A Preliminary Acoustic-Visual Survey of Cetaceans in Deep Waters around Ni'ihau, Kaua'i, and portions of O'ahu, Hawai'i from aboard the R/V *Dariabar* February 2005

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TABLE OF CONTENTS

Section Page

EXECUTIVE SUMMARY ..... **v**

ES.1 Introduction v
ES.2 Results v
ES.3 Conclusions vi
ES.4 Recommendations vii

LIST OF TABLES

Table

LIST OF FIGURES

Figure

Figure 1. R/V *Dariabar* tracks during the Ni'ihau-Kaua'i-O'ahu cruise Feb. 17-24, 2005.

Figure 2. Schematic of passive acoustic detection and location system (PADALS) used for project.

Figure 3. Example of a localized sound as displayed in Whaltrak.

Figure 4. Track lines of *Dariabar* with types of visual and acoustic effort periods during the Ni'ihau-Kaua'i-O'ahu cruise Feb. 17-24, 2005.

Figure 5. Timeline of events and types of visual and acoustic effort conducted during the Ni'ihau-Kaua'i-O'ahu cruise aboard the R/V *Dariabar* Feb. 17-25, 2005.

Figure 6. Summary of "on effort" visual observations (in hours) by Beaufort Wind Force categories.

Figure 7. Visual and acoustic localizations/detections of minke whales relative to survey effort type.

Figure 8. Visual and acoustic locations/detections of minke whales relative to survey effort type for Kaua'i and Ni'ihau.

Figure 9. Visual and acoustic locations of beaked, pilot, sperm, and unidentified whales relative to survey effort type.

Figure 10. Visual and acoustic locations of humpback whales relative to survey effort type.

Figure 11. Visual and acoustic locations of humpback whales relative to survey effort type for Kaua'i and Ni'ihau.

APPENDICES

Appendix

A Description of the R/V *Dariabar*
B Direction Finding and Ranging (DiFAR) Sonobuoy Tests
C Description of Encounters with Minke Whale and Beaked Whales
D Recommendations

EXECUTIVE SUMMARY

ES.1 INTRODUCTION

Passive acoustic-visual surveys for deep-water cetaceans were conducted from February 17-24, 2005, around the Hawaiian islands of Kaua'i, Ni'ihau, and portions of O'ahu from the R/V *Dariabar*, an 87-ft schooner (the Ni'ihau-Kaua'i-O'ahu cruise). As part of this effort, a deep-water survey was conducted on Feb. 22-24 known as the "Na Pali-Ni'ihau" survey.

There is currently a paucity of information about deep-water species of cetaceans around the main Hawaiian Islands. The goals of this project were designed to address this data gap.

Our primary goals were:

1. **To conduct a preliminary pilot survey for cetaceans in deep waters (>100-2500 fathoms) where previous survey effort has been limited.** Although deep-diving odontocetes were the initial focus of this effort, minke whales (a species recently indicated as the source of the mysterious "boing" sound in the North Pacific) were also of interest.

2. **To test and implement passive acoustic methods (complemented with standard visual survey methods) in order to maximize encounter rates of deep-water species.** The passive acoustic detection and localization system (PADALS) we used consisted of dual towed-hydrophone arrays and an associated processing and recording system. In addition, a directional finding and ranging (DiFAR) system was tested for detecting and locating sources of low-frequency (<1 kHz) cetacean vocalizations.

ES.2 RESULTS

Over 745 km of vessel effort was conducted for the entire deep-water research effort (excluding Feb. 19-20, shallow water effort). Various tests of the passive acoustic system occurred during the first five days of the research effort. Visual observations were conducted during daylight hours, whenever conditions allowed, throughout the entire research effort (Feb. 17-24). A total of 586 km visual observations were conducted during this period. Over half of this total (~285 km) consisted of "on

effort" observations (the remaining being opportunistic effort) and resulted in a total of 78 groups (179 individual cetaceans) sighted by observers (shallow and deep-water effort combined). Species observed included the minke whale, humpback whale, bottlenose dolphin, spinner dolphin, short-finned pilot whale, unidentified beaked whales (probably the dense-beaked whale, *M. densirostris*), unidentified whales, and unidentified dolphins. As expected, the humpback whale was the most commonly sighted species (n = 56).

The last three days (Feb. 22–24) of the study were dedicated to the Na Pali-Ni'ihau survey, a deep-water acoustic-visual survey. This effort resulted in a total of ~390 km of vessel tracks in water depths >100 fathoms. Of this total, visual observations were conducted for 95 km (17% of total). "Normal" acoustic effort was conducted for 283 km (72% of total track). Acoustic effort was ~2.5x that of visual effort (acoustic effort was conducted at day and night).

During the deep-water Na Pali-Ni'ihau survey, 20 visual sightings (41 individuals) of cetaceans were made (encounter rate = 0.21 animals/km). All sightings made during the deep-water survey were of humpback whales or unidentified large whales. In addition, over 200 acoustic detections of cetacean vocalizations were acquired from humpback whales, minke whales, and unidentified dolphins. Over 150 bearings-to-sources were obtained, resulting in a total of 12 location estimates. Six of these were of minke whales (all in waters >100 fathoms) and 6 were of singing humpback whales (5 in waters >100 fathoms). An additional 49 acoustic detections were made from auto-recorded data (automatic acoustic recordings at night), mostly of minke whale "boings". A group of sperm whales was acoustically detected on the first night, during the transit from O'ahu to Kaua'i, but was not followed due to time constraints (relating to travel to the project site on Kaua'i).

ES.3 CONCLUSIONS

This pilot study resulted in successful testing and implementation of quite complex acoustic equipment. Traditional visually-based field methods were effectively complemented with newer passive acoustic methods. This resulted in much higher encounter rates than possible from using either method alone. More importantly, we were able to collect new and important information on a variety of species (including some rarely documented near Hawaii) in a relatively short period of time.

The sighting of a minke whale close (< 50 nm) to the Hawaiian Islands is unique, and provides new information about the occurrence of this species in Hawaiian waters. The numerous acoustic detections and estimated locations of minke whales made during our deep-water Na Pali-Ni'ihau survey (Feb. 22-24) are perhaps more significant than the visual documentation as they imply that minke whales may be relatively common near the Hawaiian Islands during winter/spring.

Finally, we were able to detect, both visually and acoustically, numerous other species, including sperm, pilot, and beaked whales. Information on the ecology, behavior, distribution, and habitat requirements for many of these species is presently lacking, especially for the Hawaiian Islands region. This information is critical if effective and

informed decisions are to be made about management and conservation of these important living marine resources.

The results of this preliminary study illustrate the complementary nature of utilizing both visual and acoustic methods, which is perhaps the most effective method for surveying and studying cetaceans in deep waters. The success of this effort was due to the expertise and broad experience of our scientific team, and also because of the unique capabilities of the research platform (R/V *Dariabar*) and crew. We are currently working with others researchers to develop powerful techniques (e.g. 3-D tracking from hydrophone arrays, data-logging tags, and autonomous acoustic recorders) that will enable us to study elusive marine species more effectively.

ES.4 RECOMMENDATIONS

Recommendations for future research include the following:

- Additional surveys are needed to more adequately assess the occurrence of deep-water species, especially minke whales and deep-diving species. Although we did not detect many deep-diving species, additional development of our PADALS system should result in improved capabilities to detect and monitor other species, including sperm whales, beaked whales, and perhaps even pygmy and dwarf sperm whales.

- If density and/or abundance estimates are a goal of future surveys, it would be useful to determine minimum sample sizes (# of encounters) needed for the required precision (e.g. minimum Co-efficients of Variation [C.V.]) desired for each species or species group. This will allow the appropriate amount of sampling effort (i.e. ship-time required) to be estimated ahead of time.

- Further develop the PADALS (Passive acoustic) system to include automated 3-D localization and tracking of cetaceans.

- Conduct low-frequency monitoring for blue and fin whales using DiFar and towed hydrophone array listening stations.

- Increase auto-record sampling periods or better, make continuous recordings of acoustic data during all encounters and when off watch.

- Incorporate a tagging component to obtain more detailed information about deep-diving species such as their vocalization rates, acoustic behaviors, movements, and impacts from anthropogenic noise.

- Implement a centralized (i.e. networked) data-logging system that incorporates relational databases for both acoustic and visual survey/tracking programs (e.g. Whaletrack II and/or Logger incorporates some or all of these features).

- Employ a second vessel for additional small boat operations.

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Citation Page

These are the appropriate citations to use for this report and the related databases:

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Cetos 2005a. Compiled Visual Sighting Survey Database, R/V *Dariabar,* February 2005. Cetos Research Organization, Bar Harbor, ME. Database prepared under contract #2057sa05-F to Geo-Marine, Inc. for NAVFAC Pacific.

Cetos 2005b. Compiled Acoustics Sighting Survey Database, R/V *Dariabar,* February 2005. Cetos Research Organization, Bar Harbor, ME Database prepared under contract #2057sa05-F to Geo-Marine, Inc. for NAVFAC Pacific.