Summary of Winter 2001 Shore-based Monitoring

of Humpback Whales, *Megaptera novaeangliae*, off the Kohala Coast

by Christine M. Gabriele, Susan H. Rickards, Adam S. Frankel and Jan Östman-Lind
Hawai'i Marine Mammal Consortium
PO Box 384961
Waikoloa, HI 96738

Final Report to the
Hawaiian Islands Humpback Whale National Marine Sanctuary
726 S. Kihei Rd.
Kihei HI 96753

INTRODUCTION

The main goal of the Hawai'i Marine Mammal Consortium (HMMC) Kohala research program is to describe short- and long-term patterns of distribution, habitat use, and behavior of humpback whales (*Megaptera novaeangliae*). While accomplishing this goal, HMMC endeavors to provide educational opportunities for students and make the resulting information available to educators, community members and resource managers. The program was initiated in 2001 with the re-establishment of a North Kohala shore-based observation site for tracking cetaceans and vessels in the study area. Funding for equipment was provided by a $4,800 grant (Appendix 1) from the Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS). The four project leaders (the authors of this report) volunteered their time and travel expenses to work with student volunteers from four local high schools to use established scientific techniques to observe whales from late January through early March 2001. The purpose of this report is to provide the HIHWNMS, HMMC boardmembers and participating schools with a summary of the findings for the winter 2001 season.

METHODS

Observation Effort: The observation site is located on the Northwest coast of the Big Island of Hawai'i at 20° 4.925' N; 155° 51.795' W and is approximately 65.6 meters above sea level. Observation sessions were conducted once per day in one of four alternating time blocks, (07:00-10:00, 10:00-13:00, 13:00-16:00 and 16:00 - 19:00) to ensure that scans were conducted at various times during daylight hours. In each three-hour observation session, we conducted three scans (weather permitting) with at least one hour separating the start times of consecutive scans. During each session, regimented scan samples were conducted by a crew consisting of two or more people. Project leaders assumed the roles of behavioral observer and theodolite operator, while students rotated through the roles of computer operator and notetaker.

Observation Protocols: All whale and vessel locations were recorded with a Sokkia DT500 theodolite with 5-second precision and 30-power magnification. The theodolite was linked to a laptop computer running a time-synchronized data-collection program, "Aardvark", developed for shore-based whale studies by Cornell University (Mills 1996). Subsequent analysis using "Aardvark" converted theodolite angles to Cartesian coordinates and latitude/longitude, with correction for curvature of the earth and theodolite height.

Prior to beginning a scan, the theodolite operator would take location "fix" on all vessels in the area. Vessels were fixed before, during and after each scan. Vessel descriptions included: size of vessel, type of vessel, size of engines. While the vessels were being “fixed”, the behavioral observer would avoid looking at the ocean or being prompted by other crewmembers regarding the presence or absence of whales in the scan area. When the theodolite operator finished fixing all vessels, the timed 15-minute scan would begin.

During each 15-minute scan, an experienced behavioral observer searched for whales in visible waters, from south to north, in approximate 30-second sweeps, alternating between hand-held Fujinon binoculars (7x50) and the naked eye. After a humpback whale pod or other marine mammal group was sighted by the observer, descriptive information was recorded and location data was obtained via theodolite. Whales were fixed at least once during and/or after the scan. A whale pod was defined as one or more whales

within 3 whale-lengths, moving in the same general direction and/or surfacing and diving in synchrony. Pods were numbered sequentially for each observation session. Pods that were sighted in more than one scan were given a new pod number. Environmental variables including Beaufort sea state, relative visibility, swell height and glare were noted at the start of each scan and updated as conditions changed.

Student Involvement: Through the Kula Nai'a Foundation's marine science "Ocean Explorers" Program, 12 intermediate and high school students from schools including Waimea, Honoka'a, Kohala, Kealakehe and Kanu o' ka Aina charter school, took turns in the field, assisting the project leaders with the scans described above. Some students participated during school hours as part of their academic curriculum, while others were involved in the program as an extracurricular activity. A few students completed whale-related projects assigned to them by their teachers, in association with their participation in the research program. Honoka'a High School students used data collected during the study to learn math and science concepts by accessing a database posted on a web site developed in conjunction with "Unplugged Networks for Learning".

RESULTS

Humpback Whales: From January 27 through March 17,2001, shore-based observation sessions were conducted on 21 days, totaling 47.2 h of effort and 54 scans (Table 1). During these scans, a total of 330 pods composed of approximately 520 whales were sighted. The number of pods detected per scan ranged from 1-14. The mean number of pods detected per scan was 6.11 (s.d.= 2.6). The number of whales sighted per scan ranged from 1 to 16, with an average of 9.6 (s.d. = 3.9), with mean number of pods peaking in February (Table 2). A calf was present in 6.5% of pods sighted, increasing throughout the season from 1.5% in January to 15.3% in March (Table 2). The maximal number of calf pods sighted in a scan was 3, on March 16. The mean number of pods sighted in the early morning time block was slightly greater than for other blocks (Table 3, Fig. 1).

Table 1. Scan Effort at Kohala Shore Site: Winter 2001

TIME BLOCK	# DAYS	#SCANS
07:00-10:00	4	10
10:00-12:00	6	16
13:00-15:00	6	15
16:00-18:00	5	13
TOTAL	**21**	**54**

Table 2. Mean Number of Humpback Whale Groups and Vessels Sighted by Month: Kohala Shore Site, Winter 2001

MONTH	NUMBER OF SCANS	MEAN #PODS PER SCAN (Std Dev)	% PODS WITH CALF	MEAN #VESSELS PER SCAN (Std Dev)
January	12	5.4 (1.4)	1.5	4 (1.5)
February	25	7.2 (2.0)	11.6	6.1(2.9)
March	17	5. 0(3.4)	15.3	3.9(1.9)

Other Cetaceans: Humpback whales were the predominant species sighted, but other cetaceans identified during observations included 4 groups of spinner dolphins *(Stenella longirostris*) sighted on February 5, 7, 18 and March 18. Two groups of false killer whales (*Pseudorca crassidens*) were sighted, on February 2 and February 9. The February 2 group of false killer whales contained at least 30 individuals.

Vessels: We saw an average of 5.1 vessels in each scan (s.d. = 2.6). Only one scan had no vessels present, on March 18 in the 7-9 AM time block. The maximal number of vessels sighted was 13, on February 18 in the 10-noon time block, although two other days had scans containing more than 10 vessels. The 1000 to 1200 time block tended to have more vessels (Table 3, Fig. 1), but the average number of vessels across all time blocks ranged from 4.0 to 6.6 vessels.

Table 3. Mean Number of Pods, Whales and Vessels Sighted by Time Block: Kohala Shore Site, Winter 2001

TIME BLOCK	MEAN #PODS PER SCAN (Std. Dev.)	MEAN #WHALES PER SCAN (Std. Dev.)	MEAN #VESSELS PER SCAN (Std. Dev.)
07:00-10:00	7.1 (2.6)	10.8 (4.5)	4.3 (2.8)
10:00-12:00	5.3 (2.5)	9.1 (4.0)	6.6 (2.9)
13:00-15:00	6.6 (3.3)	10.3 (4.8)	4.9(1.9)
16:00-18:00	5.7 (1.7)	8.6 (2.8)	4 (2.3)

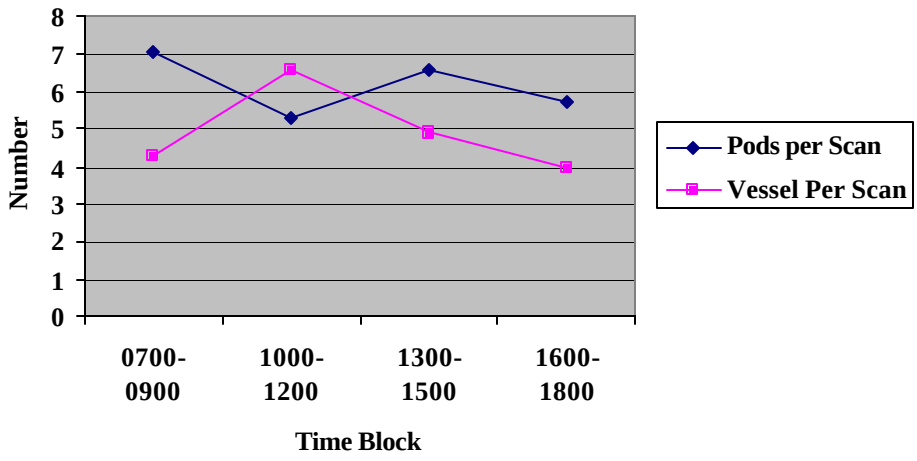
Aircraft: During 3 scans in the 10-12 noon time block on 3 different days, aircraft were sighted flying over the scan area. No other aircraft were sighted during scans. On February 18 in the 10-12 noon time block, 3 airplanes were sighted, although observers were unsure whether these were repeated passbys of the same plane. Aircraft that flew overhead on land were not counted, nor were aircraft passing outside the scan area.

DISCUSSION

Whale and Vessel Results: Patterns of whale and vessel use of the study area seemed consistent with observations by some of the authors during other studies from the Kohala observation site (Frankel et al. 1995; Frankel and Clark 1998). The increasing proportion of pods containing a calf (Table 2) in February and March was consistent with previous studies. No obvious diel changes in the number of whales or the number of vessels were evident (Table 3).

In the first year of this monitoring program we can not offer any interpretation of whale or vessel trends because we have no basis of comparison. However, by continuing the shore-based monitoring at similar levels of effort in future years, we will be able to create a database on the relative distribution and abundance of whales and vessel traffic that becomes increasingly valuable over time for understanding the enigmatic but potentially serious effects of continually increasing levels of human marine activity and coastal development in Hawai'i. This study will also provide long-term data on Sanctuary resources and may guide the agency's efforts to protect and conserve humpback whales and their habitat.

Figure 1. Mean Pod and Vessel Numbers by Time Block



Education: We were encouraged by the number of students and high schools that were interested in participating in the whale study. We were also impressed by the students ability to quickly learn the techniques we taught them. Despite some logistical and scheduling challenges, we felt that the collaboration was beneficial to the students and to the research.

Future Plans: The Winter 2002 research season is in the planning stages. We plan to approach the schools that participated in 2001 to solicit interested students for next year's research effort. We firmly believe that one of the main benefits that HMMC can provide to local communities is the opportunity for students to engage in marine mammal research. HMMC members will be discussing whether to limit the 2002 field observations to February in order to provide better staffing coverage, as we find the level of effort that HMMC can sustain over the long term. We hope to find long-term financial support for this program, but in the meantime, funding for small stipends for HMMC staff, as well as travel and living expenses for those HMMC project leaders who do not reside on the Big Island would help us to maintain this study. We would also like to purchase a hydrophone and DAT recorder to obtain opportunistic recordings of humpback whale song each winter, allowing us to create a Hawai'i humpback whale song library to be made available to students.

The 2001 field effort was the HMMC's first step toward implementing a comprehensive program which in the future would include passive acoustic monitoring. A combination of shore-based and passive acoustic techniques used in previous cetacean studies provided meaningful information on natural whale behavior, as well the short-term effects of vessels and other anthropogenic stimuli (Frankel and Clark 1998 but also see summaries in Richardson and Würsig 1995). Additional funding would be needed to move HMMC to this next research phase.

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LITERATURE CITED

Frankel, A. S., C. W. Clark, L. M. Herman and C. M. Gabriele 1995. Spatial Distribution, Habitat Utilization, and Social Interactions of Humpback Whales, Megaptera novaeangliae, off Hawai'i, determined using Acoustic and Visual Techniques. Can. J. Zool. 73: 1134-1146.

Frankel, A. S. and C. W. Clark 1998. Results of low-frequency playback of M-sequence noise to humpback whales (Megaptera novaeangliae), in Hawai'i. Can. J. Zool. 76(3):521-535.

Mills, H. 1996. Aardvark computer software. Bioacoustics Research Laboratory, Cornell University.

Richardson, W. J., and B. Würsig 1995. Significance of Responses and Noise Impacts. In: Marine Mammals and Noise. W. J. Richardson, C. R. Green, C. I. Malme, D. H. Thomson (eds.). Academic Press, San Diego, CA.

APPENDIX 1.

Hawai'i Marine Mammal Consortium 2001 Financial Report on $4,800 Funds Provided by the Hawaiian Islands Humpback Whale National Marine Sanctuary

CATEGORY	DESCRIPTION	COST
Equipment		
	Sokkia DT500 theodolite	$3,744.77
	Computer to theodolite cable	$224.50
	Fujinon 7 x 50 reticle binoculars	$216.74
	Power Inverter	$48.70
	Battery Charger	$22.88
Supplies		
	Miscellaneous supplies	$41.43
Other Costs		
	Internet access	$303.40
	Photocopying	$3.75
TOTAL		**$4,606.17**
Remaining funds for Winter 2002 Study		**$193.92**