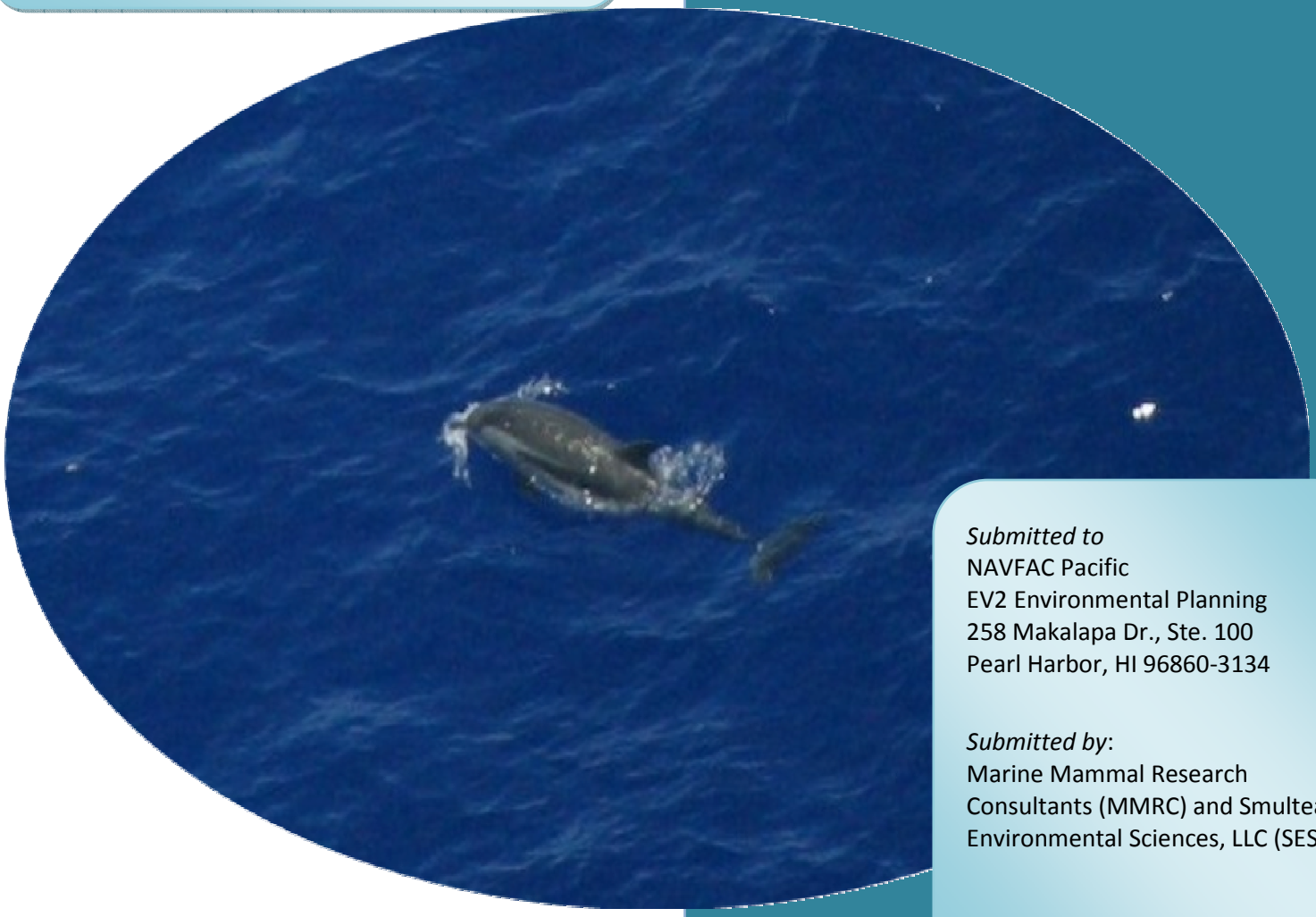
Hawaii Range Complex
June 17-25, 2009
*Final Field Report*

# Aerial Survey Monitoring for Marine Mammals and Sea Turtles off Oahu, Hawaii, in Conjunction with a Unit Level Training Event and Underwater Detonations



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**Cover Photo:** A striped dolphin (*Stenella coeruleoalba*) photographed with a telephoto lens from the aircraft during the HRC June 09 aerial monitoring survey. Photo by Mark Deakos

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# Executive Summary

A total of 44.96 hr of aerial surveys for marine mammals and sea turtles (MM/ST) was conducted on the Hawaii Range Complex (HRC) on eight of the nine-day survey period from 17-25 June 2009 in conjunction with a unit level training event (ULT) and six underwater detonations (UNDET). The surveys consisted of three parts: (a) observations near the Navy warship *USS Hopper* during a ULT (June 17-18); (b) observations before, during and after UNDET activities (June 19); and (c) systematic line-transect surveys in warning areas south of Oahu after the *Hopper* had finished training in that area (June 20-25). Beaufort sea state (Bf) conditions were generally high (modal Bf = 6) due to unusually strong prevailing trade winds for all but the final survey day. During the first two days with the *Hopper*, observations were conducted from a fixed-wing aircraft flying elliptical-shaped orbits to search for MM/ST near the *Hopper* for a total of 12.8 hr of observation. A single sighting of two unidentified dolphins was recorded on the first day at a minimum estimated distance of 1.4 km from the *Hopper*. For the subsequent single day of UNDET activities, 6.4 hr of observations were conducted from a helicopter flying pre-set line transects in a 5.75 x 5.75-km box. A total of 38 sightings of sea turtles were recorded during this effort; no marine mammals were observed. Over the last six days of transect surveys in the warning areas south of Oahu, a total of 25.7 hr of observations were conducted from a fixed-wing plane. On the last day of surveys (June. 25) a total of three cetacean species were sighted, consisting of one sighting each of Risso's dolphins, spotted dolphins, and striped dolphins. The clustering of sightings on the final day was likely due to improved sea state conditions compared to previous survey days.

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# Section 1 Introduction

Marine Mammal Research Consultants (MMRC), in collaboration with Smultea Environmental Sciences, LLC. (SES), was contracted by the US Navy to perform aerial surveys for marine mammals and sea turtles (MM/ST) in support of the Navy Hawaii Range Complex (HRC) marine monitoring plan (Navy 2008) over a nine-day period from June 17-25, 2009. These surveys were planned in conjunction with a unit level training event (ULT) in the region of the island of Oahu, Hawaii. The ULT involved the Navy vessel *USS Hopper* (*Hopper*), employing mid-frequency active sonar (MFAS) with MM/ST observers blind as to MFAS deployment status, as well as underwater detonations (UNDET) at Puuloa Underwater Range in an inshore area. For observations associated with the *Hopper*, surveys were conducted directly with the *Hopper* while it was underway (June 17-18) and subsequently in an area where the *Hopper* had operated but after the *Hopper* had returned to port (June 20-25).

The overall monitoring objective was to detect, identify and observe all MM/ST given their protected status under the Endangered Species Act (1973) and/or the Marine Mammal Protection Act (1972). This included recording the time, location, and species identity (as possible) and observing the behavior of all target species.

# Section 2 Methods

## General Approach

Surveys were generally flown at a speed of ~100 kt and altitude of ~244 m (800 ft) as stipulated under the terms of NOAA permit no. 642-1536 issued to the co-Principal Investigator (JM), unless the pilot was directed to fly at alternate altitudes by flight controllers for safety reasons. Three observation aircraft were used: (1) a twin-engine, high fixed-wing Partenavia Observer (P68) equipped with two bubble windows and a camera porthole in the co-pilot window; (2) a twin-engine, high fixed-wing Aerocommander, and (3) a Robinson 44 helicopter (Table 1). Flight dates are summarized in Table 1.

Crew consisted of two experienced observers and an experienced data recorder/photographer/videographer in addition to the pilot. Location data from a WAAS-enabled global positioning system (GPS) receiver were recorded automatically at 30-sec intervals or whenever a sighting was made. Suunto clinometers were used to obtain declination angles of sightings when the sighting was perpendicular to the aircraft using standard line-transect methodology (e.g., Buckland et al. 2001). Environmental data including Beaufort sea state (Bf), glare and visibility, were taken at the start of each survey leg or when conditions changed, as was information on effort type (see Mobley 2008, Mobley et al. 2000, Smultea and Mobley 2009, Smultea et al. 2009 for further methodology details).

When a sighting occurred, the declination angle to the sighting was called out by the observer as was species identity (if readily identifiable), group size/composition (including presence/absence of calf), general behavior, and any observed potential reactions (defined as a change in heading or behavior or a behavior deemed unusual by the experienced observers). Following the initial sighting, the aircraft typically broke from the transect line and orbited the sighting to confirm species identification, obtain more detailed behavioral observations, and take photographs. Species determination of cetaceans was often made possible via photographs taken with a Canon EOS 5D camera equipped with a 400-mm telephoto lens. A Canon Vixia HF10 high-definition video camera with an internal stabilization feature was available to obtain detailed behavioral data as feasible (though it ended up not being used during this survey).

**Table 1. Hawaii Range Complex (HRC) Aerial Survey Flight Log 17-25 June 2009.**

| Date | Platform | Training Event Monitored | Time Wheels Up | Time Wheels Down | Total Hours |
|---|---|---|---|---|---|
| 6/17/2009 | Fixed-Wing, Twin-Engine Partenavia P68 Observer (FW OBS) | Anti-submarine Warfare Training (ASW) | 10:21<br>15:28 | 13:55<br>18:30 | *3:34*<br>*3:02* |
| 6/18/2009 | FW OBS | ASW | 10:55<br>12:35 | 11:13<br>18:30 | *0:18*<br>*5:55* |
| 6/19/2009 | Robinson 44 Helicopter | Underwater Ordnance Detonation | 8:30<br>9:15<br>12:50 | 8:45<br>11:50<br>16:30 | *0:15*<br>*2:35*<br>*3:40* |
| 6/20/2009 | FW OBS | ASW | 10:30<br>14:53 | 13:46<br>18:35 | *3:16*<br>*3:42* |
| 6/21/2009 | FW OBS | ASW | 9:54 | 13:13 | *3:19* |
| 6/22/2009 | No survey due to poor weather (Bf>6) | | - | - | *0* |
| 6/23/2009 | Fixed-Wing Aerocommander (FW AC) | ASW | 10:05 | 12:17 | *2:12* |
| 6/24/2009 | FW AC | ASW | 8:32<br>12:41 | 11:34<br>15:40 | *3:02*<br>*2:59* |
| 6/25/2009 | FW AC | ASW | 7:00<br>11:12 | 10:29<br>14:52 | *3:29*<br>*3:40* |
| **TOTAL** | | | | | **44:58 (44.96)** |

## Observations during ULT with *USS Hopper*

During the first two days of the surveys (June 17-18), observations were conducted from a fixed-wing Partenavia Observer (P68) aircraft while traveling in front of the *Hopper* which was conducting unit level training (Figure 1 and Figure ). The aircraft flew elliptical orbits in front of the *Hopper* over waters ~20-35 km south of Oahu. The survey protocol involved two modes: (a) search mode—searching for target species while accompanying the *Hopper*; and (b) focal follow mode—following a sighting (see Smultea and Mobley 2009 and Smultea et al. 2009 for detailed methodology). In focal follow mode, the aircraft was to break off and orbit the sighting to obtain detailed behavioral observations for as long as the sighting was visible/trackable.

Communications were maintained between the observation aircraft and *Hopper* personnel via use of a hand-held aviation-band VHF radio operated by *Hopper* crew. Communications were initiated in the event of a sighting or prior to joining or leaving the *Hopper*.

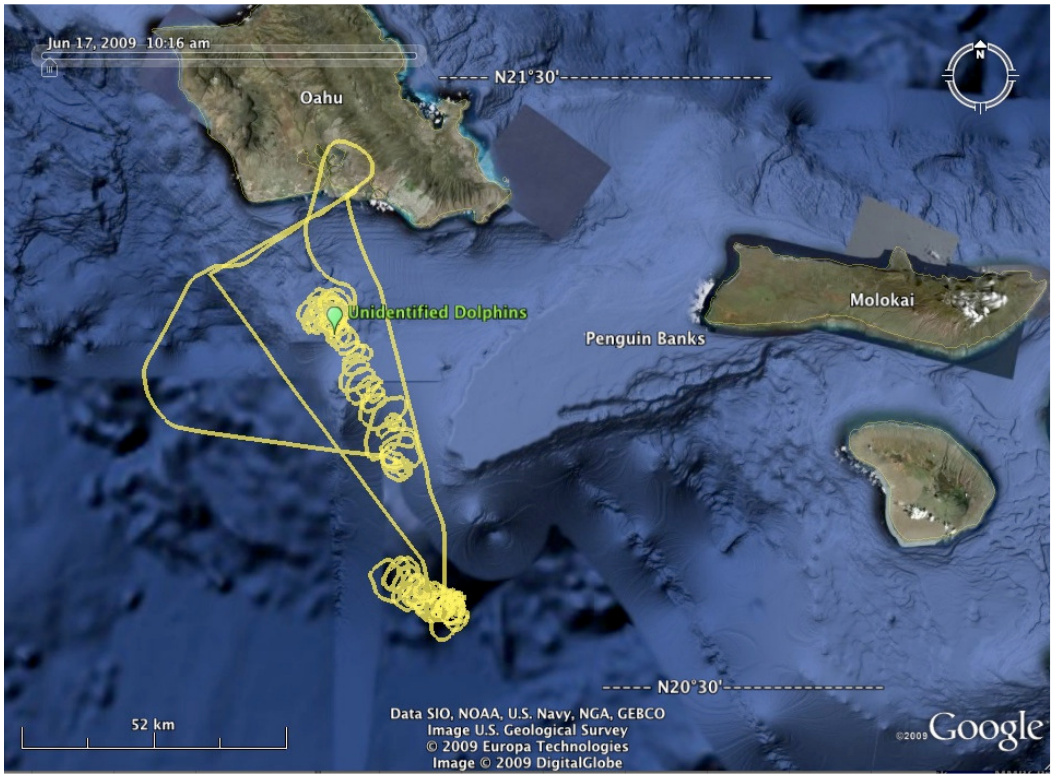


**Figure 1. Map of Survey Route June 17, 2009**

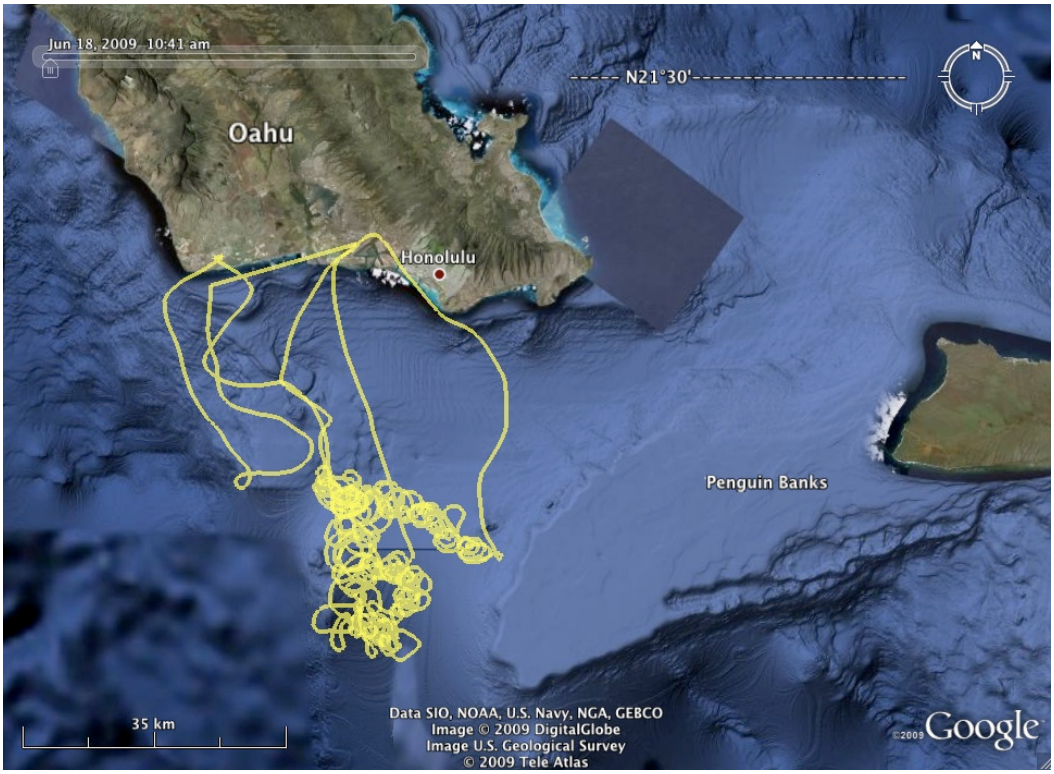


**Figure 2. Map of Survey Route June 18, 2009**

## Observations During UNDET Activity

On the third day of the survey series (June 19), observations were conducted from a Robinson 44 helicopter flying transects in a 5.75 x 5.75-km grid immediately west of the entrance to Pearl Harbor (Figure ). Since the grid was located in the final flight approach area to Honolulu International Airport, all survey operations were closely controlled by FAA flight controllers. Systematic observations occurred in the survey grid during two sessions from 9:15-11:50 and from 12:50-16:30 with a break to return to Honolulu Airport to fuel in-between the sessions (Table 1). Three underwater detonations occurred this day in the center portion of the survey grid. The observation helicopter was present during the first of these three detonation events at ~11:30. The two subsequent detonations occurred between ~11:40 - 13:00 while the helicopter was off-site refueling. Post-detonation observations from the helicopter occurred at the survey grid from ~12:55 – 16:25. Communications were maintained with naval personnel from the Mobile Dive and Salvage Unit One (MDSU) via cell phone and texting given the close proximity to shore. Professional biological observers were aboard the MDSU vessels as well as monitoring for MM/ST in and near the survey grid from a small NOAA-contracted vessel.

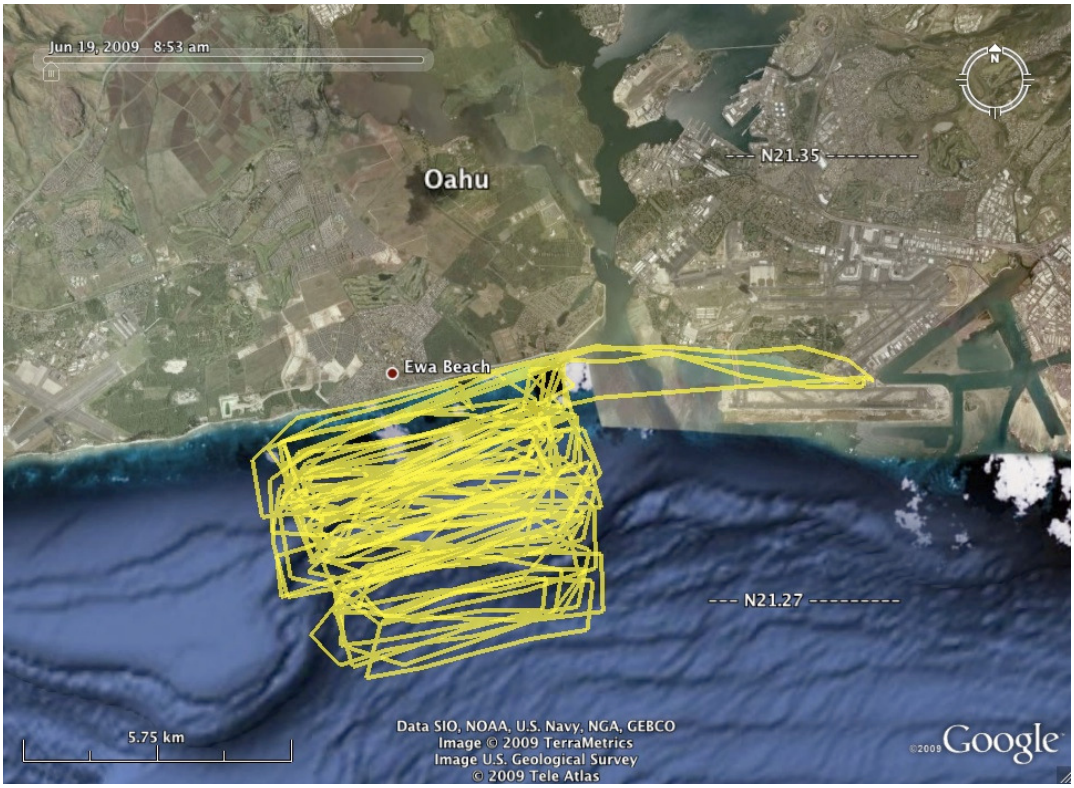


**Figure 3. Map of Survey Route June 19, 2009**

## Survey Transect Observations

For five of the six final five days of the survey series, surveys were flown following pre-set north-south oriented transect lines in the general area where *Hopper* training had been conducted (~15-35 km south of Oahu)(Figure  - Figure 8). Surveys followed north-south systematic transect lines connected at the endpoints by random lines. However, on day three (June 22) of the final six survey days, tradewinds were

so strong and widespread that observations could not be conducted by the observation aircraft due to unfavorable and unsafe wind and wave conditions (Table 1).

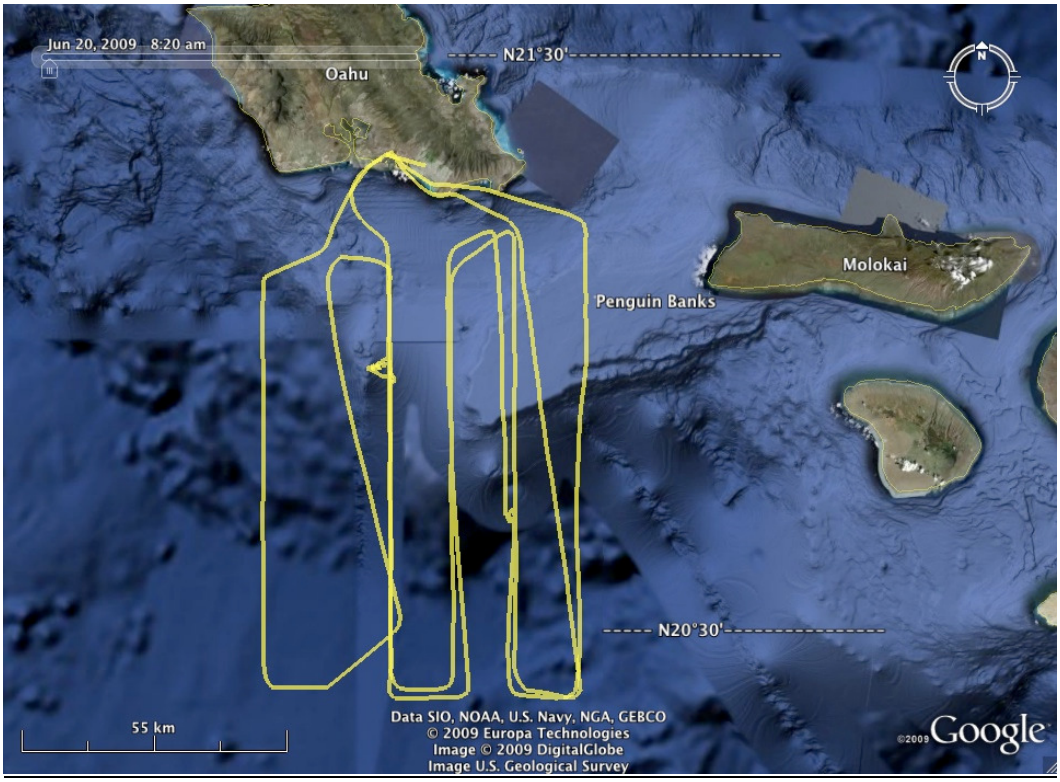


**Figure 4. Map of Survey Route June 20, 2009**

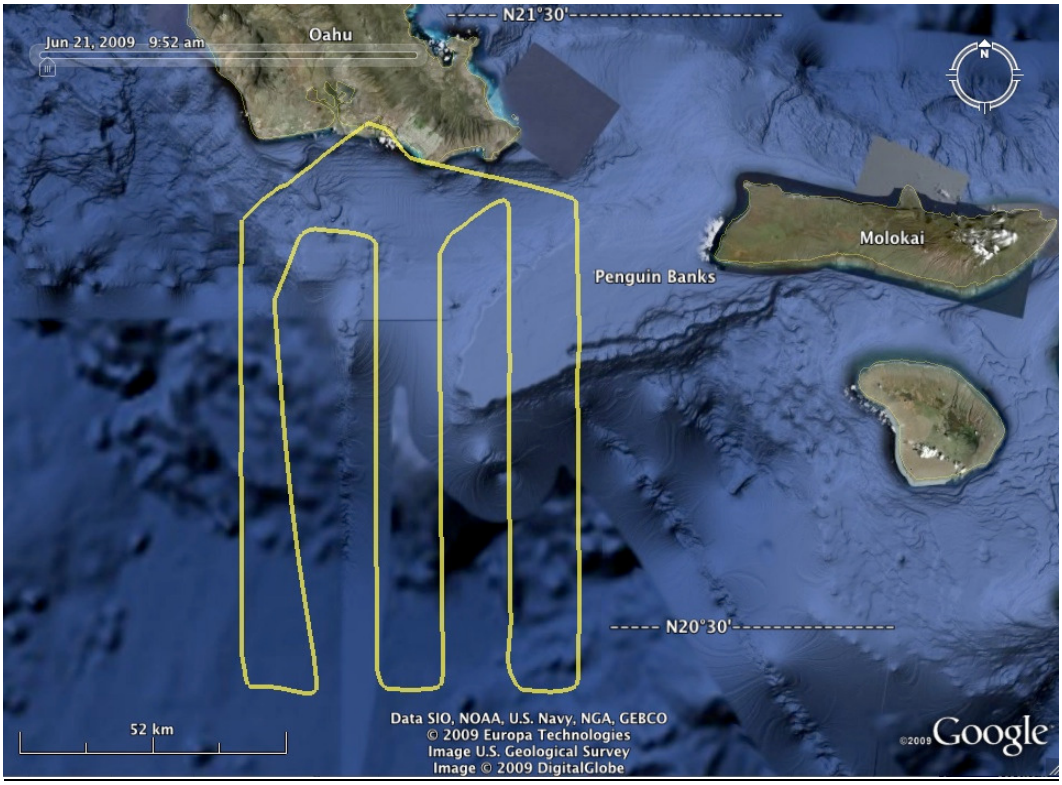


**Figure 2. Map of Survey Route June 21, 2009**

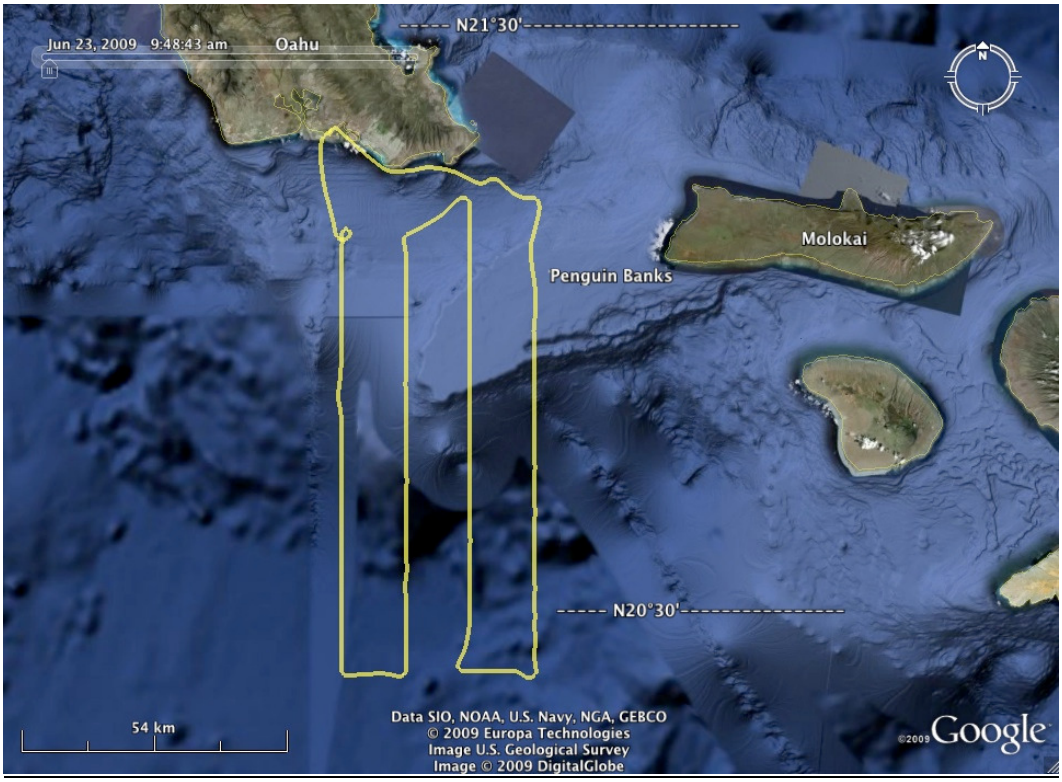


**Figure 3. Map of Survey Route June 23, 2009**

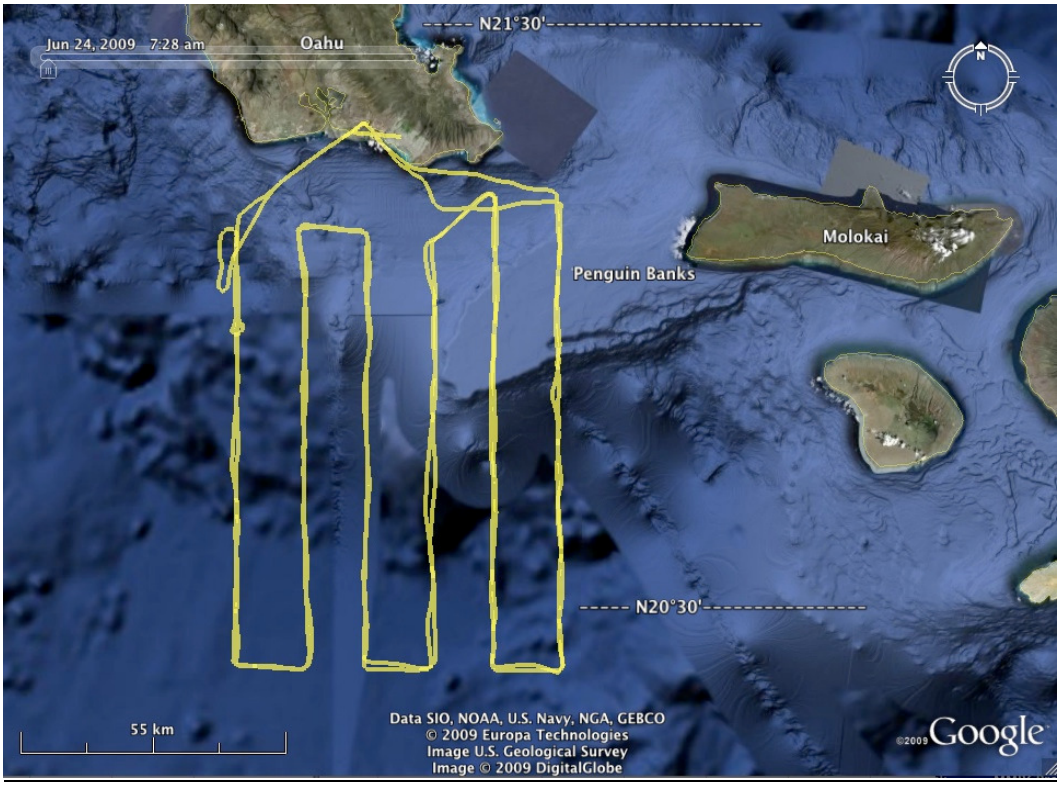


**Figure 4. Map of Survey Route June 24, 2009**

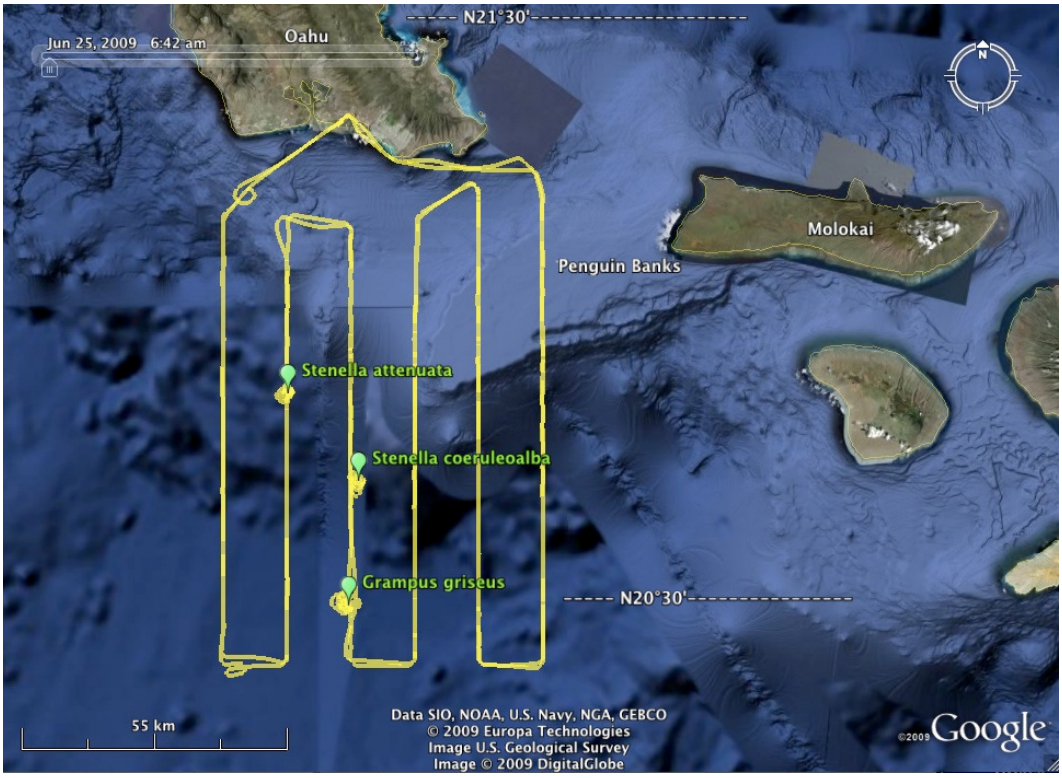


**Figure 8. Map of Survey Route June 25, 2009**

# Section 3 Results and Discussion

Survey conditions were generally hampered by poor Bf conditions due to the exceptionally strong tradewinds that prevailed during all but the final day (Table 2 and Figure 5). The modal Bf value was 6, corresponding to winds in excess of 21 knots. Bf is an important factor affecting visibility during marine surveys: as Bf increases above 2, detectability of marine mammals decreases (Buckland et al. 2001).

Sightings were recorded on only three of the nine survey dates: June 17, 19 and 25 (Table 3 and Appendix A). A single sighting of a group of two unidentified dolphins was made within the first hour of surveying with the *Hopper* on the first day (June 17) at 12:07. Based on analysis of GPS tracklines, the two dolphins were sighted at a minimum distance of 1.4 km from the *Hopper*. Since observers were blind to the status of MFAS transmissions, it was not known whether the dolphins were exposed to MFAS. The dolphins were sighted briefly as they traveled away from the *Hopper* toward a bearing of ~260° magnetic. The observation plane circled for several minutes where the dolphins had first been seen but observers were unable to relocate the dolphins in the Bf 5 conditions to obtain species identification photos or any further behavior information. No reactions/changes in behavior and no unusual behaviors were noted during the brief period of this sighting.

All sightings on June 19, during monitoring of the UNDET activities, were comprised of unidentified sea turtles (likely green sea turtles, *Chelonia mydas*). These were highly visible due to the backlighting reflecting from the sand bottom in that area. No marine mammal species were seen likely due to the shallow water in that area (< 15 m). No unusual behaviors, reactions/changes in behavior were noted among any of the sea turtles seen.

A total of three cetacean sightings occurred on the final survey date (June 25) when sea state conditions improved (Bf modal =4, range = 2 to 6). Those sightings included a group of Risso's dolphins, a group of striped dolphins, and a group of spotted dolphins (Table 3 and Appendix A). All three sightings were seen during a Bf 3 and were circled to obtain photographs to verify species and composition. No video was taken as photos were considered higher priority to confirm species. Short descriptions of these encounters are provided below.

1. A group of ~9 Risso's dolphins (including one calf) was first seen at 8:40 traveling toward ~300° (magnetic). No apparent reactions/changes in behavior were noted among these dolphins. Nearest-neighbor dispersal distance ranged from ~1 to 30 body lengths. The dolphins were circled by the plane for ~23 min during which time 23 photos were taken.
2. A group of ~12 striped dolphins was first observed at 13:02 while they were surface-active milling (a behavior state that includes individual behaviors creating conspicuous splashes, e.g., porpoising, leaps). One calf was seen in the group. Dispersal distance between individuals ranged from 1 to 10 body lengths. The plane circled the striped dolphins for ~15 min during which time 79 photos were taken (see photo on report cover page).
3. A group of ~30 spotted dolphins was sighted at 13:44 engaged in surface-active milling. The dolphins appeared to be feeding and were associated with birds. Dispersal distance between dolphins ranged from 1 to 15 body lengths. The plane circled the dolphins for ~17 min during which time 63 photos were taken. One possible reaction was noted and consisted of diving (sounding) quickly below the surface.

Low rates of sightings are typical for Hawaiian waters during the months outside of the Hawaiian humpback whale wintering season (Jan-April), particularly in offshore waters deeper than ~200 m (reviewed in Smultea 2008). This is likely due to the low productivity of tropical waters (Barlow 2006). The three cetacean species sighted during the survey (Risso's, striped, and spotted dolphins) typically occur in waters surrounding the main Hawaiian Islands (Balcomb 1979; Mobley et al. 2000). The

normally low sighting rates were further suppressed in this case due to the strong trade wind conditions extant during the study period.

**Table 2. Aerial Survey Effort Hours by Beaufort Sea State and Leg Type**

| | BEAUFORT SEA STATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **LEG TYPE** | **0** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | ***Totals*** |
| **Random** | 0:00 | 0:00 | 0:00 | 0:11 | 0:21 | 0:25 | 0:50 | 0:10 | *1:56* |
| **Systematic** | 0:00 | 0:00 | 0:21 | 2:44 | 3:29 | 3:32 | 7:42 | 1:32 | *19:20* |
| **Transiting** | 0:00 | 0:00 | 2:39 | 1:31 | 1:13 | 3:29 | 9:28 | 3:22 | *21:43* |
| ***Totals*** | ***0:00*** | ***0:00*** | ***3:01*** | ***4:26*** | ***5:03*** | ***7:26*** | ***18:00*** | ***5:04*** | ***43:00*** |

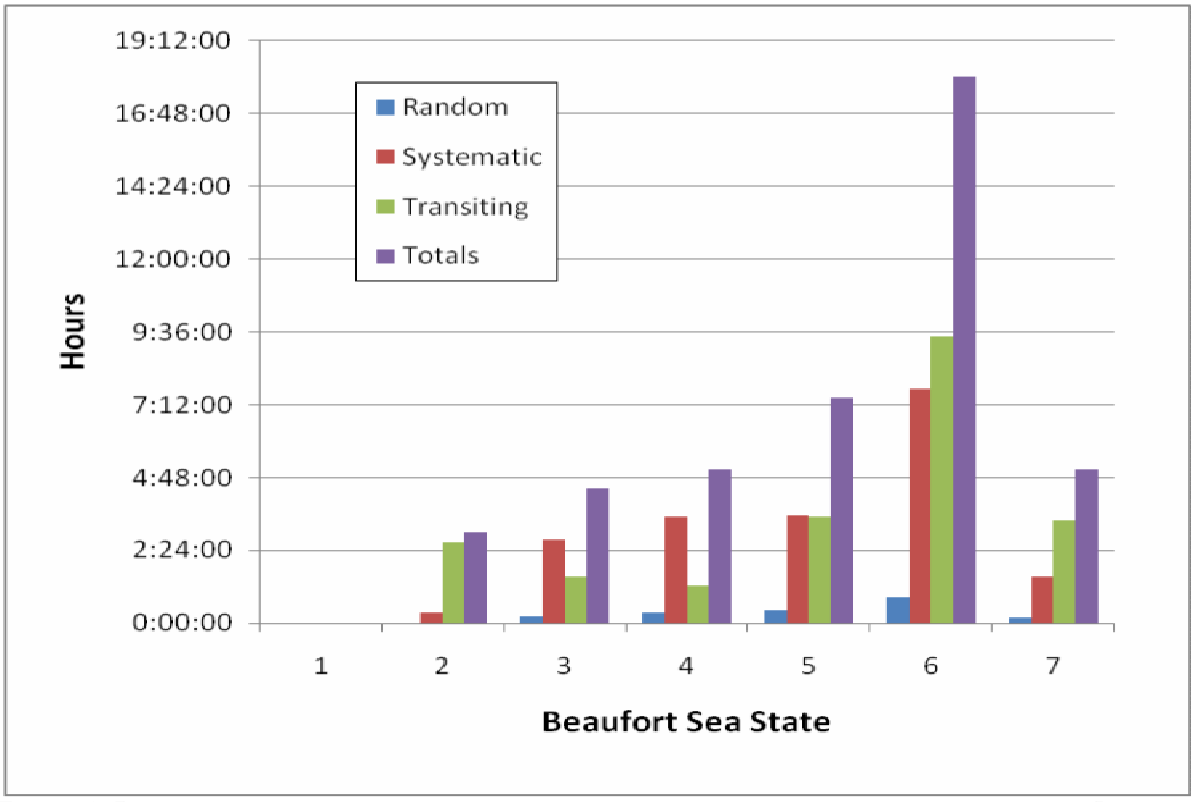


**Figure 5. Beaufort sea state conditions during periods the observer aircraft was conducting Random, Systematic and Transiting observations during the HRC June 2009 aerial survey monitoring off Oahu, Hawaii.**

**Table 3. Marine Mammal and Sea Turtle Sighting Summary by Species. Asterisk (*) indicates species verified by photographs.**

| Species | Scientific Name | Total No. of Sightings | Best Estimate of Group Size |
|---|---|---|---|
| Risso's Dolphin* | *Grampus griseus* | 1 | 9 |
| Striped Dolphin* | *Stenella coeruleoalba* | 1 | 12 |
| Spotted Dolphin* | *S. attenuata* | 1 | 30 |
| Unidentified Dolphin | *Delphinidae* sp. | 1 | 2 |
| Unidentified Sea Turtle | *Chelonia* sp. | 38 | 38 |
| **TOTAL** | | **42** | **91** |

# Section 4 Recommendations

As requested in the SOW, this section provides recommendations for future monitoring efforts relative to what was learned during this survey. Recommendations focus on experiences during this survey and those from recent similar past monitoring surveys we have conducted in the HRC (e.g., Mobley 2008; Smultea et al. 2009; Smultea and Mobley 2009), as well as other relevant professional experience. The recommendations are briefly summarized below.

- When aerial monitoring is desired, consider scheduling for training events that occur away from protected airspace near major airports. The UNDET event described here occurred immediately outside Class B airspace of Honolulu International Airport on a final approach path. As a result, our aerial monitoring activities created issues with air traffic controllers.
- When activities are planned requiring coordination with naval warships, designate on-land POC with knowledge of ship location. During the observation exercise with warship *Hopper*, refueling requirements required re-establishing the ship's location with as much as 1-2 hr intervening. In this case, approx 1-2 hr of potential observation time was lost during attempts to relocate ship.
- During training events involving civilian aircraft traveling into active warning areas, need to clarify which agency (FAA or military) is to provide air support. In this case, our aircraft was asked to broadcast different transponder codes by each agency which produced confusion.

# Section 5 Acknowledgements

We are grateful to Navy personnel from US Pacific Fleet Environmental and Naval Facilities Engineering Command Pacific for their support, coordination and facilitation in the implementation of these surveys. We are also grateful to Dr. J. Hildebrand, Paula Hodgkiss, Linda Sawyer, and other assisting staff at the Scripps Institute of Oceanography and the California Institute of Technology for facilitating this contract. Many thanks also to the hard-working and good-natured survey crew and technical assistants including co-pilot/observer Stu Smith, Robert Uyeyama, Alexis Rudd, Andrew Titmus, and Jenelle Black. Also we are grateful for the competent piloting of our pilots, including John Weiser who flew the Partenavia and helicopter, and the two pilots of AFS Air, including John Sharky, who flew the Aerocommander.

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# Appendix A List of All Sightings

**Appendix A. List of all marine mammal and sea turtle sightings observed in the Hawaii Range Complex during the 17-25 June 2009 aerial monitoring survey off Oahu.**

| Date 2009 | Estimated Group Size | Species | Scientific Name | Sighting Time | Location |
|---|---|---|---|---|---|
| 17-Jun | 2 | Unidentified Dolphin | *Delphinidae* sp. | 12:07:01 | N21.07749 W157.96041 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 9:20:58 | N21.28776 W158.03354 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia sp.* | 9:27:19 | N21.29398 W158.03253 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 9:41:30 | N21.29071 W158.01986 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 9:42:13 | N21.29000 W158.03074 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 9:45:07 | N21.30770 W157.98311 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 9:46:22 | N21.30742 W158.00365 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 9:50:11 | N21.29615 W157.98074 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 10:03:23 | N21.29283 W158.01391 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia sp.* | 10:06:59 | N21.29182 W158.02692 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 10:07:56 | N21.30066 W158.03008 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 10:09:48 | N21.30662 W157.99561 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 10:38:06 | N21.29333 W158.01343 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 10:39:51 | N21.30238 W157.98674 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia sp.* | 10:43:00 | N21.28709 W158.02345 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 10:58:04 | N21.29191 W158.02732 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 11:02:08 | N21.29840 W158.00345 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 11:03:05 | N21.29033 W158.02877 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 11:06:35 | N21.30696 W157.97880 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 11:24:32 | N21.28817 W158.02780 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 11:24:59 | N21.29472 W158.02454 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 11:28:25 | N21.30505 W157.97605 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp... | 11:39:49 | N21.31326 W157.97845 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 12:56:06 | N21.31650 W157.97288 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp... | 12:59:54 | N21.29943 W158.03273 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 13:03:01 | N21.30210 W157.98285 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 13:38:43 | N21.30504 W157.97661 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 13:39:00 | N21.30504 W157.97661 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp... | 13:39:17 | N21.31428 W157.97902 |

| Date 2009 | Estimated Group Size | Species | Scientific Name | Sighting Time | Location |
|---|---|---|---|---|---|
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 13:41:24 | N21.29723 W158.02922 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 13:44:43 | N21.29800 W157.97873 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp... | 14:02:54 | N21.29495 W157.98046 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 14:04:45 | N21.28636 W158.02722 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 14:28:44 | N21.28504 W158.03185 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 14:29:26 | N21.29282 W158.03057 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 14:34:06 | N21.29119 W158.02997 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 14:34:21 | N21.29119 W158.02997 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp... | 14:40:40 | N21.30073 W158.03009 |
| 19-Jun | 1 | Unidentified Turtle | *Chelonia* sp. | 14:44:14 | N21.31459 W157.97699 |
| 25-Jun | 9 | Risso's Dolphin | *Grampus griseus* | 8:40:08 | N20.48307 W157.90188 |
| 25-Jun | 12 | Stripped Dolphin | *Stenella coeruleoalba* | 13:02:10 | N20.70843 W157.88485 |
| 25-Jun | 30 | Spotted Dolphin | *Stenella attenuata* | 13:44:37 | N20.85654 W158.01728 |
| **TOTAL** | **91** | | | | |