Kaula Island Ship-Based Seabird Survey

July 6, 2012

Prepared for Commander, Pacific Fleet by NAVFAC Pacific

November 2012

Justin Fujimoto and Frans Juola

Seabird Monitoring Purpose

The Navy developed a seabird monitoring plan (DoN 2009) and reinitiated seabird population surveys at Kaula Island in 2009 as part of the Department of Navy's Coastal Zone Management Act consistency determination of the Hawaii Range complex (HRC) Environmental Impact Statement. After one aerial imagery attempt in January 2009, ship-based seabird monitoring has been conducted from July 2009 through 2012 (DoN 2009). Monitoring is designed to assess trends in seabird populations on Kaula over time, ensuring the maintenance of military readiness while complying with safety regulations.

Kaula Island History and Training

Kaula is a small uninhabited islet located 20 nautical miles (37 kilometers [km]) west-southwest of Niihau and approximately 60 nautical miles (111 km) southwest of the Pacific Missile Range Facility (PMRF), Kauai (Figure 1). Kaula has an area of approximately 136 acres (55 hectares), with a summit elevation of 540 feet (ft) (164.6 meters [m]). The island is crescent-shaped, with a curving crest line approximately 5,500 ft (1,676 m) in length. The terrain drops steeply from the crest at a mean slope of 36° (Palmer 1936), and steep V-shaped ravines have been cut by ephemeral streams on the windward slopes (Elmer and Swedberg 1971). The northern horn of the island extends 2,500 ft (762 m) from the summit and ends at an approximate elevation of 280 ft (85 m), while the southern horn extends 3,000 ft (914 m) from the summit and ends at an approximate elevation of 100 ft (30 m) (Palmer 1936).

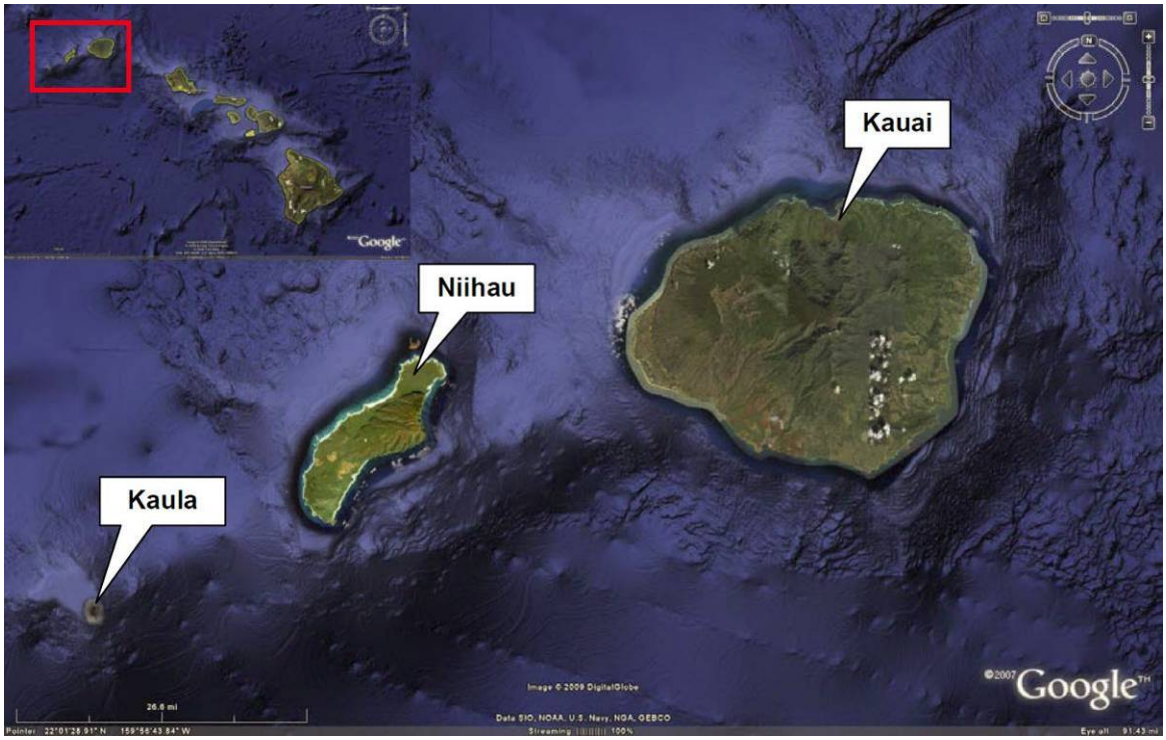

Figure 1. Location of Kaula Island relative to the main Hawaiian Islands (inset), Kauai and Niihau (imagery from Google Earth).

Title to Kaula is held by the United States. Territorial Executive Order 173 of 13 December 1924 set aside Kaula Island for public purposes under the jurisdiction of the United States Lighthouse Service. In 1939, the U.S. Coast Guard (USCG), successor to the Lighthouse Service, assumed control of Kaula (Elmer and Swedberg 1971, Balazs 1979). In 1952, USCG granted the Navy a revocable permit to use Kaula Island as a munitions target, and the Navy received jurisdiction, custody, accountability and control of the island from USCG in 1965 (Elmer and Swedberg 1971). From 1981 to the present, the Navy has restricted its munitions training to inert ordnance (Walker 1979, 1983, 1984, 1993). More detailed history of the island can be found in Anders et al. 2011, Fujimoto 2011, and Richie and Fujimoto 2011.

Methods

The survey vessel, the M/V *Searcher*, departed Na Wiliwili Harbor, Kauai, on the evening of 5 July 2012 and made the transit to Kaula Island overnight, arriving at the island on the morning of 6 July 2012. In total, eight biologists were aboard the survey vessel, including five from the U.S. Navy, one from the NOAA Pacific Island Fisheries Science Center, one from the U.S. Fish and Wildlife Service, and one contractor from the University of Hawaii. Five biologists participated in the ship-based seabird survey. The survey was conducted at Kaula Island, as well as during the return transit from Kaula to Kauai. Three biologists simultaneously conducted marine mammal surveys during both the circumnavigation of Kaula Island and during the return transit from Kaula to Kauai.

The seabird survey at Kaula began at approximately 0800 and ended at 0939. The survey was conducted by slowly circumnavigating the island. In total, two circumnavigations were completed around Kaula at a speed of 2 to 4 knots, maintaining a distance of approximately 750 ft (228 m) from the coastline. The island was divided into four quadrants (north, northwest, southwest, and east), with section boundaries defined by the island's terrain (Figure 2). Each observer was assigned one or two species to count. Observers identified birds using 7x50 hand-held binoculars or 10x42 image-stabilizing binoculars.

All birds present on Kaula as well as those flying near the island were counted during the survey. Species were counted between one and four times each during the survey. Based on observer availability, in some cases multiple observers counting the same species independently and/or species were counted again during the second circumnavigation. At the end of the survey, species totals for each of the four quadrants were summed, yielding species counts for the entire island. For species counted more than one time, the mean and standard deviations were calculated for their island totals. Relative abundance of each species was compared to the previous three years of ship-based summer surveys (2009 – 2011). In addition, a list of all seabird species observed while in transit from Kaula Island to Kauai was recorded.

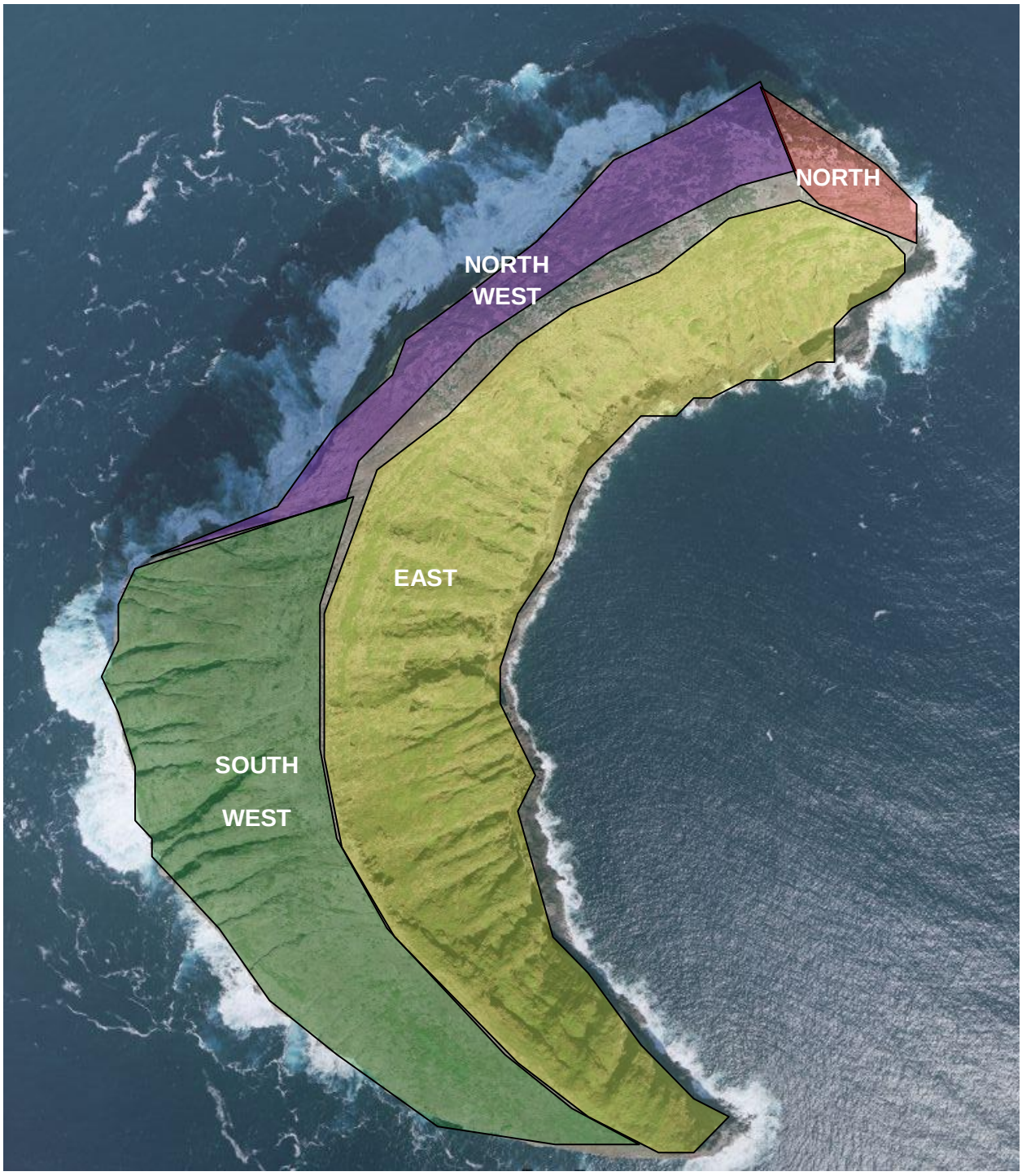

Figure 2. Survey quadrants defined on Kaula Island for the 6 July 2012 seabird survey.

Results

Wind conditions were estimated at Beaufort scale 6 during the survey. Large swells and waves forming white caps were present, with swirling ocean spray coming off the island.

As was the case in previous ship-based surveys at Kaula Island, it was not possible to differentiate between some species due to the distance between the island and the ship. In these cases, the species were combined into groups during survey counts. These included masked and red-footed boobies (*Sula dactylatra* and *Sula sula*) and brown and black noddies (*Anous stolidus* and *Anous minutus*). A total of nine seabird species were observed during the survey of the island (Table 1). These included five from the Order Pelecaniformes (masked booby, red-footed booby, brown booby (*Sula leucogaster*), great frigatebird (*Fregata minor*) and red-tailed tropicbird (*Phaethon rubricauda*), and four from the order Charadriiformes (sooty tern (*Sterma fuscata*), brown noddy, black noddy, and white tern (*Gygis alba*)).

Sooty terns were present in the greatest numbers (mean = 4509), followed by masked and red-footed boobies combined (mean = 912), and brown and black noddies combined (mean = 597; Table 1). In total, these three species or groups of species accounted for 99% of all of the seabirds observed during the survey (sooty terns = 74%, masked and red-footed boobies combined = 15%, brown and black noddies combined = 10%). Relative abundance data for the summer circumnavigation surveys from 2009 to 2012 is presented in Figure 3.

Table 1. Mean number of each seabird species or group of species observed, along with minimum, maximum, and standard deviation during the 6 July 2012 ship-based survey of Kaula Island. Counts were conducted during two circumnavigations of the island. In 2012, the number of counts conducted for each species or groups of species was dependent on observer availability and ranged from one to four. Masked/red-footed boobies = 4 counts, sooty terns = 3 counts, great frigatebirds = 2 counts, brown/black noddies = 2 counts, brown boobies = 2 counts, white terns = 1 count, red-tailed tropicbirds = 1 count. The results of the summer surveys from 2009-2011 are also presented for comparison.

		July 2012	**June 2011**	**June 2010**	**July 2009**
Common Name	**Scientific Name**	**Mean ± SD (range)**	**Mean ± SD (range)**	**Mean ± SD (range)**	**Mean ± SD (range)**
Masked / Red-footed boobies	*Sula dactylatra / Sula sula*	912 ± 62 (829-979)	1859 ± 255 (1675-2036)	850 ± 67 (775-907)	820 ± 286 (494-1026)
Brown boobies	*Sula leucogaster*	40 ± 8 (34-46)	6 ± 2 (4-7)	1 ± 1 (0-1)	112 ± 132 (19-205)
Great frigatebirds	*Fregata minor*	26 ± 3 (24-28)	105 (NA)	430 ± 28 (410-450)	131 ± 45 (71-170)
Red-tailed tropicbirds	*Phaethon rubricauda*	1 (NA)	5 (NA)	3 ± 1 (2-3)	31 ± 32 (8-53)
Sooty terns	*Sterna fuscata*	4509 ± 347 (4217-4892)	9745 ± 460 (9419-10070)	3382 ± 663 (2913-3851)	6169 ± 1043 (5435-7363)
Brown / Black noddies	*Anous stolidus / Anous minutus*	597 ± 159 (484-709)	306 ± 55 (267-345)	705 ± 78 (649-760)	711 ± 656 (270-1465)
White terns	*Gygis alba*	12 (NA)	9 ± 4 (6-11)	9 ± 9 (2-15)	10 ± 2 (8-11)
	Total	**6097**	**12035**	**5380**	**7984**

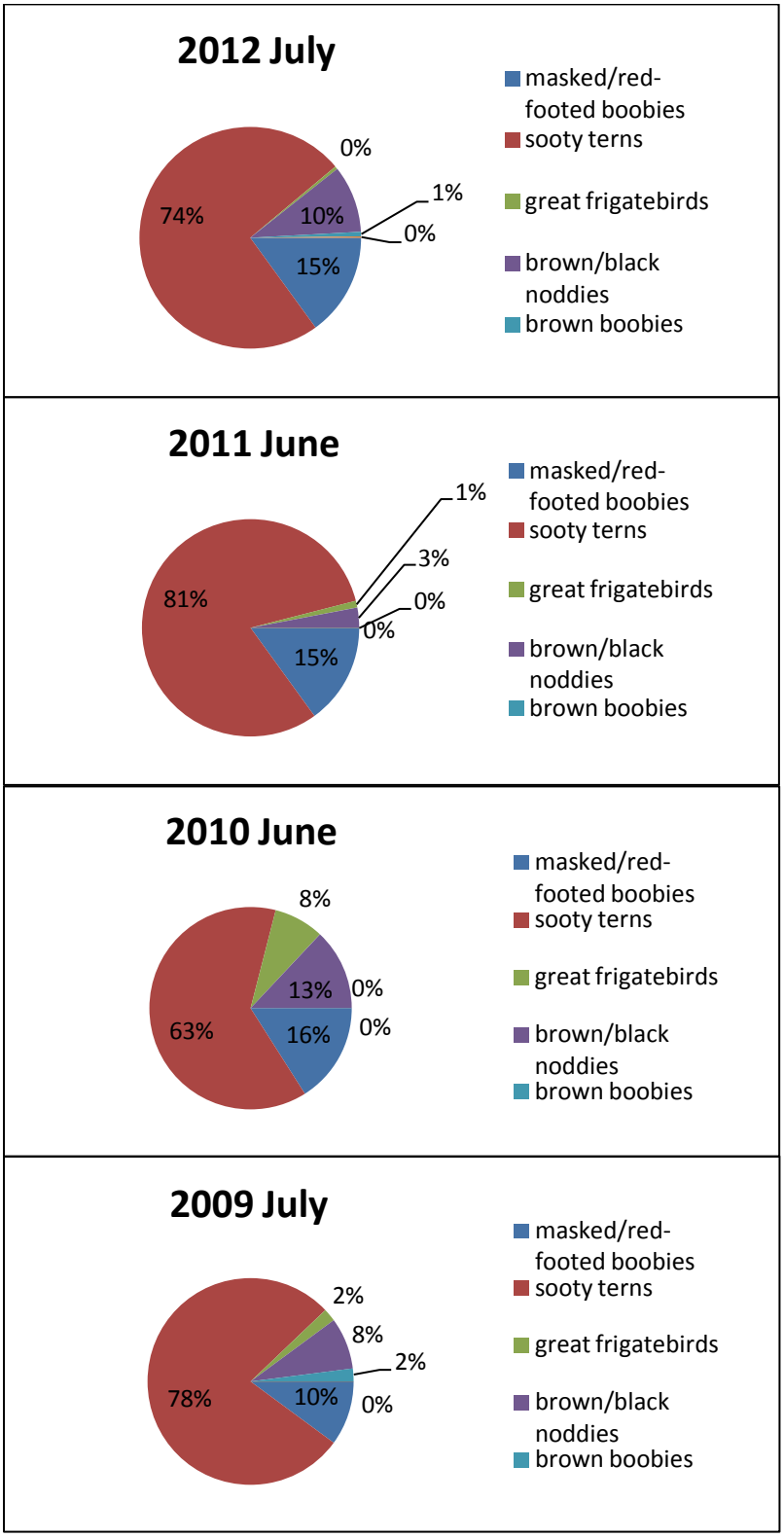

Figure 3. Relative abundance of seabird species observed during the July 2012, June 2011, June 2010, and July 2009 Kaula Island surveys.

During the July 2012 surveys, sooty terns were observed on the slopes of the north, northwest and southwest sides of the island (Figure 4). Masked and red-footed boobies were primarily seen on the east side of the island in stream-carved ravines, and similarly in small numbers on the southwest side of the island (Figures 4 and 5). Brown/black noddies were observed in small groups on the southwest side of the island and on cliff ledges of the north and northwest side of the island. White terns were seen on ledges of steep cliffs on the north and northwest sections. Great frigatebirds, brown boobies and red-tailed tropicbirds were only observed flying near the island during the survey.

Figure 4. Masked and red-footed boobies (*Sula dactylatra / Sula sula*) in a ravine and sooty terns (*Sterna fuscata*) on the slope of the southwest side of Kaula Island.

Figure 5. A group of Masked and/or Red-footed boobies (*Sula dactylatra / Sula sula*) on the east side of the island near the summit.

In addition to the survey conducted at Kaula Island, a list of species observed during the return trip from Kaula to Kauai was recorded (Table 2). Two species that were not detected during the survey but were observed during the return trip were wedge-tailed shearwaters (*Puffinus pacificus*) and Bulwer's petrels (*Buleria bulwerii*), both from the order Procellariiformes (Table 2).

Table 2. List of seabird species observed during the return trip from Kaula Island to Kauai on 6 July 2012.

Common Name	**Scientific Name**
Masked booby	*Sula dactylatra*
Red-footed booby	*Sula sula*
Brown booby	*Sula leucogaster*
Red-tailed tropicbird	*Phaethon rubricauda*
Sooty tern	*Sterna fuscata*
Brown noddy	*Anous stolidus*
Black noddy	*Anous minutus*
Bulwer's petrel	*Buleria bulwerii*
Wedge-tailed shearwater	*Puffinus pacificus*

Discussion and Next Steps

The July 2012 survey marked the fourth consecutive summer (2009 – 2012) that the Navy has conducted ship-based seabird surveys of Kaula Island. Comparing the most recent ship-based survey data with past ship-based surveys conducted at the same time of year is the most unbiased way to assess seabird trends at Kaula Island. All species observed during the 2012 survey were also seen in the most recent ship-based summer surveys from 2009 – 2011, and all were typical species recorded during historical surveys of Kaula. Overall seabird abundance was lower in 2012 compared to 2011, but on par with abundances observed in 2009 and 2010. The most abundant species in 2012 was the sooty tern, accounting for 74% of all seabirds observed. Since 2009, sooty terns have accounted for between 63% - 81% of all birds observed during the summer surveys at Kaula. The total number of sooty terns estimated at Kaula in 2012 was lower than the total number estimated in 2011, though similar to the numbers observed in 2009 and 2010. Masked and red-footed boobies (combined) were the next most abundant group in 2012, just as they were in the three previous years. Similar to sooty terns, the total number of masked and red-footed boobies was lower in 2012 compared with 2011, but on par with 2009 and 2010. Brown and black noddies (combined) were the third most common group of species observed, just as they were in 2009-2011. Other species observed, such as great frigatebirds, brown boobies, white terns and red-tailed tropicbirds were seen in low numbers, similar to the previous three years.

Over the past four years, with the exception of 2011, the overall seabird abundance on Kaula has remained qualitatively similar. In 2011, there were more birds detected overall on the island. There could be several reasons for this. Although all surveys have been conducted first thing in the morning, on any given day, the number of birds present on an island such as Kaula is dependent upon many factors, including food availability at sea, oceanographic conditions, and weather. Fluctuations in colony attendance can occur rapidly based upon how far birds travel to forage and how difficult it is to fly given wind speeds and direction. Higher or lower abundance in one year based upon a one-day survey is not necessarily indicative of a population change. In addition, adverse ocean conditions such as those during the date of the 2012 survey make observations from a ship more difficult. Even with image-stabilizing binoculars that reduced vibrations and minimized the pitch of the ship to the observer, conducting counts can still be quite challenging. All of these factors might contribute to the fluctuations in abundance observed from year to year.

The Navy's first survey was conducted from an aerial platform collecting digital imagery, however, given the altitude restrictions and the commercially available photographic equipment, the resolution of the photos created was not sufficient to perform an adequate static bird count. However, given recent improvements in aerial imagery technology, the Navy intends to use aerial imagery instead of a ship-based survey for the winter/spring 2013 survey as this might allow for better data from sitting birds on the topside of the island.

Literature Cited

Anders, A.D., Uyeyama, R.K., and Hanser, S.F. 2011. Kaula Island ship-based seabird and marine mammal surveys, 26-28 June 2010. Prepared for Commander, Pacific Fleet. NAVFAC Pacific. Pearl Harbor, HI.

Department of the Navy. 2009. Kaula Island Seabird Monitoring Plan. July 2009.

Elmer, J.S. and Swedberg, G. 1971. Assessment of Environmental Impact, Kaula Island Target. DON, Commander Fleet Air Hawaii.

Fujimoto, J. 2011. Kaula Island ship-based seabird surveys. Prepared for Commander, Pacific Fleet. NAVFAC Pacific. Pearl Harbor, HI.

Palmer, H.S. 1936. Geology of Lehua and Kaula Islands. Bernice Pauahi Bishop Museum Occasional Papers 12(13). 11pp.

Richie, M. and J. Fujimoto. 2011. Kaula/ Kauai field report, HRC marine species monitoring, February 15-20 2011. Prepared for Commander, Pacific Fleet. NAVFAC Pacific. Pearl Harbor, HI.

Walker, R. L. 1979. Report on trip to Kaula island, March 6-8, 1979. Unpublished. On file, State of Hawaii Division of Forestry and Wildlife, Department of Land and Natural Resources. Honolulu, HI.36

Walker, R. L. 1983. Report on trip to Kaula Island, June 19-20, 1980. Unpublished. On file, State of Hawaii Division of Forestry and Wildlife, Department of Land and Natural Resources. Honolulu, HI.

Walker, R. L. 1984. Kaula trip report, April 16-18, 1984. Unpublished. On file, State of Hawaii Division of Forestry and Wildlife, Department of Land and Natural Resources. Honolulu, HI.

Walker, R. L. 1993. Kaula trip report, June 1-2, 1993. Unpublished. On file, State of Hawaii Division of Forestry and Wildlife, Department of Land and Natural Resources. Honolulu, HI.