KAULA SHIP-BASED SEABIRD SURVEYS
30 June 2011

Prepared for Commander, U.S. Pacific Fleet
By NAVFAC Pacific

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1.0 Introduction

1.1 Seabird Monitoring Purpose

As part of the Department of Navy's Coastal Zone Management Act consistency determination of the Hawaii Range complex (HRC) Environmental Impact Statement, the Navy reinitiated seabird population monitoring at Kaula Island in 2009. A seabird monitoring plan for Kaula Island was finalized in 2009, and ship-based seabird monitoring has been conducted from July 2009 to the present. Monitoring is designed to detect trends in seabird population on Kaula Island over time, while ensuring the maintenance of military readiness.

1.2 Kaula Island Owner Information

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).

Kaula Island is associated with Hawaiian culture and is assumed to have been visited in the past by Hawaiians for the purposes of fishing and bird collection however, there is no evidence of regular human habitation on Kaula Island (Elmer and Swedberg 1971). The U. S. Lighthouse Service established an automatic gas light near the summit of Kaula on August 18, 1932. The lighthouse was located at the summit of the island and operated until 1947. In 1939, the U.S. Coast Guard (USCG), successor to the Lighthouse Service, assumed control of Kaula (Elmer and Swedberg 1971, Balazs 1979). Following World War II, USCG used Kaula as a radar navigation target. In 1952, USCG granted the U.S. Navy a revocable permit to use Kaula as a munitions target. The Navy received jurisdiction, custody, accountability and control of the island. After receiving permission to use the island for munitions training, the southeastern tip (1000 ft) was designated as a practice range for air-to-surface and surface-to-surface weapons delivery (Elmer and Swedberg 1971, DON 1976a). Both live and inert ordnance was used during training missions through 1980. From 1981 to the present, the Navy has restricted its munitions training at Kaula to inert ordnance delivery and aircraft gunnery (Walker 1979, 1983, 1984, 1993).

1.3 Property Description

Kaula is a small, uninhabited islet near the islands of Niihau and Kauai in the Hawaiian Archipelago (Figure 1; latitude: 21°39’29” North, longitude: 160°32’39” West; Palmer 1936). It is 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) Main Base, 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]) (Palmer 1936). 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, such that the island has little level terrain (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).

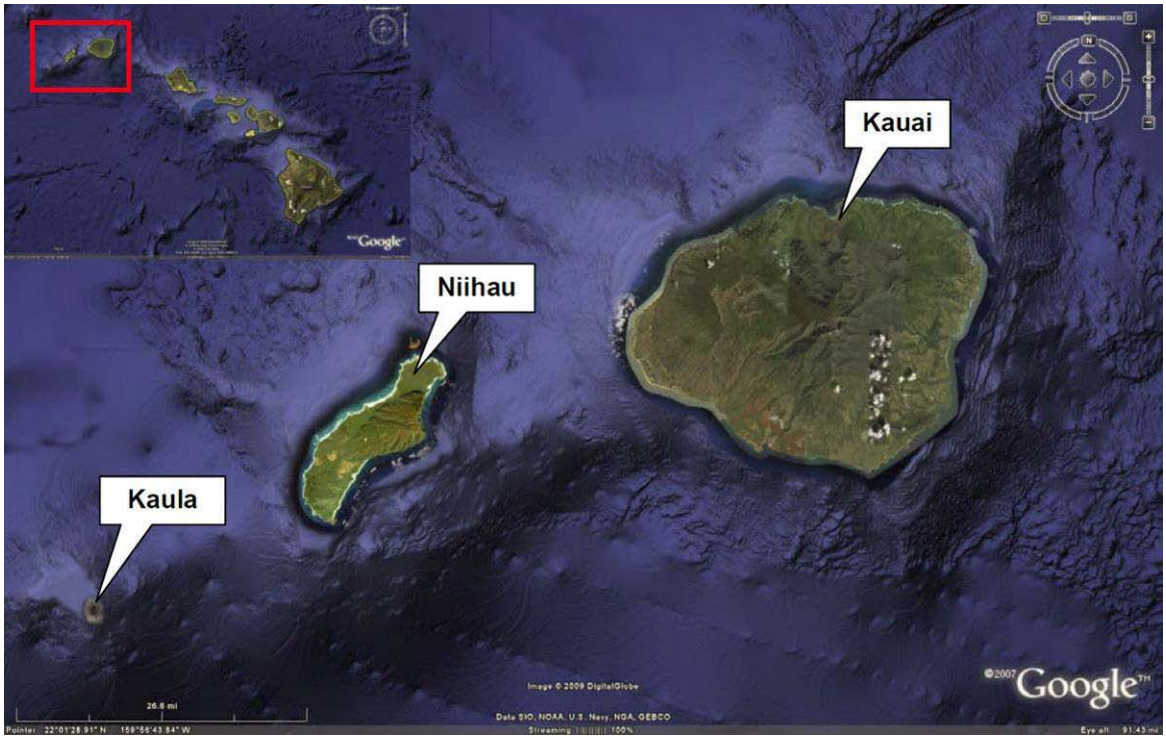


Figure 1. Location of Kaula Island relative to the main Hawaiian Islands (inset), Kauai and Niihau (imagery from Google Earth).

Due to increasing concerns by the Navy regarding the potential injury to personnel visiting Kaula by unexploded ordnance, bird aircraft strikes, and steep, unstable terrain, access to the island for land-based surveys has not been granted since 1998. In January 2009, the Navy contracted a private company to obtain aerial imagery of Kaula via small airplane to conduct seabird surveys using high-resolution digital images. The resolution of the imagery obtained during those flights, however, was not high enough to accurately determine seabird species or assess presence or abundance on the island. Therefore, it was determined that the best approach to conduct seabird surveys in the absence of direct access to land was via vessel platform. On 21-22 July 2009 avian surveys were conducted by Navy biologists from a chartered research vessel, with marine mammal surveys conducted concurrently (Pepi et al. 2009). This survey marked the beginning of a series of surveys incorporating marine mammal and avian survey from a vessel platform on an alternately annual and biannual basis. Subsequent surveys have occurred in June 2010, February 2011, and the topic of the current report, June 2011.

2.0 Methods

Ship-based seabird surveys were conducted at Kaula, as well as during transit between Kaula and Niihau on 30 June 2011. Eight biologists, including six from the U.S. Navy, one from the NOAA Pacific Island Fisheries Science Center, and one from the University of Hawaii, Institute of Marine Biology, boarded the MV *Searcher* to conduct surveys (Appendix A). Four biologists from the U.S. Navy conducted the seabird surveys; all had previous experience conducting offshore seabird studies.

2.2 Survey Timeline

The M/V *Searcher* departed Port Allen, Kauai, on the evening of 29 June, 2011 and made the transit to Kaula overnight arriving at Kaula on the morning of 30 June, 2011. The seabird survey started at 07:28 hours and ended at 09:10 and consisted of three circumnavigations around the island at a speed of approximately 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 and identified birds using 7x50 hand-held binoculars. During the survey, as with the 2009/10 ship-based surveys, the M/V Searcher circumnavigated Kaula Island at approximately 2 to 4 knots, maintaining a distance of approximately 750 ft (228 m) from the coastline. Seabird survey methods used in 2009 and 2010 were repeated during this survey, with birds counted on land and in the air.

The two white booby species (masked boobies and red-footed boobies) were difficult to differentiate from the distance of the observation deck, such that these two species were combined during the survey. The first two circumnavigations around the island focused on just two survey counts, sooty terns and the white boobies (combined count of masked and red-footed boobies). The third circumnavigation focused on the remaining species not covered on the first two rounds. For species with two data sets, the mean and standard deviation from the first and second circumnavigations were calculated. Relative abundance of each species or group of species was compared to the results of summer surveys from previous years –winter survey results were not compared. A list of all seabird species observed while in transit between Kaula and Niihau was also compiled during the return trip.

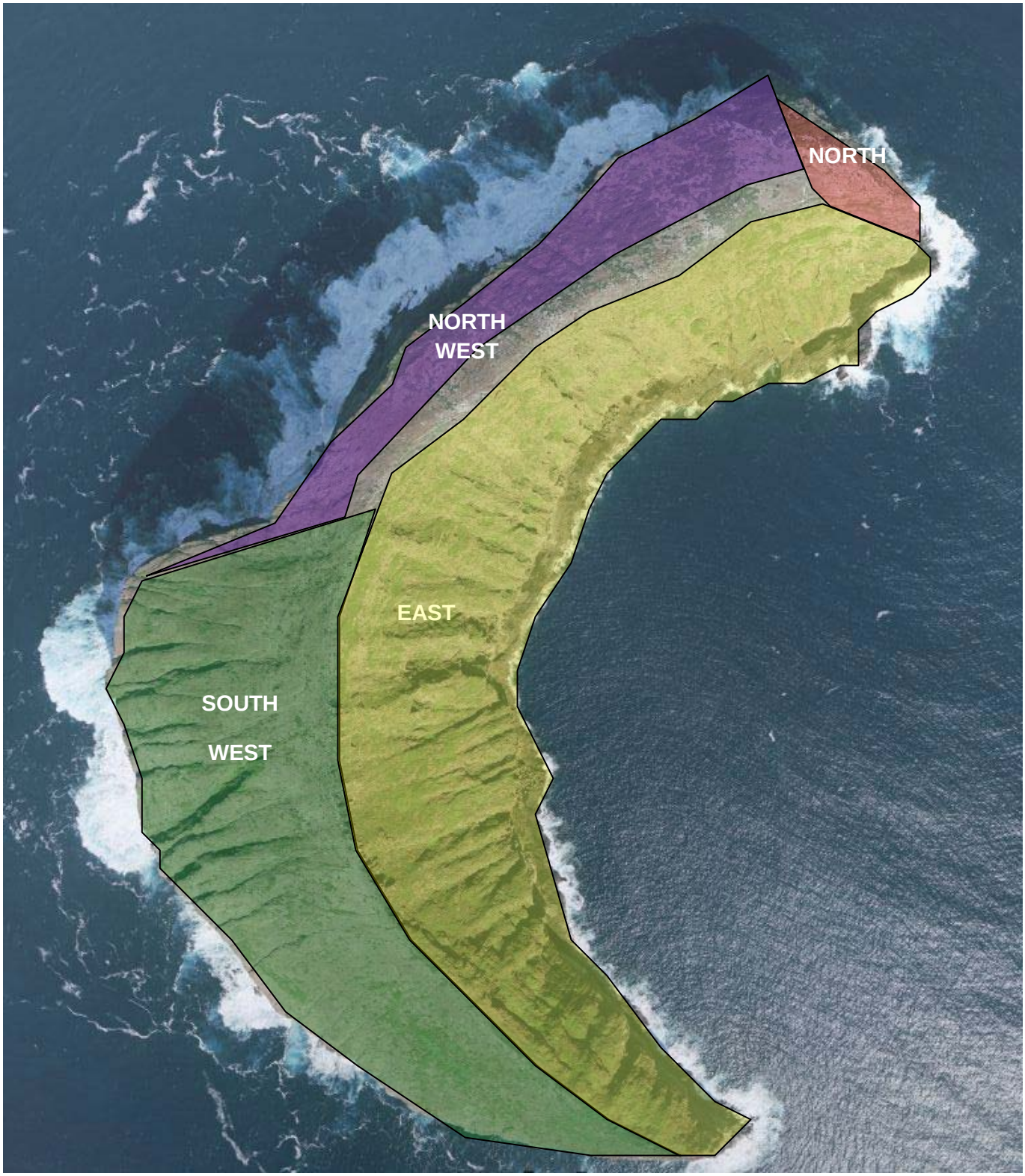


Figure 2. Survey quadrants defined on Kaula for the 30 June 2011 seabird surveys.

3.0 Seabird Survey Results

During the June 2011 survey of Kaula, a total of ten seabird species were observed from the MV *Searcher*. These included six species from the Order Pelecaniformes (brown booby (*Sula leucogaster*), red-footed booby (*Sula sula rubripes*), masked booby (*Sula dactylatra*), great frigatebird (*Fregata minor*), and red-tailed tropicbird (*Phaethon rubricauda*)), three species from the Order Charadriiformes (sooty tern (*Sterma fuscata*), brown noddy (*Anous minutus*), and white tern (*Gygis alba*) and one species from the Order Procellariiformes (Laysan albatross (*Phoebastria immutabilis*)). All species observed in 2011 had been observed at some point during previous surveys conducted between 1932 and 2010 (no new seabird species were observed in 2011) (Table 1). Sooty terns were present in the greatest numbers, followed by masked and red-footed boobies, and brown noddies. Masked and red-footed boobies were observed primarily on the east side of the island in stream-carved ravines. Brown noddies were seen on the cliff faces and cliff edges of the northwest and north sections of the island (Figure 3). Frigatebirds were seen flying above and around the edges of the island. No seabirds were observed nesting on the southeastern tip (1000 ft) of the island, which is used by the Navy as a munitions training target (Figure 4). Sooty terns were observed primarily on the upper slopes of the southwest, northwest, and north side the island (Figure 5)

Table 1. Seabird species observed, and the means, standard deviations, and ranges of number of individuals counted at Kaula Island during the June 2011, June 2010, and July 2009 surveys.

Common name	**Scientific name**	**Jun-11**				**Jun-10**			
		Mean # observed	**Standard deviation**	**Min**	**Max**	**Mean # observed**	**Standard deviation**	**Min**	**Max**
Masked /red-footed booby	*Sula dactylatra, S. sula*	**1859**	5	1675	2036	**850**	67	775	907
Great frigatebird	*Fregata minor*	**105**	74	2	64	**430**	28	410	450
Sooty tern	*Sterna fuscata*	**9745**	460	2925	16113	**3382**	663	2913	3851
Brown noddy	*Anous stolidus*	**306**	55	345	267	**705**	78	649	760
White tern	*Gygis alba*	**9**	4	6	11	**9**	9	2	15
Blue noddy	*Procelsterna cerulea*	**0**	0	0	0	**1**	1	0	2
Wedge-tailed shearwater	*Puffinus pacificus*	**3**	2	0	3	**0**	0	0	0
Bulwer's petrel	*Bulweria bulwerii*	**0**	0	0	0	**1**	1	2	3
Red-tailed tropicbird	*Phaethon rubricauda*	**9**	4	0	5	**3**	1	2	3
Brown booby	*Sula leucogaster*	**6**	2	4	7	**1**	1	0	1
Totals		**12042**	--	4957	18506	**5382**	--	4753	5992

Common name	**Scientific name**	**Jul-09**			
		Mean # observed	**Standard deviation**	**Min**	**Max**
Masked /red-footed booby	*Sula dactylatra, S. sula*	**820**	286	494	1026
Great frigatebird	*Fregata minor*	**131**	45	71	170
Sooty tern	*Sterna fuscata*	**6169**	1043	5435	7363
Brown noddy	*Anous stolidus*	**711**	656	270	1465
White tern	*Gygis alba*	**10**	2	8	11
Blue noddy	*Procelsterna cerulea*	**0**	0	0	0
Wedge-tailed shearwater	*Puffinus pacificus*	**16**	8	7	21
Bulwer's petrel	*Bulweria bulwerii*	**1**	0	1	1
Red-tailed tropicbird	*Phaethon rubricauda*	**31**	32	8	53
Brown booby	*Sula leucogaster*	**112**	132	19	205
Totals		**8001**	--	6313	10315

Figure 3. Brown noddies on the cliff face of the northwestern side of Kaula.

Figure 4. The southeastern tip of Kaula is used as a munitions target area.

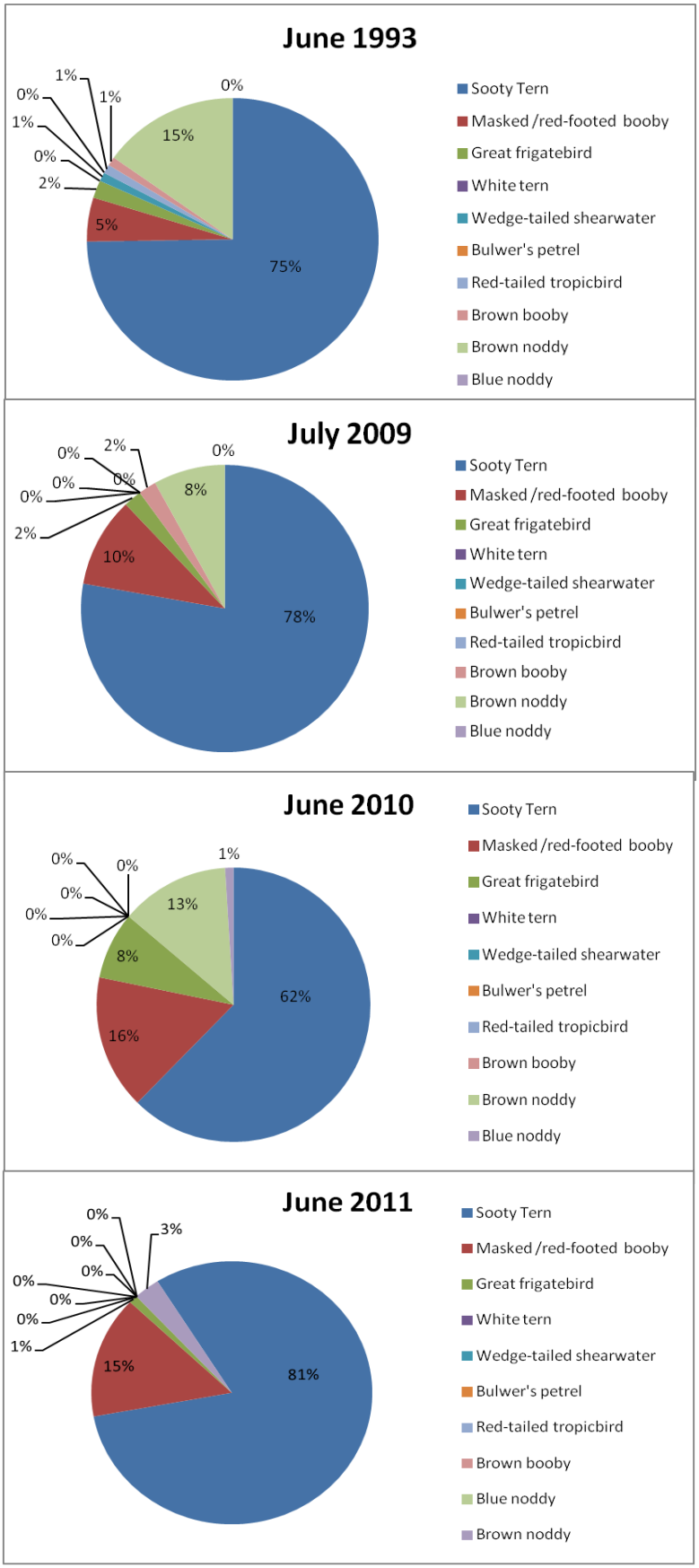
Figure 5. Sooty terns nesting on the southwest side of Kaula.

The flat plateau across the top of Kaula Island is difficult to observe from a ship, therefore limiting our ability to observe seabirds on that portion of the island. Comparing current ship-based survey data with past ship-based survey data is the most unbiased way to look at seabird usage trends on Kaula Island. More sooty terns were observed during the June 2011 survey compared with any previous summer ship-based surveys (9,745 in 2011 compared to 3,382 in 2010 and 6,169 in 2009). None of these counts compare to the last on-island count during 1993 (27,255 sooty terns). More than likely, the ship-based surveys underestimate the number of sooty terns present on the island, as many sooty terns could be present on the plateau. The number of white boobies observed during this ship-based survey was comparable to past on-island surveys. In 2011, 1,859 white boobies were counted where as in 1993, 1,942 masked and red-footed boobies combined were observed.

The June 2011 ship-based survey of Kaula Island had the highest total number of seabirds recorded compared with any ship-based summer surveys from previous years. Figure 6 shows seabird species relative abundance from the June 2011 survey compared to the summer surveys of 1993, 2009, and 2010. During all four survey years, sooty terns were the most abundant species with the most observed in 1993. The second most observed species were masked and red-footed boobies (combined). During the 2011 and 2010 surveys, more masked and red-footed boobies were observed during the 2011 and 2010 summer surveys compared with previous summer ship-based surveys in 2009 and 1993. Brown noddies were the next most abundant species observed over the past four ship-based summer surveys.

Some seabird species were not observed during our ship-based survey, or were observed in very low numbers. Nocturnal Procellariiformes, such as wedge-tailed shearwaters, nest and roost in burrows and would be very difficult to detect during the day on a ship-based survey. In addition, other species, such as brown boobies, leave their roosts to forage at sea during the day and thus would not be on island during our daytime survey.

Figure 6. Relative seabird species abundance during the June 1993, July 2009, June 2010, and June 2011 Kaula Island surveys. All surveys were conducted from a ship platform.



Nine species of seabirds were observed between Niihau and Kaula Island during the return trip to Kauai. These include five species from the order Pelecaniformes (brown booby (*Sula leucogaster*), red-footed booby (*Sula sula rubripes*), masked booby (*Sula dactylatra*, great frigatebird (*Fregata minor*), red-tailed tropicbird (*Phaethon rubricauda*), two species from the Order Procellariiformes (Bulwer's petrel (Bulweria bulwerii), and wedge-tailed shearwater (Puffinus pacificus) and two species from the Order Charadriiformes (sooty tern (*Sterma fuscata*) and brown noddy (*Anous minutes*)).

4.0 Conclusion

The total number of seabirds observed at Kaula Island during the June 2011 ship survey was on par with previous year's ship-based summer surveys. In general, the number of seabirds using the island seems to be the same, or in some cases slightly higher. Comparing multiple years' data using a similar survey technique will allow for detection of changes in seabird use of Kaula Island over time. If sudden changes were observed, specific management responses could be implemented.

It was difficult to count seabirds on Kaula Island from the ship. The movement of the boat, the sheer numbers of birds of some species, such as the sooty terns, and the visual limitations being so far from the island and not having a clear vantage point to observe the upper plateau all make it unlikely that the data presented here is extremely accurate. In addition to the normal difficulties of surveying from the boat, the growth of vegetation on Kaula Island also contributed to the difficulty in detecting seabirds.

5.0 Works Cited

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Appendix A

Appendix A. June 2011 survey personnel *

30 June 2011	U.S. Navy	Justin Fujimoto	Wildlife Biologist
(Ship-based survey)		Frans Juola, PhD	Wildlife Biologist
		Joel Helm	Wildlife Biologist
		Morgan Richie	Marine Biologist
		Kate Winters, GDipSc	Marine Biologist
		Robert Uyeyama, PhD	Marine Biologist
	University of Hawaii-Hawaii Institute of Marine Biology	Michael Richlen	Bio Acoustician
	NOAA-Pacific Island Fisheries Service Center	Brenda Becker	Monk Seal Biologist

*Survey dates and personnel that traveled to Kaula Island, Hawaii, 1932-Feb 2011 provided in earlier reports.