MARINE SKILL REPORT SUBMITTED TO THE
UNIVERSITY OF HAWAII
MARINE OPTION PROGRAM

Pacific Whale Foundation's Humpback Whale Recovery Project

DURATION

January 5, 1992-January 16,1992

PROJECT ADVISORS
Greg Kaufman and Paul Forestell

PROPOSAL DATE
December 23, 1991

FINAL REPORT DEADLINE

March 23, 1992

By

Kelly Woodward

UHM MOP Student

TABLE OF CONTENTS

PAGE

INTRODUCTION

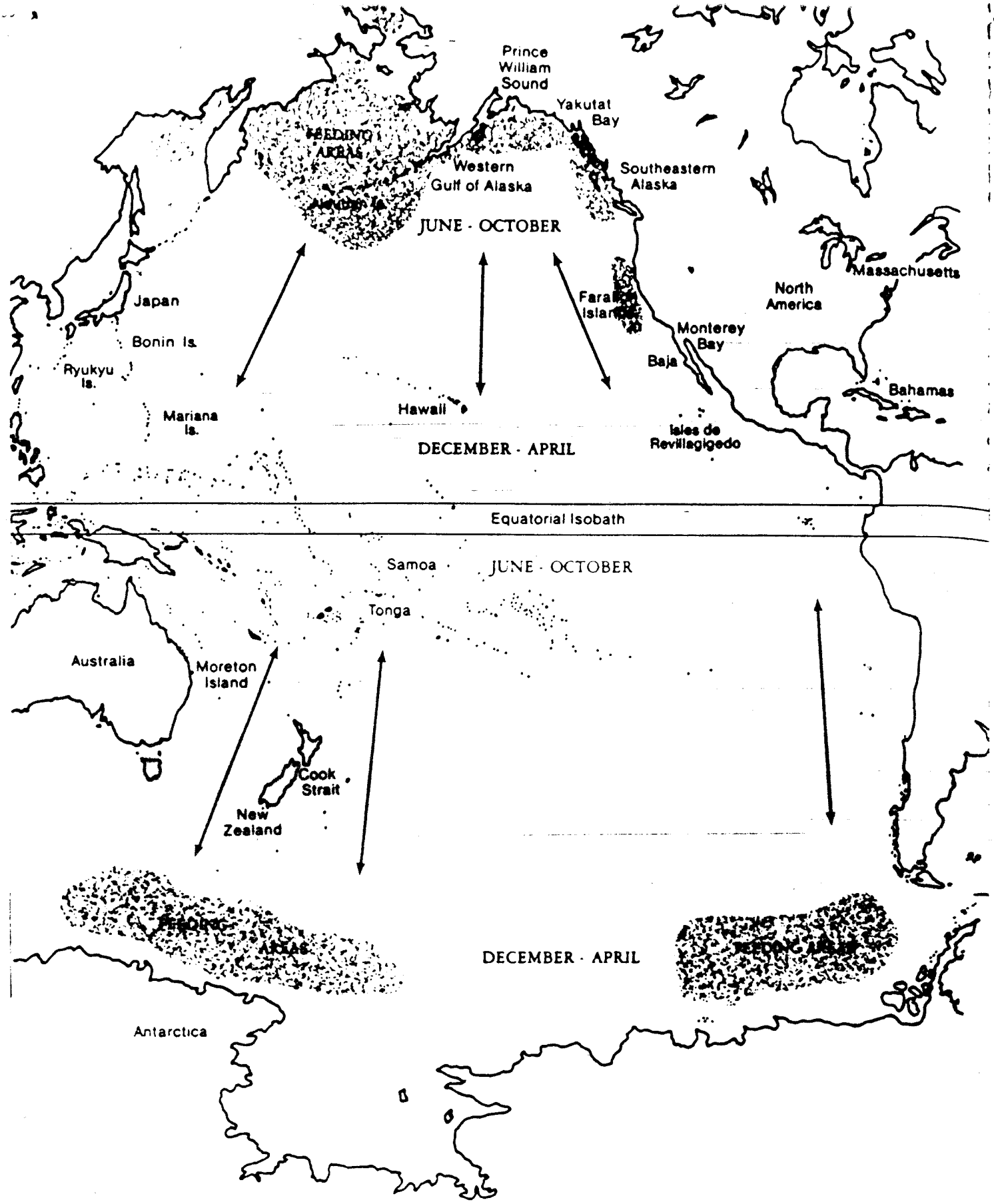
The Pacific Whale Foundation (PWF), is a research, conservation and education organization that specializes in the study of marine mammals and their ocean environment. PWF was founded by scientists and concerned environmentalists who felt a common need for an organization to support benign research projects that would benefit marine ecosystems. The internship program combines the expertise of scientists and field researchers with the commitment of interns-concerned individuals with a keen interest in the marine ecosystem.

The Pacific Whale Foundation was begun by Greg Kaufman, a marine biologist interested in field studies of humpback whales, Megaptera novaeangliae. He was interested in gathering public support through educational programs such as internships, adopt-a-whale, and school visits and field trips, and through educational marine tourism (whale watching), for whale studies. Such "Ocean Outreach" programs as these are based on experiential education which introduces the general public to a challenging environmental concern, or exposes them to a significant environmental experience (usually whales or dolphins), and presents them with practical alternative strategies for resolving the concern. The Pacific Whale Foundation is a non-profit organization that has grown over the years. In 1979 they began offering whale watch expeditions for the public that were based on scientifically sound natural history interpretations of the whales that

migrate to Hawaiian waters each winter. Funds generated from the whalewatches were used to support scientific field studies of humpback whales.

Currently the Pacific Whale Foundation is concentrating on studies of marine mammals in Hawaii, Alaska, Japan, Australia; tropical reef studies in Hawaii, and the impacts of marine debris in the Pacific. The Pacific Whale Foundation believes that scientific study of the marine mammals is crucial to the endangered species' survival, and will enhance education programs for the general public.

The Hawaiian archipelago is an ideal place for studying the humpback whale due to its geographical location as the winter breeding and calving grounds to which the humpback whale migrates from its summer feeding ground in Alaska (Baker et al., 1986; Kaufman and Forestell, 1986). Hawaii along with two other winter breeding grounds, one in Mexican waters including the Baja Peninsula, Gulf of California, and Islas de Revillagigedo (Urban and Aguayo, 1987), the other located south of Japan, among the Ogasawara, Ryukyuan and Marianas Islands (Nishikawa, 1966), (Figure 1), is believed to hold the largest breeding population (Herman, et al., 1980; Baker and Herman, 1981). The humpback whales arrive from Prince William Sound and southeast Alaska to Hawaii during the months of November and December, and the last whales of the season are usually seen in May. Current research by the Pacific Whale Foundation indicates there may be as many as 3,000 humpback whales in the North Pacific, with



Map of the Pacific Ocean showing major feeding and breeding areas of the humpback whale. Arrows indicate general movement trends and not specific migratory routes.

approximately 1,500 of those coming to Hawaii in a given year.

The Pacific Whale Foundation stands out among environmental organizations due to the long-term field studies that they are involved in. Research by the Pacific Whale Foundation has led to the development of marine parks in New Zealand and Australia and whale watching regulations in Hawaii and Australia. They also have supported research projects on the Ganges River dolphin, Plantanista gangetica, and the Chilean dolphin, Inia geoffrensis. Their photo-identification studies have increased our understanding of the migratory movement of whales between Mexico and Hawaii, and between the Antarctic and east Australia. Comparison of the humpback whale songs collected by Pacific Whale Foundation scientists in Japan and Hawaii has led to important new discoveries about stock separation in the North Pacific (PWF Advance Information packet).

By participating in the PWF internship I assisted scientists with vital whale research, that provided me with an ideal opportunity to gain hands on experience in field research, as well as an opportunity to become better acquainted with marine mammals in their natural environment. I helped with many phases of data collection. I was trained in such areas as photography, boat handling, equipment maintenance, such as the theodolite and other data collecting devices, behavioral data collection and field data analysis. I gained additional knowledge through informal lectures and discussions

on topics like marine biology, cetaceans and underwater photography.

METHODS AND MATERIALS

Description of 1991-1992 Hawaii Humpback Whale Research Effort

1. Continuation of contract with US Army Corps of Engineers to document humpback whale abundance and distribution patterns in Maalaea Bay on Maui;
2. A study of respiration patterns of humpback whales in pods of different size and composition.
3. Shore station study to examine whale-boat interactions and respiratory rates.

Maalaea Bay Survey:

Purpose of the study: National Marine Fisheries Service has designated Maalaea Bay as cow/calf waters, to protect the new mothers and their calves. As such, greater restrictions have been placed on boat approaches in Maalaea Bay (no closer than 300 yds.) than in other areas in Hawaii (100 yds.). The purpose of the present study was to determine, through systematic surveys, whether there is a greater density of mother with calves inside Maalaea Bay than in an equal-

sized area outside Maalaea Bay. Additionally, the general density patterns of whales overall was documented throughout the study area, to determine whether there are differences in distribution that may be correlated with depth contour, density of boat traffic, or time of year. Finally, we wish to determine whether the 300- yard limit is effective in reducing the number of close approaches by boats, by comparing the rate of close approaches by boats in the 300-yard area, with approaches within the 100-yard area.

Importance of study

The data from the present study are critical to a full understanding of the significance of Maalaea Bay and the surrounding area as critical habitat for mothers and calves. Data from this study have been requested by the U.S. Army Corps of Engineers as part of their Environmental Impact Study on the expansion of Maalaea Bay Small Boat Harbor.

Surfacing Intervals of Focal or Specifically observed Pods:

Purpose of the Study: The second boat-based project is a two-year study aimed at determining the respiration frequencies and surfacing patterns of pods of different size and composition (i.e., with or without a calf). This will be the second and final year of the study, to be conducted from January through April, 1992.

Importance of study

Results of this study will be used to derive a correction

factor for abundance estimates based on our aerial survey results, to account for proportion of animals present but not observed at the surface during overflights. Previous work has been done in Alaska and in Hawaii on respiration rates, but the Alaska data can not be generalized to Hawaii, given significant differences in water temperature and its effect on the physiology of animals, the difference in reproductive state, and the major difference in primary activities of the whales (i.e., feeding in Alaska, but not in Hawaii; reproductive and nursing activities in Hawaii, but not in Alaska).

Shore Based Station

Purpose of Study: A shore station was set up along the Maalaea Bay coastline to document whale-boat interactions and provide data on respiration rates for pods of various composition (i.e. with or without a calf). Observing whales from a non-intrusive site on land clarifies results collected from research boat operations in the same area.

Importance of study: This study provided important data on whale-boat interactions from a non-intrusive viewpoint, enhanced existing respiration data and verified results collected from boats in the same operation area. In addition, this data will be compared with earlier shore- based work

done during 1981 and 1983 (Info. about research projects from PWF Advance information packet).

The research itself involved: observation from land, photographic identification and acoustic work on the water, and aerial surveys. When observing mammals from shore, we used binoculars and a theodolite to track the movements of the animals. We used data sheets to record exact location, speed, direction of travel, behavior and pod composition. Researchers also used small, inflatable boats with outboard motors to maneuver near and among the animals.

The internship program was designed to develop my ability to observe, measure, and analyze. I was carefully guided in the development of some of the following field techniques: small boat handling, population modeling, acoustical recordings and analysis, behavioral observation, computer and theodolite operation, scientific report writing, and journal skills.

My final report includes a summary detailing my experiences during the internship. I provided information about the data collecting processes we engaged in, and how the data that we collected contributes to the PWF's on going studies. I will include photographs taken during the internship to illustrate the experience. I also discuss how I benefited personally from the experience, including skills I have gained, and knowledge I have acquired through the internship.

THE PWF INTERNSHIP EXPERIENCE

In completing the PWF internship I have come away a more knowledgeable, skillful, humpback whale enthusiast. Participating in the collection of data from the shore station on Pu'u Olai, and from boat surveys on Ma'alae'a Bay, I have acquired such skills as theodolite operation, boat maintenance, data collection, and data organization. Utilizing such basic scientific instruments as a bearing compass, stopwatch, and binoculars, in studying the humpback whales, has made me more confident about my basic research capabilities.

Working together with others that share my enthusiasm and eagerness to learn about and contribute to humpback whale research was a very enjoyable and satisfying experience. I recommend this experience to anyone interested in humpback whale research, or to anyone who has a keen interest in cetaceans.

Through the internship I got a taste of what scientific research entails, as far as collecting raw data for on going studies, and then organizing that data for later analysis to answer such questions as: How will the humpbacks be affected by the expansion of Maalaea harbor? What are the respiration frequencies and surface patterns of pods of various sizes and composition? What are people's individual perceptions of the 100 yard distance between themselves and a whale on the ocean? Do people overestimate or underestimate the distance? During the course of the 11 day internship we

alternated shore station and boat days. I will describe in detail the process of data collection for each vantage point and conlude with my personal impressions of the experience.

SHORE STATION: PU'U OLAI

After a day of orientation and familiarization with the instruments used in the studies, we set out for the shore station Pu'u Olai, a cinder cone 360 ft. in elevation. Once you reach the top you are rewarded with an excellent view form La Perouse Pt. across Ma'alae'a Bay to Kaho'olawe, and over to the west Maui mountains. We begin by setting up the theodolite. The theodolite is centered over a permanent premarked X on a rock embedded in the dirt. La Perouse at 0°, and the Kihei coastline at 360°. Our fixes or the angle and bearing obtained on either whales or boats is within this 360° range. All the interns got a chance at setting the theodolote onto the stand and leveling it. Once this is done everyone prepares for their job for the day, these include: theodolite operator, observers (usually two people with binoculars), data recorder (with data sheet and stopwatch).

We start by doing a weather check, which consists of: wind speed, wind direction, overall visibility: 1-good, 2-fair, 3-poor, sea state (Beaufort scale), cloud cover (%). This information, as well as the study start time is recorded on the hill data sheet (Appendix 1). We then start a "window" of observation. Our observations consisted

of three windows: whale window, boat window, and focal pod window. the first two windows lasted 15 minutes, the last window 30 minutes. Observation begins as soon as a whale or usually a "blow" is spotted. The theodolite operator must locate the whale with the theodolite that has usually been spotted by an observer, quickly lining the cross hairs of the theodolite up with the whale before the whale does a warning "fluke-up" dive and dives down for as long as 10 minutes, only to resurface in a new location. As soon as the theodolite operator locks the theodolite onto the whale he yells "fix". The data recorder must immediately record the time from the stopwatch, then take down the angle and bearing of the whale, recited by the theodolite operator. During the boat window, using the theodolite we scanned the entire bay form La Perouse Pt. to Kihei coast, getting a fix on every boat therein, for boat distribution information.

Then for the focal pod window, we focus on one pod, ideally we have traced the movement of a surface active pod from the "whale window" and are able to focus on it right away for the focal pod window, by getting fixes on it whenever it surfaces during that 30 minutes.

The shore station and the boat kept in contact by VHF radio. The shore station can be very helpful in spotting pods from their vantage point. Also, when the boat approaches a pod the shore station gets a fix on the boat and the pod that the boat is "on" or observing. This is compared and verifed with the boats distance estimations of how close

they think they are to the whale (Appendix 2). Also, by getting a fix with the theodolite, we have data that can verify the actual distance the boat was from the whales in case there is any question from shore observers, or the National Marine Fisheries Service later.

All the data gathered form the shore station will be plotted onto the computer that evening. The window data is plotted onto a program identical to the data sheet, and the distance estimations are plotted onto a map.

BOAT SURVEY

Boat observations from the Achilles in Ma'alae'a Bay were accomplished without a NMFS permit so we had to adhere to the distance limitation of 300 yards within all inshore waters from Hekili Point at Olo Walu to Pu'u Olai at Makena, the calving and breeding grounds, and 100 yards outside of that boundary. As we headed out into the bay we would radio the shore station to see if they were tracking any pods, and if so, direct us to that pod. After approaching the pod and staying the legal distance away, we would start our data collection. We started the data collection by recording spot time, contact time, weather conditions, and pod behaviors (Appendix 3). The respiration time is taken with the stopwatch. Respiration time is the accumulated time the whale is visible above the water, until a fluke-up dive when the "down-time" is timed, the total time the whale spends underwater until it resurfaces with a blow. The down-time can average 5-20 minutes. At the same time

someone else using the bearing compass, got our bearings using land marks such as the light house on Molokini, Pu'u Olai, Polo Beach, smoke stack, or McGreggor Pt. Later, three of these landmarks will be plotted on the map with a parallel ruler to give us an accurate picture of where exactly we were located in the bay at that time. At the same time we radioed the shore station so they could get a fix on the boat, and the pod of whales we were on, to use to compare and verify with our bearings, and to get an accurate distance between the boat and the pod. On the boat we all estimate how far we think we are from the pod and record our estimations. These estimates, and the shore stations accurate bearings will later be compared to determine peoples accuracy at determining distance on the ocean. During the course of the day we tried to come in contact and collect data on as many pods as possible. At the end of the day we headed back to the boat launch, put the boat on the trailer, pulled it out of the ocean, hosed the entire boat down, flushed the engine out tied it securely to the trailer, and headed home to organize the data.

Because of the lack of a permit the on-going photo-identification study had to be put on hold, because the boat could not get close enough to get clear fluke photos.

The studies we did gather data for included: Surfacing intervals of focal pods. The results of this study will be used to derive a correction factor for abundance estimates based on their aerial survey results, to account for proportion

of animals present but not observed at the surface during overflights. The data gathered from the shore based station will provide important information on whale-boat interactions from a non-intrusive viewpoint, enhance existing respiration data and verify results collected form boat operations in the same operation area. The distance estimation data will be used to determine whether or not the distance laws protecting whales in Hawaiian waters are fair. Do people tend to over estimate or under estimate distance on the ocean. Judging from our estimations alone, there is a wide range of distance perception on the ocean from the same location.

As a result of observing pods of whales from the boat and shore station, I became familiar with what to look for when trying to spot a whale. The most obvious behaviors include:A blow- a visible plume created when a whale exhales at the surface, usually 3-5m high, that dissipates after 2-10 seconds. The appearance of the dorsal fin at the surface of the water as the whale swims along. The peduncal arch- the animal arches the caudal peduncal or tail stalk in a very pronounced fashion during a diving sequence, this is often but not always followed by a fluke-up dive- a dive where the fluke breaks the surface of the water with the full ventral portion exposed. The most visible and spectacular behavior is the breach- where the animal leaps out of the water head first, and typically rolls in midair before crashing down of its dorsal or ventral surface.

CONCLUSION

Overall every aspect of th internship was educational. I learned that research is quite a challenge, and with whale research out in the field, it is hard to have the control one would have in a laboratory. Also, the data collected is only as accurate as the one collecting it, and with the variety of people participating in an internship it is hard to keep the data collection process consistent, thus creating a situation for high error variance.

The skills and experience acquired through the internship has opened such doors as, doing boat surveys off of O'ahu for Dr. Herman of the U.H. humpback whale research project, as well as aerial surveys off of O'ahu, Kaua'i, and Ni'ihau for Dr. Mobley.

REFERENCES

Baker,C., L. Herman, A. Perry, W. Lawton, J. Straley, G. Kaufman, J. Reinke and J. Ostman. 1986. The migratory movement and population structure of humpback whales (Megaptera novaeangliae) in the Central and Eastern North Pacific. Marine Ecology Progress Series.31:105-119.

Baker, C.S., nd L.M. Herman. 1981. Migration and local movement of humpback whales (Megaptera novaeangliae) through Hawaiian waters. Canadian Journal of Zoology, 59:460-469.

Herman, L.M., P.H. Forestell, and R.C. Antinoja, 1980. The 1976/1977 migration of humpback whales into Hawaiian waters: a composite description. Final Report to the Marine Mammal Commission, Contract# MM7AC014. pg.16.

Kaufman, G. and P. Forestell. 1986. Hawaii's Humpback Whales. Pacific Whale Foundation Press, Hawaii.

Nishiwaki, M. 1966. Distribution and migration of the larger cetaceans in the North Pacific as shown by Japanese whaling results. In K.S.Norris (ed.) Whales, Dolphins, and Porpoises. UC Press, Berkeley, Calif. pg.25.

Urban, J.R., and A.L. Aguayo. 1987. Spatial and seasonal distribution of the humpback whale, Megaptera novaeanglia,in the Mexican Pacific. Marine Mammal Science,3, 333-344.

Pacific Whale Foundation's 1991-1992 Humpback Whale Recovery

Project: Advance Information Packet. Distributed in advance to interns.

Pacific Whale Foundation Internship Program Pamphlet. Distributed in advance to interns.

Hill Data Sheet (Hawaii)

DATE: ____________ TIME IN: ____________ TIME OUT: ____________

THEO: OBS: Windnid REC: LOCATION:

SS	WS	WD	CL	VS	TM	SC	PD	PC	BT	BH/DESCRIPTION	AN	BG	DR	DS

Page ____ of ____

APPENDIX 1

DISTANCE ESTIMATIONS

DATE:
NAME:

TIME:	POD #	BT/PD	DIST EST

APPENDIX 3

PWF FIELD SHEET

DATE: START TIME FOR STUDY:	GRID #:	VESSEL:	RECORDER: DRIVER:	OBSERVER: OBSERVER2:

EVENT TIME:	BOAT HEADING	SPOT TIME:	CONTACT TIME:	BREAK TIME:	LOCATION OF WHALES FIX1 + D:	FIX2 + D:	FIX3 + D:	POD #:	POD COMPOSITION: A / S / C / U	POD ACTIVITY/COMMENTS	BOAT:	BOAT D:	BOAT ACT:

POD COMPOSITION	POD ACTIVITY			BOAT	BOAT D	BOAT ACT
A=ADULT C=CALF	AF=AFFILIATION/DISAFF.	SS=SLOW SWIM <3MPH ST=SURFACE TRAVELING	MR=MILLING/RESTING	1=POWER	1= <1/4m	1=NOT MOVING
S=SUBADUI U=UNKN.	C=COALESCENCE/DISPERSAL	RS= RAPID SWIM >3 MPH	MS=MILLING/SURFACE ACTIVE	2=SAIL	2= >1/4m	2= <5MPH
						3 = >5MPH

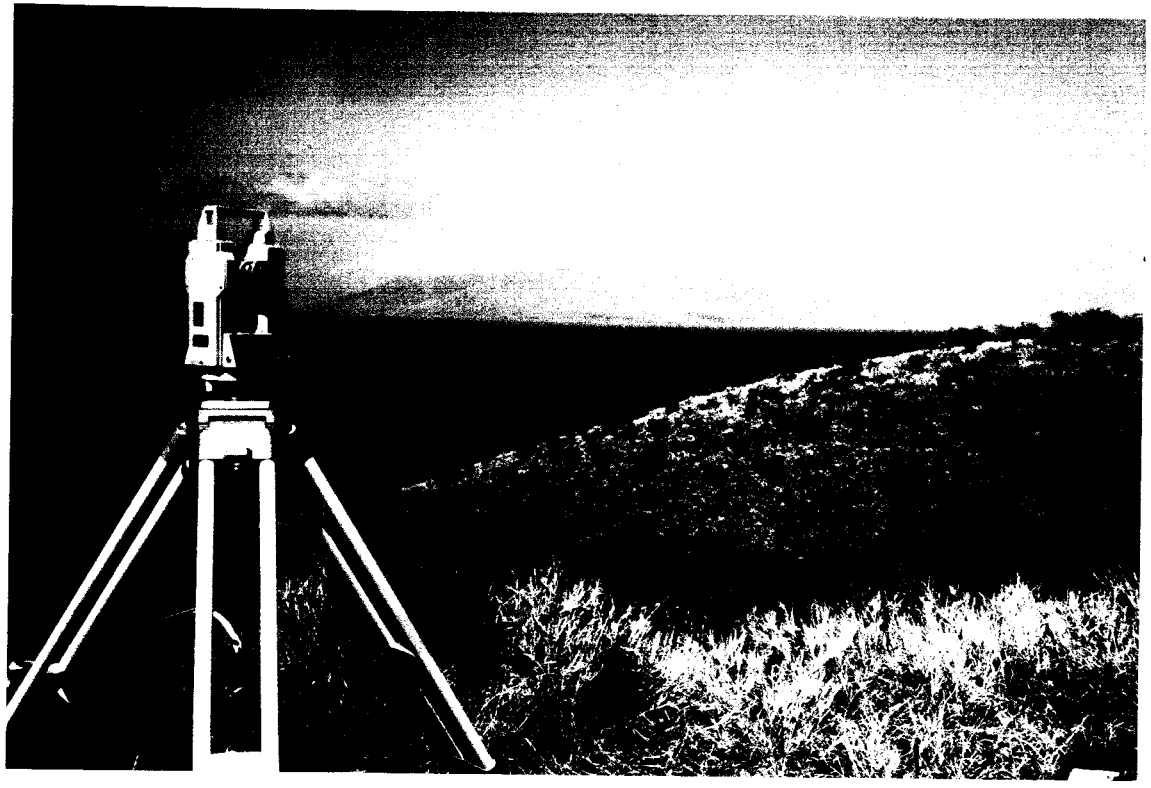
TIME:	SS:	WS/WD:	VS:	CL:	TIME:	SS:	WS/WD:	VS:	CL:	TIME:	SS:	WS/WD:	VS:	CL:

Hiking up to shore station Pu'u Olai.

Pu'u Olai shore station across from Kaho'olawe facing Molokini Island. Scanning the ocean for humpback whales with binoculars and the theodolite.

Theodolite operator getting a fix on a whale with the help of an observer. Data recorder waiting for the angle and bearing read out.

The theodolite operator, an observer with binoculars, and the VHF radio operator in contact with the achilles on Maalaea Bay.



The theodolite on Pu'u Olai, with a view of the West Maui mountains to the right.

Molokini Island located in front of Pu'u Olai.

A "fluke-up" dive with the full ventral portion of the whale's fluke exposed.

A breaching whale.

A breaching whale.

Recording a singing whale with a submerged hydrophone.