Mobley 2004). The overall sighting rate for odontocetes (0.004 sightings/km) for all non-ship-follow surveys was lower than that reported earlier from transect surveys of the main Hawaiian Islands in 2000 (0.006 sightings/km) with no training events ongoing (Mobley 2004). However, when the analysis was restricted to the Kauai/Niihau region where training events were closer to the surveyed regions involved, the sighting rate for odontocetes (0.008 sightings/km) was higher than that seen earlier during 2002 surveys of the same region with no training events ongoing (0.006 sightings/km) (Mobley 2004). This suggests that the training events did not result in the evacuation of the area on the part of odontocetes.
- (b) Distribution/redistribution. The same principle described in (a) applies to assessing changes in distribution, i.e., changes in distribution can only be reliably detected for the most abundant species, e.g., seasonally present humpbacks via comparisons across consecutive seasons (e.g., Mobley 2005). If one examines the locations of humpbacks observed in this survey series (**Figures 2 through 4**), it is clear that they were seen throughout their normal preferred habitat of shallow, coastal regions as shown in previous surveys (e.g., Mobley 2004). In contrast, since the distribution of odontocetes is typically sparse, particularly for tropical waters such as Hawaii (Barlow 2006), discerning distribution change is made difficult. Sea turtles are also sparsely distributed, and only seen occasionally along primarily sand-bottom coastal regions (see Recommendations), so it is similarly difficult to discern changes in distribution for these species.

- (c) Reaction/no reaction. For this category one must be able to distinguish reactions to the observation platform (survey aircraft in this case) from reactions related to the training event (e.g., MFAS). For that reason, the best source of data would be to aggregate the focal follow observations across multiple trials based on observations from non-reactive platforms (e.g., aircraft altitude  $\geq$  457 meters). That way one can discern changes in respiration rates, dive times, and other factors that might correlate with MFAS transmissions with little or no reactivity to the platform itself. To that end, we will continue to provide Navy sponsors with videotaped results of focal follows and detailed behavioral logs (**Appendix C**).
- (d) Injury and mortality. Injury and mortality are readily discernible for each of the target species due to marked reduction or cessation of locomotion and by other cues, such as visible wounds or blood. As such, it is arguably the most detectible of the four categories listed here. There was no evidence of injury or mortality for any of the target species observed before, during, or after either of the two training events.

Given the caveats noted, overall there were no direct observations of adverse effects of the training event. As for the effects of sonar, since the status of MFAS transmissions throughout the survey period was unknown, any specific response of the animals observed to such transmissions would require more detailed behavioral analyses by the Navy with knowledge of the time/duration of MFAS. The time-stamped audio/video files from the focal follows will be provided to the Navy to enable such detailed analyses. Per the SOW, the data obtained in this study are meant to contribute to a growing baseline of information on the distribution, occurrence, and behavior of MM/ST near Navy training events in the HRC per the HRC marine species monitoring plan (DoN 2008) and as revised in the Pacific Fleet Annual Monitoring Report (DoN 2009).

## SECTION 5 RECOMMENDATIONS

In light of the issues summarized in this report, the following recommendations are offered:

- (1) Promote development of baseline behavior and density database for more abundant species (e.g., humpback whales, spinner dolphins). Discerning effects of MFAS or any other training event-related stimulus requires comparisons with baseline behavior and densities particularly for the more abundant species where sufficient statistical power can be more readily obtained. For the HRC, the more abundant species include the seasonally present humpbacks and the spinner dolphins that are present year-round (Moblely 2004). It is recommended that the Navy consider promoting the development of these databases to facilitate such comparisons.
- (2) Consider limiting sea turtles as target species for coastal surveys only since they can only be reliably detected along coastlines with primarily sandy bottoms. Sea turtles are rarely observed during open ocean surveys.
- (3) Consider revising goal of detecting “presence/absence” to focus primarily on aggregate indices such as sighting rates (e.g., sightings/km) of highly abundant species (e.g., humpback whales) or combined sightings of remaining species (e.g., odontocetes). For reasons noted previously, applying a presence/absence criterion on a species by species basis, except for the most abundant species, is not a defensible approach.



- (4) Consider revising goal of detecting “redistribution” to focus similarly on more abundant species (e.g., humpbacks) where changes in distribution are more readily discernible.
- (5) Consider briefing Range Control officers concerning the mission of the marine mammal monitoring team. The Range Control interventions during this event were more disruptive of the marine mammal monitoring effort than occurred in the past (**Table 6**). It is likely that the level of disruption could be reduced by briefing those involved in directing range activities as to the mission and protocols involved in the monitoring effort.

## SECTION 6 ACKNOWLEDGEMENTS

We are grateful to Navy personnel from U.S. Pacific Fleet Environmental (NoiCE1) and Naval Facilities Engineering Command Pacific EV24 (NAVFAC PAC) for their support, coordination, and facilitation in the implementation of these surveys. Many thanks to my fellow observer, Lenisa Blair and to our pilot team consisting of Matt Dornan, Jeff Kinyon, Nakana Rivera, and John Sharkey. All observations were made in accordance with NOAA permit no. 14451 issued to Joseph R. Mobley, Jr.

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**APPENDIX A**  
**Summary of Sightings with Positions (GPS)**

Date	Time	Species*	Composition (# Indivs)	Latitude (N)		Longitude (W)	
				(degrees)	(minutes)	(degrees)	(minutes)
2/16/2011	7:40:01	MN	2	21	52.08	159	22.963
2/16/2011	7:42:01	MN	1	21	53.1	159	23.692
2/16/2011	13:17:01	MN	2	21	57.465	159	20.192
2/16/2011	13:18:01	MN	3	21	55.946	159	20.624
2/16/2011	13:20:01	MN	1	21	52.54	159	23.356
2/16/2011	13:21:01	MN	1	21	51.165	159	25.53
2/16/2011	13:23:01	MN	1	21	51.298	159	30.911
2/16/2011	13:24:01	MN	1	21	51.95	159	33.738
2/16/2011	13:25:01	MN	1	21	52.431	159	36.847
2/16/2011	14:05:01	MN	1	22	18.581	159	53.454
2/16/2011	14:12:01	MN	1	22	19.297	159	53.317
2/16/2011	16:13:01	MN	2	22	15.213	159	25.088
2/16/2011	16:14:10	MN	3	22	14.382	159	22.497
2/16/2011	16:14:31	MN	2	22	14.07	159	21.772
2/17/2011	7:43:58	MN	2	21	56.83	159	19.079
2/17/2011	7:49:58	MN	3	21	50.643	159	26.704
2/17/2011	8:10:58	MN	1	22	24.634	159	52.77
2/17/2011	11:37:58	MN	1	22	15.48	159	43.551
2/17/2011	11:41:58	MN	2	22	14.42	159	34.547
2/17/2011	11:44:58	MN	1	22	15.571	159	26.484
2/17/2011	11:45:58	MN	1	22	15.166	159	23.908
2/17/2011	11:48:58	MN	1	22	11.931	159	17.959
2/17/2011	11:51:58	MN	1	22	6.182	159	17.049
2/17/2011	13:38:58	MN	1	21	51.787	159	31.269
2/17/2011	16:33:58	MN	2	22	14.447	159	20.262
2/17/2011	16:39:58	MN	1	22	4.352	159	17.363
2/18/2011	9:58:02	MN	4	21	54.874	159	21.214
2/18/2011	9:59:02	MN	1	21	53.479	159	22.798
2/18/2011	10:07:02	MN	2	21	53.324	159	37.495
2/18/2011	10:12:02	MN	2	21	56.602	159	47.303

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Date	Time	Species*	Composition (# Indivs)	Latitude (N)		Longitude (W)	
				(degrees)	(minutes)	(degrees)	(minutes)
2/18/2011	10:22:02	MN	2	22	17.158	159	52.081
2/18/2011	13:13:59	MN	2	22	42.253	160	5.611
2/19/2011	7:49:58	MN	1	22	1.902	159	18.875
2/19/2011	7:52:58	MN	1	22	8.441	159	17.2
2/19/2011	7:53:58	MN	2	22	10.628	159	17.539
2/19/2011	7:54:58	MN	1	22	12.376	159	18.921
2/19/2011	7:55:58	MN	1	22	13.86	159	20.829
2/19/2011	7:56:58	MN	2	22	15.922	159	21.968
2/19/2011	8:06:58	GM	4	22	19.662	159	23.906
2/19/2011	9:49:58	MN	1	22	17.086	159	34.371
2/19/2011	10:45:58	MN	4	22	19.789	159	32.044
2/19/2011	10:55:58	MN	4	22	20.138	159	31.405
2/19/2011	10:56:03	GM	10	22	20.142	159	31.577
2/19/2011	13:24:58	MN	3	22	7.598	159	17.097
2/19/2011	13:39:02	GM	18	22	20.67	159	22.262
2/19/2011	13:42:02	UD	3	22	21.979	159	23.34
2/19/2011	14:20:02	SL	35	22	12.839	159	39.71
2/19/2011	15:28:02	GM	4	22	17.143	159	25.713
2/19/2011	15:35:01	UD	3	22	19.389	159	21.706
2/24/2011	8:46:00	MN	2	22	1.013	159	18.517
2/24/2011	8:47:00	MN	2	22	3.12	159	18.65
2/24/2011	8:51:00	MN	2	22	10.723	159	17.906
2/24/2011	8:53:00	MN	2	22	13.386	159	20.45
2/24/2011	8:53:30	MN	3	22	13.848	159	21.282
2/24/2011	9:02:00	MN	3	22	12.004	159	38.393
2/24/2011	9:05:00	MN	1	22	8.442	159	44.295
2/24/2011	9:08:00	MN	1	22	3.382	159	47.868
2/24/2011	9:15:00	MN	2	21	59.758	159	58.163
2/24/2011	9:19:00	MN	1	22	1.833	160	5.216
2/24/2011	9:26:00	MN	3	21	57.628	160	8.499
2/24/2011	9:29:00	MN	1	21	54.438	160	13.511
2/24/2011	9:30:00	MN	2	21	53.035	160	14.993
2/24/2011	9:30:30	MN	1	21	52.094	160	15.312

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				(degrees)	(minutes)	(degrees)	(minutes)
2/24/2011	9:32:00	MN	2	21	49.113	160	15.361
2/24/2011	9:32:30	MN	1	21	48.154	160	15.036
2/24/2011	9:33:00	MN	1	21	47.234	160	14.615
2/24/2011	9:35:00	MN	1	21	46.403	160	11.755
2/24/2011	9:36:00	MN	2	21	47.923	160	11.448
2/24/2011	9:36:30	SL	110	21	48.677	160	10.998
2/24/2011	9:45:00	MN	1	21	51.83	160	7.669
2/24/2011	9:45:30	MN	1	21	52.028	160	6.692
2/24/2011	9:47:00	MN	2	21	53.39	160	4.194
2/24/2011	9:50:00	MN	3	21	57.984	160	3.5
2/24/2011	9:53:00	MN	1	22	0.244	160	6.052
2/24/2011	9:58:00	MN	1	21	54.003	160	13.396
2/24/2011	9:59:00	MN	1	21	52.588	160	14.77
2/24/2011	10:00:00	MN	1	21	50.559	160	15.036
2/24/2011	10:16:00	MN	1	21	58.839	160	1.995
2/24/2011	10:29:00	CM	1	21	55.28	159	38.745
2/24/2011	10:29:10	CM	1	21	55.039	159	38.551
2/24/2011	10:34:00	CM	5	21	52.887	159	32.575
2/24/2011	10:34:30	SL	12	21	52.74	159	31.64
2/24/2011	10:55:00	CM	1	22	10.463	159	18.378
2/24/2011	10:58:00	MN	2	22	13.514	159	22.226
2/24/2011	11:00:00	CM	1	22	13.83	159	26.023
2/24/2011	11:06:00	MN	4	22	12.475	159	37.794
2/24/2011	11:20:00	CM	4	21	54.854	159	38.421
2/24/2011	12:26:02	UW	3	21	44.725	158	55.448
2/24/2011	12:31:02	PM	3	21	40.113	158	45.01
2/26/2011	8:35:30	MN	4	21	56.244	159	11.143
2/26/2011	8:39:30	MN	2	21	56.923	159	15.397
2/26/2011	8:45:30	UD	20	22	5.442	159	17.363
2/26/2011	8:45:33	MN	2	22	5.372	159	17.306
2/26/2011	8:54:09	MN	2	22	6.446	159	17.068
2/26/2011	8:54:36	MN	2	22	7.355	159	17.124
2/26/2011	8:55:06	MN	2	22	8.344	159	17.139

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Date	Time	Species*	Composition (# Indivs)	Latitude (N)		Longitude (W)	
				(degrees)	(minutes)	(degrees)	(minutes)
2/26/2011	8:56:03	CM	1	22	9.934	159	17.991
2/26/2011	8:56:18	CM	2	22	10.354	159	18.266
2/26/2011	8:56:36	CM	3	22	10.922	159	18.481
2/26/2011	8:57:18	CM	1	22	11.939	159	19.333
2/26/2011	8:57:21	CM	2	22	11.998	159	19.415
2/26/2011	8:57:39	CM	2	22	12.448	159	19.818
2/26/2011	8:57:54	CM	3	22	12.802	159	20.172
2/26/2011	8:58:57	CM	1	22	13.417	159	22.265
2/26/2011	8:59:18	CM	1	22	13.729	159	22.933
2/26/2011	8:59:54	MN	2	22	14.25	159	24.096
2/26/2011	9:02:03	CM	2	22	14.124	159	28.504
2/26/2011	9:03:45	CM	1	22	13.161	159	31.217
2/26/2011	9:07:12	UD	3	22	12.282	159	37.36
2/26/2011	9:10:03	MN	2	22	12.073	159	37.612
2/26/2011	9:12:09	UD	7	22	10.324	159	41.065
2/26/2011	9:12:39	CM	1	22	10.088	159	41.991
2/26/2011	9:13:15	CM	1	22	9.647	159	43.01
2/26/2011	9:13:49	CM	1	22	9.199	159	43.926
2/26/2011	9:17:42	MN	1	22	3.89	159	48.164
2/26/2011	9:18:27	MN	1	22	3.346	159	49.591
2/26/2011	9:25:42	MN	2	22	0.289	160	3.166
2/26/2011	9:26:09	SL	175	22	0.564	160	4.029
2/26/2011	9:26:12	MN	2	22	0.588	160	4.125
2/26/2011	9:32:36	CM	1	21	59.774	160	7.022
2/26/2011	9:34:57	SL	40	21	56.751	160	9.656
2/26/2011	9:39:06	SL	50	21	53.215	160	14.078
2/26/2011	9:39:45	MN	2	21	52.138	160	14.486
2/26/2011	9:40:48	MN	2	21	50.443	160	15.213
2/26/2011	9:41:57	MN	2	21	48.444	160	14.921
2/26/2011	9:43:27	MN	2	21	47.935	160	14.891
2/26/2011	9:43:57	MN	2	21	47.156	160	14.316
2/26/2011	9:44:24	MN	2	21	46.796	160	13.59
2/26/2011	9:46:06	MN	1	21	47.848	160	11.365



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Date	Time	Species*	Composition (# Indivs)	Latitude (N)		Longitude (W)	
				(degrees)	(minutes)	(degrees)	(minutes)
2/26/2011	9:49:24	MN	2	21	52.085	160	7.002
2/26/2011	9:50:21	MN	2	21	50.533	160	6.279
2/26/2011	9:52:15	MN	1	21	52.897	160	4.956
2/26/2011	9:53:24	MN	1	21	54.426	160	3.947
2/26/2011	9:54:45	MN	1	21	56.874	160	3.812
2/26/2011	9:55:21	MN	3	21	57.929	160	3.353
2/26/2011	9:56:57	MN	2	22	0.338	160	3.471
2/26/2011	9:57:27	MN	1	22	0.736	160	4.435
2/26/2011	10:02:45	UD	11	22	3.02	159	58.193
2/26/2011	10:11:51	MN	2	22	1.034	159	48.121
2/26/2011	10:12:48	MN	2	21	59.735	159	47.343
2/26/2011	10:17:42	SL	85	21	57.625	159	43.858
2/26/2011	10:23:39	MN	1	21	54.49	159	38.394
2/26/2011	10:34:03	MN	1	21	56.906	159	20.155
2/26/2011	12:07:49	MN	1	21	58.513	159	14.067
2/26/2011	12:09:07	MN	1	21	58.033	159	11.401
2/26/2011	12:15:22	PM	6	21	53.354	159	0.407
2/26/2011	12:24:22	PM	2	21	50.804	158	54.934
2/26/2011	12:26:04	PM	3	21	51.683	158	54.636
2/28/2011	8:05:06	CM	2	21	19.901	158	7.999
2/28/2011	8:07:39	MN	3	21	16.405	158	4.48
2/28/2011	8:09:27	CM	2	21	18.017	158	7.309
2/28/2011	8:15:03	MN	2	21	18.05	158	0.434
2/28/2011	8:16:00	CM	1	21	18.191	157	58.495
2/28/2011	8:16:21	CM	1	21	18.064	157	57.783
2/28/2011	8:17:24	CM	3	21	17.728	157	55.653
2/28/2011	8:18:12	CM	3	21	17.669	157	54.005
2/28/2011	8:22:09	CM	1	21	15.326	157	46.958
2/28/2011	8:23:12	CM	1	21	16.077	157	44.966
2/28/2011	8:28:48	MN	2	21	19.185	157	36.516
2/28/2011	8:35:15	MN	2	21	14.914	157	23.331
2/28/2011	8:36:30	MN	1	21	14.077	157	20.827
2/28/2011	8:39:30	MN	2	21	11.886	157	15.352

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Date	Time	Species*	Composition (# Indivs)	Latitude (N)		Longitude (W)	
				(degrees)	(minutes)	(degrees)	(minutes)
2/28/2011	8:48:21	MN	2	21	4.862	157	12.381
2/28/2011	8:49:48	MN	2	21	4.923	157	9.456
2/28/2011	8:51:36	MN	2	21	5.265	157	5.889
2/28/2011	8:52:15	CM	6	21	5.059	157	4.58
2/28/2011	8:52:36	CM	1	21	5.024	157	3.882
2/28/2011	8:53:00	CM	4	21	4.825	157	3.106
2/28/2011	8:53:21	CM	1	21	4.616	157	2.447
2/28/2011	8:53:48	MN	1	21	4.339	157	1.627
2/28/2011	8:55:21	MN	1	21	3.573	156	58.743
2/28/2011	8:55:39	CM	2	21	3.421	156	58.185
2/28/2011	8:56:03	CM	7	21	3.226	156	57.442
2/28/2011	8:57:27	CM	3	21	2.562	156	54.783
2/28/2011	8:58:48	MN	2	21	2.114	156	52.145
2/28/2011	8:59:36	MN	6	21	2.402	156	50.581
2/28/2011	9:01:42	CM	1	21	3.89	156	46.923
2/28/2011	9:02:18	CM	1	21	4.659	156	45.995
2/28/2011	9:02:51	MN	1	21	5.318	156	45.133
2/28/2011	9:03:27	CM	1	21	6.103	156	44.25
2/28/2011	9:04:24	MN	1	21	7.518	156	43.124
2/28/2011	9:08:00	MN	2	21	6.542	156	38.496
2/28/2011	9:10:06	MN	1	21	3.415	156	36.113
2/28/2011	9:10:24	MN	2	21	2.975	156	35.746
2/28/2011	9:12:09	CM	1	21	1.815	156	38.663
2/28/2011	9:13:39	CM	1	20	59.702	156	40.796
2/28/2011	9:18:54	MN	1	20	50.54	156	40.327
2/28/2011	9:19:51	MN	1	20	49.256	156	38.93
2/28/2011	9:22:36	MN	3	20	46.641	156	34.143
2/28/2011	9:24:48	MN	2	20	47.186	156	30.409
2/28/2011	9:28:33	MN	1	20	41.718	156	27.434
2/28/2011	9:28:45	MN	2	20	41.335	156	27.44
2/28/2011	9:30:45	MN	2	20	37.588	156	27.642
2/28/2011	9:32:04	MN	1	20	37.588	156	30.196
2/28/2011	9:32:31	MN	2	20	38.272	156	30.49

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				(degrees)	(minutes)	(degrees)	(minutes)
2/28/2011	9:32:52	MN	3	20	38.477	156	29.947
2/28/2011	9:36:10	MN	2	20	35.204	156	25.402
2/28/2011	9:47:27	UD	3	20	38.469	156	4.004
2/28/2011	9:54:06	MN	2	20	39.13	156	0.047
2/28/2011	10:10:39	MN	2	20	7.56	155	54.233
2/28/2011	10:14:09	MN	2	20	1.689	155	50.386
2/28/2011	10:14:12	MN	2	20	1.594	155	50.352
2/28/2011	10:15:54	MN	1	19	58.533	155	51.163
2/28/2011	10:19:15	MN	2	19	53.327	155	55.081
2/28/2011	10:19:18	MN	2	19	53.254	155	55.147
2/28/2011	10:21:33	MN	2	19	51.045	155	58.683
2/28/2011	10:25:48	SL	7	19	45.036	156	3.697
2/28/2011	12:20:03	SL	35	19	44.5	156	3.256
2/28/2011	13:36:01	MN	3	19	44.829	156	3.676
2/28/2011	13:39:10	MN	1	19	50.166	155	59.544
2/28/2011	13:39:13	MN	1	19	50.23	155	59.47
2/28/2011	13:44:04	MN	3	19	56.16	155	53.455
2/28/2011	13:46:22	MN	2	19	59.235	155	50.275
2/28/2011	13:51:16	MN	2	20	6.863	155	53.556
2/28/2011	13:53:13	MN	1	20	10.023	155	54.546
2/28/2011	13:53:16	MN	1	20	10.106	155	54.574
2/28/2011	13:56:16	MN	2	20	15.109	155	53.569
2/28/2011	13:57:58	MN	1	20	17.109	155	53.258
2/28/2011	14:00:31	MN	2	20	19.44	155	57.037
2/28/2011	14:19:16	MN	1	20	34.925	156	31.612
2/28/2011	14:19:58	MN	1	20	35.62	156	32.737
2/28/2011	14:20:40	MN	2	20	36.39	156	33.761
2/28/2011	14:21:13	MN	1	20	36.517	156	34.821
2/28/2011	14:21:49	SL	50	20	36.225	156	35.979
2/28/2011	14:30:40	MN	1	20	29.972	156	38.736
2/28/2011	14:31:07	MN	1	20	30.088	156	37.758
2/28/2011	14:33:13	MN	1	20	30.432	156	33.237
2/28/2011	14:36:43	MN	1	20	35.468	156	32.532

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				(degrees)	(minutes)	(degrees)	(minutes)
2/28/2011	14:57:43	MN	2	20	55.576	157	2.407
2/28/2011	14:58:16	MN	2	20	55.981	157	1.381
2/28/2011	14:58:31	MN	2	20	56.077	157	0.875
2/28/2011	15:03:49	MN	1	20	53.178	156	50.729
2/28/2011	15:05:55	MN	1	20	50.126	156	47.966
2/28/2011	15:09:58	MN	2	20	44.175	156	52.42
2/28/2011	15:10:22	MN	2	20	43.956	156	53.218
2/28/2011	15:11:34	MN	1	20	43.382	156	55.515
3/5/2011	7:42:24	CM	2	21	15.356	157	46.116
3/5/2011	7:43:03	CM	1	21	15.853	157	44.702
3/5/2011	7:56:06	MN	1	21	8.137	157	20.939
3/5/2011	8:01:27	CM	1	21	4.906	157	10.947
3/5/2011	8:02:21	MN	1	21	4.917	157	9.016
3/5/2011	8:02:48	MN	1	21	4.924	157	8.061
3/5/2011	8:04:15	CM	1	21	4.954	157	5.022
3/5/2011	8:07:33	MN	1	21	3.437	156	58.266
3/5/2011	8:09:03	MN	2	21	3.129	156	55.253
3/5/2011	8:12:27	MN	2	21	2.199	156	53.792
3/5/2011	8:13:54	CM	5	21	2.588	156	50.773
3/5/2011	8:14:24	CM	3	21	2.887	156	49.734
3/5/2011	8:18:03	MN	2	21	7.414	156	43.317
3/5/2011	8:20:15	MN	1	21	10.389	156	43.979
3/5/2011	8:21:24	MN	3	21	11.408	156	43.146
3/5/2011	8:25:48	MN	1	21	3.661	156	39.203
3/5/2011	8:29:33	MN	1	20	57.063	156	41.876
3/5/2011	8:32:57	MN	1	20	51.118	156	40.385
3/5/2011	8:34:06	MN	1	20	49.498	156	38.771
3/5/2011	8:34:21	MN	1	20	49.167	156	38.417
3/5/2011	8:34:51	MN	1	20	48.473	156	37.75
3/5/2011	8:35:18	GM	2	20	48.067	156	36.969
3/5/2011	8:38:24	MN	1	20	46.421	156	31.101
3/5/2011	8:39:03	MN	1	20	47.263	156	30.002
3/5/2011	8:41:30	MN	1	20	43.571	156	27.655

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				(degrees)	(minutes)	(degrees)	(minutes)
3/5/2011	8:43:21	MN	1	20	40.042	156	27.154
3/5/2011	8:51:51	MN	1	20	35.764	156	14.992
3/5/2011	9:02:00	MN	1	20	44.641	155	58.463
3/5/2011	9:18:24	MN	1	20	18.172	155	52.336
3/5/2011	9:27:33	TT	5	20	6.505	155	53.524
3/5/2011	9:28:12	MN	1	20	5.465	155	52.903
3/5/2011	9:33:27	MN	1	19	57.061	155	52.444
3/5/2011	9:35:39	MN	1	19	53.626	155	54.813
3/5/2011	9:40:15	MN	1	19	48.238	156	1.383
3/5/2011	12:01:00	MN	3	19	43.275	156	3.551
3/5/2011	12:32:12	MN	3	20	35.009	156	32.045
3/5/2011	12:32:42	MN	1	20	35.815	156	32.816
3/5/2011	12:45:39	MN	1	20	36.81	156	41.267
3/5/2011	12:52:39	MN	1	20	48.445	156	47.833
3/5/2011	12:52:51	MN	3	20	48.881	156	47.826
3/5/2011	12:53:39	MN	2	20	50.451	156	48.492
3/5/2011	12:54:54	MN	1	20	52.677	156	50.146
3/5/2011	12:55:18	MN	2	20	53.256	156	50.81
3/5/2011	12:55:51	MN	1	20	53.982	156	51.794
3/5/2011	13:14:00	SL	50	20	44.467	156	52.712
3/5/2011	13:18:33	MN	1	20	49.049	156	47.996
3/5/2011	13:18:36	MN	2	20	49.157	156	48.007
3/5/2011	13:18:39	MN	1	20	49.265	156	48.023
3/5/2011	13:20:33	MN	1	20	52.851	156	50.494
3/5/2011	13:20:48	MN	1	20	53.256	156	50.928
3/5/2011	13:21:36	MN	1	20	54.495	156	52.341
3/5/2011	13:21:39	MN	2	20	54.564	156	52.436
3/5/2011	13:22:06	MN	1	20	55.156	156	53.315
3/5/2011	13:22:54	MN	1	20	55.755	156	55.113
3/5/2011	13:23:27	MN	1	20	56.035	156	56.412
3/5/2011	13:24:57	MN	1	20	56.449	157	0.002
3/5/2011	13:29:00	MN	1	20	57.883	157	9.703
3/5/2011	13:34:51	MN	1	21	3.071	157	23.07

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				(degrees)	(minutes)	(degrees)	(minutes)
3/5/2011	13:35:18	MN	1	21	3.372	157	24.142
3/5/2011	13:35:42	MN	1	21	3.605	157	25.089
3/5/2011	13:36:24	MN	1	21	3.98	157	26.805
3/5/2011	13:38:18	MN	3	21	5.039	157	31.433

*Species Code	Species (Latin name)
CM	green sea turtle ( <i>Chelonia mydas</i> )
GM	short-finned pilot whale ( <i>Globicephala macrorhynchus</i> )
MN	humpback whale ( <i>Megaptera novaeangliae</i> )
PM	sperm whale ( <i>Physeter macrocephalus</i> )
SL	spinner dolphin ( <i>Stenella longirostris</i> )
TT	bottlenose dolphin ( <i>Tursiops truncatus</i> )
UD	unidentified dolphin spp.
UW	unidentified whale spp.
UT	unidentified sea turtle spp.

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**APPENDIX B**  
**Summaries of Behavior**

Date	Time	Grp#	Focal Follow	Grp Size (calf)	Species	Behavior	Animal Bearing (degrees)	Comments
2/16/11	7:40	1	No	2	MN	slow swim (sl sw)	270	
2/16/11	7:42	2	No	1	MN	sl sw	270	
2/16/11	13:17	3	No	2	MN	sl sw	N/A	
2/16/11	13:18	4	No	3	MN	sl sw	90	
2/16/11	13:20	5	No	1	MN	sl sw	110	
2/16/11	13:21	6	No	1	MN	sl sw	270	
2/16/11	13:23	7	No	1	MN	sl sw	90	
2/16/11	13:24	8	No	1	MN	sl sw	110	
2/16/11	13:25	9	No	1	MN	sl sw	200	
2/16/11	14:05	10	No	1	MN	sl sw	N/A	told to return to DDG; DDG confirmed same sighting
2/16/11	14:12	11	No	1	MN	sl sw	N/A	(could not video)
2/16/11	16:13	12	No	2	MN	sl sw	110	
2/16/11	16:14:10	13	No	3	MN	sl sw	300	
2/16/11	16:14:30	14	No	2	MN	sl sw	90	
2/17/11	7:44	1	No	2	MN	sl sw	90	
2/17/11	7:50	2	No	3	MN	milling; sl sw	N/A	
2/17/11	8:11	3	No	1	MN	sl sw	N/A	near DDG; directed away from sighting by Bravo
2/17/11	11:38	4	No	1	MN	breach	N/A	
2/17/11	11:42	5	No	2	MN	sl sw	270	

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Date	Time	Grp#	Focal Follow	Grp Size (calf)	Species	Behavior	Animal Bearing (degrees)	Comments
2/17/11	11:45	6	No	1	MN	splash	270	
2/17/11	11:46	7	No	1	MN	blow	70	
2/17/11	11:49	8	No	1	MN	sl sw	90	
2/17/11	11:52	9	No	1	MN	sl sw	180	
2/17/11	13:39	10	No	1	MN	sl sw	360	
2/17/11	16:34	11	No	2	MN	sl sw	N/A	only puka
2/17/11	16:40	12	No	1	MN	sl sw	180	body at surface
2/18/11	9:58	1	No	4	MN	body	270	
2/18/11	9:59	2	No	1	MN	splash	90	
2/18/11	10:07	3	No	2	MN	body	270	
2/18/11	10:12	4	No	2	MN	milling	milling	
2/18/11	10:22	5	Yes	2	MN	sl sw	180	within 2–4 km DDG; likely same pod spotted by DDG per TJ
2/18/11	13:15	6	No	2	MN	splash	150	Focal follow pod; video
2/19/11	7:50	1	No	1	MN	blow only	N/A	Cascadia tagging support
2/19/11	7:53	2	No	1	MN	sl sw	90	
2/19/11	7:54	3	No	2	MN	sl sw	180	
2/19/11	7:55	4	No	1	MN	sl sw	90	
2/19/11	7:56	5	No	1	MN	underwater (UW)	300	
2/19/11	7:57	6	No	2	MN	sl sw	270	
2/19/11	7:58	7	No	4	UD	sl sw	270	
2/19/11	8:07	8	No	4	GM	sl sw	270	same group that Cascadia tagged yesterday
2/19/11	9:50	9	No	1	MN	sl sw	270	



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Date	Time	Grp#	Focal Follow	Grp Size (calf)	Species	Behavior	Animal Bearing (degrees)	Comments
2/19/11	10:46	10	No	4 (1)	MN	splash; tail-lob, then milling	270	
2/19/11	10:56	11	No	4	MN	milling	N/A	Nakana via window
2/19/11	10:56		No	10 (1)	GM	milling	N/A	GM group with 4 humpbacks
2/19/11	13:25	12	No	3	MN	sl sw	90	CC&E
2/19/11	13:39	13	No	18	GM	milling	N/A	
2/19/11	13:42	14	No	3	UD	fast swim	270	
2/19/11	14:20	15	No	35	SL	fast swim	70	
2/19/11	15:28	16	No	4	GM	milling	90	
2/19/11	15:35	17	No	3	UD	milling	N/A	likely pilot whale
2/24/11	8:46	1	No	2	MN	sl sw	90	
2/24/11	8:47	2	No	2	MN	sl sw	90	
2/24/11	8:51	3	No	2	MN	sl sw	45	
2/24/11	8:53	4	No	2	MN	sl sw	90	
2/24/11	8:53:30	5	No	3	MN	sl sw	290	
2/24/11	9:02	6	No	3	MN	sl sw	90	
2/24/11	9:05	7	No	1	MN	sl sw	270	
2/24/11	9:08	8	No	1	MN	sl sw	180	
2/24/11	9:15	9	No	2	MN	milling; surface active, pec slap	N/A	
2/24/11	9:19	10	No	1	MN	milling	N/A	inside Lehua Rock
2/24/11	9:26	11	No	3	MN	sl sw	300	
2/24/11	9:29	12	No	1	MN	milling; breach	N/A	
2/24/11	9:30	13	No	2	MN	sl sw	N/A	

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Date	Time	Grp#	Focal Follow	Grp Size (calf)	Species	Behavior	Animal Bearing (degrees)	Comments
2/24/11	9:30:30	14	No	1	MN	sl sw	360	
2/24/11	9:32	15	No	2	MN	sl sw	60	
2/24/11	9:32:30	16	No	1	MN	sl sw	360	
2/24/11	9:33	17	No	1	MN	sl sw	130	
2/24/11	9:35	18	No	1	MN	UW	350	
2/24/11	9:36	19	No	2 (1)	MN	UW	360	
2/24/11	9:36:30	20	No	110	SL	milling; sl travel; spinning	350	
2/24/11	9:45	21	No	1	MN	blow	180	
2/24/11	9:45:30	22	No	1	MN	breach	N/A	
2/24/11	9:47	23	No	2	MN	sl sw	10	
2/24/11	9:50	24	No	3	MN	milling; surface active	N/A	
2/24/11	9:53	25	No	1	MN	sl sw	40	
2/24/11	9:58	26	No	1	MN	breach	N/A	
2/24/11	9:59	27	No	1	MN	tail lob	N/A	
2/24/11	10:00	28	No	1	MN	sl sw	90	
2/24/11	10:04	29	No	1	MN	sl sw	360	
2/24/11	10:16	30	No	1	MN	breach	10	
2/24/11	10:29	31	No	1	CM	sl sw	N/A	
2/24/11	10:29:10	32	No	1	CM	sl sw	N/A	
2/24/11	10:34	33	No	5	CM	sl sw	N/A	
2/24/11	10:34:30	34	No	12	SL	milling; rest	N/A	tight aggregation inside small bay
2/24/11	10:55	35	No	1	CM	sl sw	N/A	

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2/24/11	10:58	36	No	2	MN	milling; sl sw	N/A	
2/24/11	11:00	37	No	1	CM	sl sw	N/A	
2/24/11	11:06	38	No	4	MN	sl sw	190	
2/24/11	11:20	39	No	4	CM	sl sw	N/A	
2/24/11	12:26	40	No	3	UW	dove	N/A	
2/24/11	12:31	41	No	3	PM	breach; blows synchronous	N/A	photos
2/26/11	8:35:31	1	No	4	MN	surface active	N/A	
2/26/11	8:39:29	2	No	2	MN	sl sw	90	
2/26/11	8:45:30	3	No	20	UD	uw swim; tightly coalesced	N/A	
2/26/11	8:45:31	4	No	2	MN	sl sw	N/A	
2/26/11	8:54:08	5	No	2 (1)	MN	sl sw	180	
2/26/11	8:54:35	6	No	2	MN	sl sw	350	
2/26/11	8:55:07	7	No	2	MN	sl sw	350	
2/26/11	8:56:04	8	No	1	CM	sl sw	N/A	
2/26/11	8:56:19	9	No	2	CM	sl sw	N/A	
2/26/11	8:56:35	10	No	3	CM	sl sw	N/A	
2/26/11	8:57:17	11	No	1	CM	sl sw	N/A	
2/26/11	8:57:20	12	No	2	CM	sl sw	N/A	
2/26/11	8:57:40	13	No	2	CM	sl sw	N/A	
2/26/11	8:57:53	14	No	3	CM	sl sw	N/A	
2/26/11	8:58:56	15	No	1	CM	sl sw	N/A	
2/26/11	8:59:18	16	No	1	CM	sl sw	N/A	

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2/26/11	8:59:55	17	No	2	MN	sl sw	N/A	
2/26/11	9:02:03	18	No	2	CM	sl sw	N/A	
2/26/11	9:03:44	19	No	1	CM	sl sw	N/A	
2/26/11	9:07:12	20	No	3	UD	no resight	N/A	circling limited due to Na Pali
2/26/11	9:10:02	21	No	2 (1)	MN	sl sw	N/A	
2/26/11	9:12:10	22	No	7	UD	sl sw	N/A	
2/26/11	9:12:40	23	No	1	CM	sl sw	N/A	
2/26/11	9:13:15	24	No	1	CM	sl sw	N/A	
2/26/11	9:13:49	25	No	1	CM	sl sw	N/A	
2/26/11	9:17:42	26	No	1	MN	milling; surface active	N/A	
2/26/11	9:18:14	27	No	1	MN	sl sw	200	
2/26/11	9:18:28	28	No	1	MN	sl sw	270	
2/26/11	9:25:41	29	No	2	MN	sl sw	350	
2/26/11	9:26:11	30	No	175	SL	sl sw	360	clumps fairly wide apart
2/26/11	9:26:12	31	No	2	MN	sl sw	350	
2/26/11	9:32:36	32	No	1	CM	sl sw	100	
2/26/11	9:34:58	33	No	40 (1)	SL	sl sw	N/A	uw tightly aggregated
2/26/11	9:39:05	34	No	50	SL	milling	N/A	
2/26/11	9:39:44	35	No	2	MN	milling	N/A	
2/26/11	9:40:48	36	No	2 (1)	MN	sl sw	180	
2/26/11	9:41:56	37	No	2	MN	stationary	N/A	sitting on bottom
2/26/11	9:43:28	38	No	2 (1)	MN	sl sw	350	

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2/26/11	9:43:58	39	No	2	MN	sitting on bottom	N/A	
2/26/11	9:44:23	40	No	2	MN	sitting on bottom	N/A	
2/26/11	9:46:07	41	No	1 (1)	MN	milling	N/A	lone calf
2/26/11	9:49:25	42	No	2	MN	sl sw	270	
2/26/11	9:50:20	43	No	2	MN	sl sw	270	
2/26/11	9:52:14	44	No	1 (1)	MN	stationary	N/A	lone calf
2/26/11	9:53:25	45	No	1	MN	sl sw	350	
2/26/11	9:54:46	46	No	1	MN	sl sw	350	
2/26/11	9:55:20	47	No	3	MN	UW swim	350	
2/26/11	9:56:56	48	No	2	MN	sl sw	90	
2/26/11	9:57:28	49	No	1	MN	sl sw	270	
2/26/11	10:02:45	50	No	11	UD	sl sw	180	spread out
2/26/11	10:11:52	51	No	2	MN	sl sw	360	
2/26/11	10:12:48	52	No	2	MN	sl sw	360	
2/26/11	10:17:43	53	No	85	SL	milling; dispersed spinning	N/A	
2/26/11	10:23:39	54	No	1	MN	sl sw	270	
2/26/11	10:34:02	55	No	1	MN	sl sw	90	sl sw off airport
2/26/11	12:07:49	56	No	1	MN	sl sw	90	
2/26/11	12:09:07	57	No	1	MN	sl sw	270	
2/26/11	12:15:23	58	No	6 (1)	PM	sl sw	90	sperm whales!
2/26/11	12:24:22	59	No	2 (1)	PM	surface swim	90	
2/26/11	12:26:05	60	No	3	PM	surface swim	90	whale poop!

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2/28/11	8:05:06	1	No	2	CM	sl sw	N/A	
2/28/11	8:07:40	2	No	3	MN	sl sw	270	
2/28/11	8:09:26	3	No	2	CM	sl sw	N/A	
2/28/11	8:15:03	4	No	2	MN	sl sw	270	
2/28/11	8:15:59	5	No	1	CM	sl sw	90	
2/28/11	8:16:20	6	No	1	CM	sl sw	90	
2/28/11	8:16:58	7	No	3	CM	sl sw	N/A	
2/28/11	8:17:25	8	No	3	CM	sl sw	N/A	
2/28/11	8:18:12	9	No	3	CM	sl sw	N/A	
2/28/11	8:22:10	10	No	1	CM	sl sw	N/A	
2/28/11	8:23:13	11	No	1	CM	sl sw	N/A	
2/28/11	8:28:48	12	No	2	MN	sl sw	300	
2/28/11	8:35:15	13	No	2	MN	sl sw	360	
2/28/11	8:36:29	14	No	1	MN	sl sw	360	
2/28/11	8:39:31	15	No	2	MN	1 breached	270	
2/28/11	8:48:20	16	No	2	MN	UW	270	
2/28/11	8:49:47	17	No	2	MN	sl sw	270	
2/28/11	8:51:37	18	No	2	MN	blow	270	
2/28/11	8:52:15	19	No	6	CM	sl sw	N/A	
2/28/11	8:52:35	20	No	1	CM	sl sw	N/A	
2/28/11	8:52:59	21	No	4	CM	sl sw	N/A	
2/28/11	8:53:20	22	No	1	CM	sl sw	N/A	
2/28/11	8:53:48	23	No	1	MN	sl sw	300	body visible uw

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Date	Time	Grp#	Focal Follow	Grp Size (calf)	Species	Behavior	Animal Bearing (degrees)	Comments
2/28/11	8:55:22	24	No	1	MN	slow dive	N/A	
2/28/11	8:55:40	25	No	2	CM	sl sw	N/A	
2/28/11	8:56:03	26	No	7	CM	sl sw	N/A	
2/28/11	8:57:28	27	No	3	CM	sl sw	N/A	
2/28/11	8:58:48	28	No	2	MN	sl sw	90	
2/28/11	8:59:36	29	No	6	MN	sl sw	90	
2/28/11	9:01:42	30	No	1	CM	sl sw	N/A	
2/28/11	9:02:18	31	No	1	CM	sl sw	N/A	
2/28/11	9:02:50	32	No	1	MN	dove	N/A	Puka
2/28/11	9:03:28	33	No	1	CM	sl sw	N/A	
2/28/11	9:04:25	34	No	1	MN	sl sw	310	
2/28/11	9:08:00	35	No	2	MN	sl sw	200	
2/28/11	9:10:06	36	No	1	MN	sl sw	N/A	
2/28/11	9:10:25	37	No	2	MN	sl sw	270	
2/28/11	9:12:08	38	No	1	CM	sl sw	N/A	
2/28/11	9:13:40	39	No	1	CM	sl sw	N/A	
2/28/11	9:18:53	40	No	1	MN	sl sw	110	
2/28/11	9:19:52	41	No	1	MN	UW	90	
2/28/11	9:22:37	42	No	3	MN	sl sw	200	
2/28/11	9:24:48	43	No	2	MN	sl sw	N/A	
2/28/11	9:28:33	44	No	1	MN	blow	180	
2/28/11	9:28:44	45	No	2	MN	sl sw	180	
2/28/11	9:30:45	46	No	2	MN	sl sw	180	

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Date	Time	Grp#	Focal Follow	Grp Size (calf)	Species	Behavior	Animal Bearing (degrees)	Comments
2/28/11	9:31:29	47	No	2	MN	blow	350	
2/28/11	9:32:04	48	No	1	MN	breach	N/A	
2/28/11	9:32:31	49	No	2	MN	sl sw	240	
2/28/11	9:32:52	50	No	3	MN	sl sw	45	
2/28/11	9:36:10	51	No	2	MN	blow; then UW	90	
2/28/11	9:47:25	52	No	3	UD	UW swim	90	
2/28/11	9:54:05	53	No	2	MN	UW swim	90	
2/28/11	10:10:40	54	No	2	MN	blow	270	
2/28/11	10:14:09	55	No	2	MN	blow	300	line abreast in groups of two
2/28/11	10:14:10	56	No	2	MN		300	
2/28/11	10:15:55	57	No	1	MN	sl sw	110	
2/28/11	10:19:15	58	No	2	MN	pec slap; side swim	350	
2/28/11	10:19:16	59	No	2	MN	sl sw	350	
2/28/11	10:21:32	60	No	2	MN	UW swim	200	
2/28/11	10:25:48	61	No	7	SL	spinning; milling	N/A	boat present
2/28/11	12:20:03	62	No	35	SL	sl sw	45	large group sighted during final approach
2/28/11	13:36:00	63	No	3 (1)	MN	sl sw	180	
2/28/11	13:39:11	64	No	1	MN	sl sw	350	
2/28/11	13:39:13	65	No	1	MN	sl sw	350	
2/28/11	13:44:05	66	No	3 (1)	MN	blow; UW swim	45	
2/28/11	13:46:22	67	No	2 (1)	MN	sl sw	45	
2/28/11	13:51:17	68	No	2	MN	sl sw	350	



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Date	Time	Grp#	Focal Follow	Grp Size (calf)	Species	Behavior	Animal Bearing (degrees)	Comments
2/28/11	13:53:13	69	No	1	MN	breach	N/A	
2/28/11	13:53:14	70	No	1	MN	sl sw	350	
2/28/11	13:56:15	71	No	2	MN	sl sw	350	
2/28/11	13:57:58	72	No	1	MN	sl sw	130	
2/28/11	14:00:30	73	No	2	MN	sl sw	130	
2/28/11	14:19:17	74	No	1	MN	breach	N/A	
2/28/11	14:19:58	75	No	1	MN	blow	N/A	
2/28/11	14:20:40	76	No	2	MN	sl sw	270	
2/28/11	14:21:13	77	No	1	MN	stationary UW	N/A	
2/28/11	14:21:48	78	No	50	SL	milling; mostly UW	N/A	
2/28/11	14:30:40	79	No	1	MN	sl sw	270	
2/28/11	14:31:08	80	No	1	MN	sl sw	90	
2/28/11	14:33:12	81	No	1	MN	sl sw	90	body
2/28/11	14:36:43	82	No	1	MN	sl sw	330	
2/28/11	14:57:43	83	No	2	MN	UW swim; splash	40	
2/28/11	14:58:16	84	No	2	MN	sl sw	120	
2/28/11	14:58:30	85	No	2	MN	sl sw	180	
2/28/11	15:03:48	86	No	1	MN	UW	270	
2/28/11	15:04:49	87	No	2	MN	blow	30	
2/28/11	15:05:55	88	No	1	MN	sl sw	90	
2/28/11	15:09:58	89	No	2	MN	sl sw	270	
2/28/11	15:10:23	90	No	2 (1)	MN	breach simultaneous	N/A	

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Date	Time	Grp#	Focal Follow	Grp Size (calf)	Species	Behavior	Animal Bearing (degrees)	Comments
2/28/11	15:11:34	91	No	1	MN	UW; slow surface	90	
3/5/11	7:42:24	1	No	2	CM	sl sw	N/A	
3/5/11	7:43:02	2	No	1	CM	sl sw	N/A	
3/5/11	7:56:07	3	No	1	MN	UW swim	90	
3/5/11	8:01:26	4	No	1	CM	sl sw	N/A	
3/5/11	8:02:22	5	No	1	MN	UW swim	N/A	
3/5/11	8:02:49	6	No	1	MN	blow; sl sw	270	
3/5/11	8:04:15	7	No	1	CM	sl sw	N/A	
3/5/11	8:07:33	8	No	1	MN	side swim; then dive	180	
3/5/11	8:09:04	9	No	2 (1)	MN	sl sw; shallow dive	110	
3/5/11	8:12:28	10	No	2	MN	breach	180	
3/5/11	8:13:54	11	No	5	CM	sl sw	N/A	
3/5/11	8:14:23	12	No	3	CM	sl sw	N/A	
3/5/11	8:18:04	13	No	2	MN	both circular swim UW	N/A	
3/5/11	8:20:16	14	No	1	MN	blow	90	
3/5/11	8:21:25	15	No	3	MN	sl sw	90	
3/5/11	8:25:49	16	No	1	MN	sl sw	90	
3/5/11	8:29:32	17	No	1	MN	blow; sl sw	180	
3/5/11	8:32:58	18	No	1	MN	diving	360	
3/5/11	8:34:07	19	No	1	MN	dove	N/A	
3/5/11	8:34:20	20	No	1	MN	dove	N/A	
3/5/11	8:34:50	21	No	1	MN	sl sw	270	

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Date	Time	Grp#	Focal Follow	Grp Size (calf)	Species	Behavior	Animal Bearing (degrees)	Comments
3/5/11	8:35:19	22	No	2	GM	sl sw	270	
3/5/11	8:38:25	23	No	1	MN	sl sw	120	
3/5/11	8:39:04	24	No	1	MN	breach	N/A	
3/5/11	8:41:31	25	No	1	MN	blow	180	
3/5/11	8:43:21	26	No	1	MN	stationary	N/A	
3/5/11	8:51:52	27	No	1	MN	blow	N/A	
3/5/11	9:02:00	28	No	1	MN	sl sw; UW	90	
3/5/11	9:18:24	29	No	1	MN	sl sw; surface	180	
3/5/11	9:27:32	30	No	5	TT	sl sw	180	
3/5/11	9:28:11	31	No	1	MN	sl sw	180	
3/5/11	9:33:28	32	No	1	MN	sl sw	180	
3/5/11	9:35:39	33	No	1	MN	sl sw	180	
3/5/11	9:40:16	34	No	1	MN	sl sw	180	
3/5/11	12:01	35	No	3	MN	breach	350	
3/5/11	12:31:59	36	No	2	MN	sl sw	90	
3/5/11	12:32:11	37	No	3	MN	UW swim	90	
3/5/11	12:32:41	38	No	1	MN	pec-slap	270	
3/5/11	12:45:38	39	No	1	MN	sl sw	350	
3/5/11	12:52:40	40	No	1	MN	UW stationary	180	
3/5/11	12:52:50	41	No	3	MN	sl sw	360	
3/5/11	12:53:40	42	No	2	MN	blow; sl sw	90	
3/5/11	12:54:55	43	No	1	MN	UW swim	270	
3/5/11	12:55:19	44	No	2 (1)	MN	sl sw	90	

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Date	Time	Grp#	Focal Follow	Grp Size (calf)	Species	Behavior	Animal Bearing (degrees)	Comments
3/5/11	12:55:52	45	No	1	MN	breach	90	
3/5/11	13:14:00	46	No	50	SL	milling	N/A	tightly coalesced group in Manele Bay
3/5/11	13:18:33	47	No	1	MN	sl sw	45	
3/5/11	13:18:36	48	No	2	MN	fast swim	90	
3/5/11	13:18:39	49	No	1	MN	UW swim	180	
3/5/11	13:20:32	50	No	1	MN	dove	N/A	
3/5/11	13:20:49	51	No	1	MN	sl sw	20	
3/5/11	13:21:35	52	No	1	MN	sl sw	45	
3/5/11	13:21:40	53	No	2	MN	sl sw	90	
3/5/11	13:22:05	54	No	1	MN	UW swim	280	
3/5/11	13:22:55	55	No	1	MN	sl sw	110	
3/5/11	13:23:28	56	No	1	MN	blow	100	
3/5/11	13:24:57	57	No	1	MN	blow	90	
3/5/11	13:29:01	58	No	1	MN	splash	90	
3/5/11	13:34:52	59	No	1	MN	blow only	N/A	
3/5/11	13:35:18	60	No	1	MN	splash	N/A	
3/5/11	13:35:43	61	No	1	MN	sl sw	90	
3/5/11	13:36:23	62	No	1	MN	sl sw	180	
3/5/11	13:38:19	63	No	3 (1)	MN	sl sw	90	

**APPENDIX C**  
**Detail of Videotaped Focal Follow**

<b>Date</b>	<b>Clock Begin</b>	<b>Elapsed Begin</b>	<b>Description</b>	<b>Lat/Lon (degrees)</b>	<b>Pod on Video (Y/N)</b>
Feb. 18	13:19	0:02	Session starts—two humpbacks sighted within 2–4 km of DDG; pod is underwater at start; good sighting conditions (Bf 3); heading 150		N
	13:21	2:06	Pod at surface; visible blow, large splash, peduncle slap by closer whale, then blow; closer animal fluke-up dive; puka visible		Y
	13:21	2:35	Further animal dove; both animals now underwater		N
	13:23	4:38	Both animals up (per audio); backs visible at elapsed time (ET) 4:41; then submerged; blow at ET 5:04, both whales visible, blow at ET 5:30; both submerged at ET 5:34		Y
	13:24	5:34	Both animals submerged, no longer visible		N
	13:26	6:46	Pukas visible (might have missed surfacing)		N
	13:30	11:03	Pilot confirms surfacing (forward of plane); not visible in frame; going in and out of clouds		N
	13:36	17:34	Observer sights pod at surface; blows visible in frame briefly; (aircraft now at 1,400 feet to avoid clouds)		Y
	13:37	17:50	Both animals submerged; no longer visible		N
	13:42	23:18	Conditions changed to Bf 4; still good visibility		N
	13:43	23:46	Pilot sights blow behind left engine; pilot reports both visible (ET 24:13); still swimming line abreast approx. 2 whale lengths apart, heading 150; pilot reports whales no longer visible (ET 25:03)		N
	13:47	28:02	Chafee visible in frame still within 2–4 km		N
	13:50	30:48	Pilot sees blow; not yet visible in frame; still up at ET 31:30;		N
13:51	32:08	Breaking off episode; animals not visible		N	

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