Summary of humpback whale research at American Samoa, 2003-2005

RICHARD J. ROBBINS1 AND DAVID K. MATTELL1
1Provincial Center for Coastal Studies, 3 Hoben Ave., Province-town, Massachusetts, 02655, U.S.A.
a-mail: richard@ccs.delete.host.org
2Hawaiian Islands Humpback Whale National Marine Sanctuary, 716 South Kiihi Road, Kaa-ki, Hawai'i, 96735
3U.S.A.

Abstract
American Samoa is a newly understood, promising site for humpback whale studies in Oceania. Here we describe the results of photo-identification and biopsy sampling performed on 21 days between June 10 and October 13, 2003-2005. Work was performed from a single vessel working in the coastal waters of Tutulea, the primary site of American Samoa. The detection rate was consistently low, averaging 5.3 whales per day in all three years. The most common sightings were of singletons (31%) and parent-calf pairs (21%). Few elephants were encountered, being rare, but not all were marked for that behavior. Mother-calf pairs were noted (11%) or occurred as a single large group (12%). One mother was observed on two occasions prior to her calf sighting with a ship, making it likely that the birth took place in American Samoa waters. Comparative activity was observed in 9% of groups sighted, despite the low detection observed. Comparative groups were small, ranging from only three to six whales (average 3.8). Overall, the behavior observed was consistent with those at other low-density breeding grounds, although apparent feeding was noted on one occasion. Of 20 individuals with sufficient photo-identificational data, seven were recognized from between years. However, 17% (n = 4) of those photo-identified prior to 2005 were successfully matched to other breeding sites in Oceania, including the Cook Islands, Tonga and New Zealand (French Polynesia). Together these results indicate that American Samoa is part of a widely dispersed breeding population. The future, molecular genetic analysis of skin samples from this area (n = 45) may help to clarify breeding stock structure and migratory destinations.

Keywords: SOUTHERN OCEAN, BREEDING GROUNDS, PHOTO-ID

Introduction
The distribution, abundance and stock structure of humpback whales, Megaptera novaeangliae, in Oceania are poorly understood. Recent studies indicate a complex situation of genetic heterogeneity (Garrigue et al., 2006a) and limited movement between regions previously assumed to be a single breeding population (Garrigue et al., 2006b). The majority of data with which to address these questions come from a few areas in Oceania, especially Tonga, French Polynesia, New Caledonia and the Cook Islands (Garrigue et al., 2006b). The Samoan Archipelago, located west of the French Polynesia and northeast of Tonga, is also a known wintering site for humpback whales (Kaufman, 1985; Reeves et al., 1999, and Craig, 2005). In one unpublished study, humpback whales were detected in American Samoa from June 30 through November 15, and were most common from September 15 to October 1 (Kaufman, 1985). However, no research has been performed since 1983, and a recent visual/aurometric survey at the adjacent islets of Western Samoa identified only three humpback whales (Nood et al., 2006). In 2007, photo-identification and biopsy-based research were initiated to clarify the stock identity and initial use patterns of humpback whales in American Samoa waters.

Methods
Between 2003 and 2005, vessel surveys were performed in the coastal waters of Tutulea, the main island of American Samoa (Figure 1). Effort focused on late September and early October in order to maximize the number of animals available for photo-identification and biopsy sampling efforts. Surveys were performed on a total of 27 days over the three seasons, from a 7-meter vessel working within three miles of the Tutulea coastline.

The vessel was launched daily from either the north or south side of the island, depending on prevailing weather. Two experienced observers were on watch at all times, except during other unobstructable sighting conditions and to and from the launch site. Vessel track was automatically logged by GPS at 3-minute intervals.

When humpback whales were encountered, the time, position, group size and group behavior were recorded. Photographs were obtained of the right and left flukes and the flukes using a Canon digital SLR equipped with a 100-300-mm zoom lens. Images were shot in 24-bit color at a resolution of 3072 x 2048 pixels and saved in jpeg format. Tissue samples were obtained from selected individuals following biopsy techniques (Phillips et al., 1996) or by the collection of scoughed skin (Clayton et al., 1993).

Behavioral classes were assigned based on group size, composition and the presence of stereotypical wintering ground behaviors, such as competitive groups (Tynock and Whitehead 1983) or singing. Although not a primary objective of this project, songs were recorded on six occasions. In 2003, recordings were made with a video.
RESULTS

Six surveys were limited to the northern side of Tautau, 10 to the northern side and 11 encompassed portions of both at circumnavigation of the island (Figure 2, top). Whales were found in all of these areas, but were slightly less common to the south and east (Figure 2, bottom). Daily detection rates ranged from 0 to 13 whales per day, with an average of 5.5 whales per day in all three areas. As shown in Figure 3, movement tended to parallel the coastline. Otherwise, there was no apparent preferred direction of travel.

The most common sightings were of singletons (31%) and paired whales (22%). Four singletons were confirmed to be nursing, but not all were checked for that behavior. Calves made up 13% of all individuals sighted. Mother-calve pairs were almost (15%) or exceeded by a single large whale (12%). One mother was observed on two occasions prior to her first sighting with a calf, making it likely that the birth took place in American Samoa waters. Competitive activity was observed in 9% of groups sighted, despite our low densities observed. Competitive groups were small, ranging from only one to six whales (average-3). The waters of American Samoa are relatively productive and feeding was observed on one occasion. Several other sightings occurred in the vicinity of seal-rich areas, although we did not witness feeding in these instances. Defecation was never observed.

Tissue samples were obtained from nearly half of the individuals encountered over three seasons. Sampling represents a range of behavioral classes, including singletons (n=2), other singletons (n=3), paired whales (n=15), single cows to calves (n=1), and competitive group members (n=17). Sample collection was obtained from two calves, but biopsy sampling of mothers and calves was prohibited by permit. Tissue samples have been offered to geneticists studying humpback whales in the Southern Oceans, but no results are currently available.

Of 92 sightings in the study period and re-identified at least once, 62% were bulls, 27% cows, and 11% singletons. The maximum interval between re-sightings was 74 days (n=1) and the average was 2.3 days. High quality humpback whale documentation was obtained from 50 individuals, some of which were re-sighted between years. Nevertheless, 63% (n=4) of those photo-identified prior to 2005 were successfully matched to other humpback whales in Oceania, including the Cook Islands, Tonga and French Polynesia (n=2) To date, there have been no successful high latitude matches.

DISCUSSION

The results of this study indicate that American Samoa is a low-density whaling area where mating and calving likely take place. We observed the full range of behaviors typically found on humpback whale breeding grounds. Furthermore, the observation of one female whale before and after calving strongly suggests that at least some females occur in American Samoa waters. Although our encounter rates were low compared to those breeding grounds, they were considerably higher than recent observations at Western Samoa, just 80 km west of our study area. In 24 days at sea, Not et al. (2006) reported an average of only 0.25 whales sighted per day. A co-executive project with the Western Samoa Division of Conservation and Environment is planned for 2006 and may provide insight into differential habitat use between these two areas. Remove acoustic packaging, primarily for deployment at American Samoa in 2006, should also improve our knowledge of humpback whales in the area.

Based on the frequency and spans of within-season sightings, lack of clear directional travel and evidence for in situ calving, it is possible that American Samoa is a migratory end point for some whales. However, we have not yet re-identified any individuals between years. By contrast, 1% of identified individuals have been successfully matched to other breeding sites. This discrepancy may reflect a lower likelihood of return to American Samoa, or a lower probability of making a successful return with our small enquiring catalog. However, matches to other, larger catalog systems that animals found at American Samoa can be easily matching sites in Oceania. At a longitude of 170.5W, American Samoa lies near the boundary of breeding stocks E and...
F. Three matches to day were made to the Cook Islands and French Polynesia (breeding stock F), and the Smart
stock to Tonga (proposed breeding stock E3). By constant no matches were made to New Calidonia (proposed
breeding stock E2). Contribution of work by American Samoa may therefore help to clarify the issue of breeding
stock boundaries in Oceania. The breeding range of American Samoa whales is similarly variable. Humpback
whales in this part of the swimming range are known to migrate more or less directly to the south, which
could place them in either Antarctic Area V or Area VI. Tonga lies slightly south of American Samoa and has
produced matches to both Antarctic areas. In the future, larger photographic sample sizes and matching
gentic analysis of skin specimens from this area may help to clarify breeding stock structure and geographic
distributions.

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Figure 1: Location of Tutuila, the main island of American Samoa, in the Samoan Archipelago.

Figure 2: Track lines (top) and humpback whale sightings (closed circles, bottom) at Tutuila, American Samoa, 2003-2005. Lines emanating from sighting positions indicate the distance and direction of observed displacement (not adjusted for intervening coastline).