

***PHOTOGRAPHIC MONITORING OF RESIDENT KILLER WHALES
IN PRINCE WILLIAM SOUND AND KENAI FJORDS, ALASKA (Submitted under
BAA #52ABNF200037)***

Project Number: 030012-BAA
Restoration Category: Monitoring, Research
Proposer: North Gulf Oceanic Society
Lead Trustee Agency: NOAA
Duration: 1 year
Cost FY 03: \$18,100
Geographic Area: Prince William Sound/Kenai Fjords, Alaska
Injured Resource/Service: Killer whales

ABSTRACT

This project transitions monitoring of the damaged resident AB pod and other resident pods and the potentially endangered AT1 transient population into a cooperative program with Alaska Sea Life Center and various foundations. Monitoring has occurred on a yearly basis since 1984 and was crucial in evaluating the serious oil spill effects on killer whales. This proposal seeks funds to augment current research directed at transient killer whales and provide for annual monitoring of AB pod and other resident pods and analysis and reporting of results.

INTRODUCTION

On March 31, 1989 AB pod was observed in oil sheens and six of the 36 pod members were missing. A total of 14 whales were lost from resident AB pod in the two years following the *Exxon Valdez* oil spill and there was no recruitment into the pod during those years. Since that time the social structure within AB pod has shown signs of deterioration. Maternal groups have traveled independently or with other pods, and pod members have not consistently traveled with closest relatives. Although 4 calves were recruited during the period 1992-1994, there were 5 additional mortalities in 1994. There has been a net increase of four individuals since 1995. In 2001 there were two recruited calves and one newmortality, the pod currently contains 26 individuals. The rate of mortality observed in this pod after the oil spill far exceeds that recorded for 10 other resident pods observed in southern Alaska over the past 18 years or for 19 pods in British Columbia over the past 23 years. Although it appears this pod is now slowly recovering, population modeling indicates recovery will not be complete until 2015 due to the loss of females and juveniles and their reproductive potential at the time of the spill.

Nine whales from the transient AT1 group have not been observed since 1989. Two additional AT1 whales have not been sighted for seven years. Another member of this group stranded and died on a beach near Cordova, Alaska in July 2000 and another stranded and died in 2001.. From genetic and photographic data from beached whales, four of these thirteen missing AT1 group whales are known to be dead. Although transient killer whale social structure is not fully understood, we are confident that the other missing AT1 whales also are dead. Statistical analysis backs up this supposition and strongly suggests that they have either died or permanently emigrated from the area. Since there is no record of these whales in adjacent regions and they appear to have a limited range, it is almost certain that the missing AT1 whales are dead.

Eighteen years of systematic data collected under public and private funding have been placed in a specially designed GIS database currently housed at the U.S. Fish and Wildlife Service, Marine Mammals Management Division, Anchorage, Alaska and at Alaska Pacific University, Anchorage, Alaska under the management of collaborator, Dr. David Scheel. The database contains 914 records of encounters with killer whales in and near Prince William Sound and Kenai Fjords, Alaska. Analyses have determined large-scale differences in spatial distribution patterns between resident and transient whales over time (Sheel et al. 2001). Changes in transient whale distributions have been examined in relation to changes harbor seal populations.

There is worldwide concern that specific PCB and dioxin congeners may have negative effects on reproduction in mammals. The recovery of killer whales in Prince William Sound and the long-term health of the population is dependent on unimpeded reproductive processes. Recently there is concern over contaminant levels and their relationship to the recent decline of southern resident killer whales in Puget Sound. During this study we have measured contaminant levels in both resident and transient killer whales, and found much higher levels in the transient population. Contaminants apparently passed from mother to offspring via lactation and levels follow consistent patterns within genealogies (Ylitalo et al 2001). Samples were obtained from individually identified living whales that can be re-identified and re-sampled to assess future changes in levels. The ability to sample and potentially resample specific known individuals and their known kin is a unique aspect of this project. Results of contaminant analysis (Ylitalo et al 2001) raise concern that contaminants in transient whales could negatively impact reproduction and/or reduce immune response leading to mortalities.

There has been no successful reproduction in the AT1 group since 1984. All chemical analysis of tissue and assistance in the interpretation of results is provided by the NMFS/NOAA Environmental Contaminant Laboratory, Seattle, Washington under a cooperative agreement with N.G.O.S. that is continuing

In FY97 we initiated a remote hydrophone and acoustic monitoring as a long-term assessment tool. Initial analysis and separation of pods has been completed and results are in publication. (Yurk et al. in press). Currently we are operating a hydrophone in Resurrection Bay and another at Chiswell Island, both powered by solar and wind power and using microwave transmission technology. Both of these hydrophones are fully supported by the Alaska Sea Life Center, (funds are not requested here) but will aid in our overall monitoring efforts of resident pods.

NEED FOR THE PROJECT

A. Statement of Problem

The AB pod of killer whales was injured by the EVOS. Although it initially had shown signs of recovery from 1991 to 1993, mortalities in 1994/95 reduced the number of surviving AB pod whales to a low of 22. Since 1995 there has been a net gain of four individuals; however, recovery to prespill numbers is not expected until 2015, provided there are no additional atypical mortalities. At least 12 of the original 22 members of AT1 group of transient killer whales have apparently died since 1989 and there has been no recruitment within the group. Recovery for this group seems doubtful at this time and a petition to list them as an endangered population is in preparation. This project will continue to monitor the status of AB pod and the AT1 group.

Sightability of killer whales in Prince William Sound has changed since the spill; particularly resident whales have been more frequently encountered in the Kenai Fjords region. Transient whales are seen less frequently in all areas than prior to the spill.

Initial mortalities within AB pod following the spill have apparently led to additional mortalities due to loss of key individuals. Deterioration of AB pod social structure has led to a situation where one subpod now travels separately most of the time (the AB25 subpod travels with AJ pod). The project will provide long-term insight into effects of changes in killer whale social structure due to unnatural mortalities. A detailed population model for resident killer whales is under construction.

Despite considerable effort, re-sightings of the AT1 group have declined and fewer individuals are seen when members of this transient group are located. We are confident that 12 of the original 22 members of this group are dead, or have emigrated to other regions; although the later possibility is very unlikely. None of the AT1 whales have been sighted or identified in southeastern Alaska despite healthy pinniped populations and frequent transient sightings in that region.

Although the rate of encounter with members of the AT1 transient group has declined, there has been no detectable increase in the sightings of other transient groups, suggesting that other transients are not increasing their use of the Sound as use of the region as AT1 group declines. Whether this overall decline in the encounters with transient (marine mammal eating) killer whales is related to oil spill effects or ecosystem changes is not clear, but we suspect a combination of the two factors. It is likely that the

severe decline in harbor seals and Steller sea lions are important factors in the decline of transients in the region.

MtDNA and nuclear DNA analysis has demonstrated the genetic uniqueness of the AT1 group from residents as well as from other transients. If the AT1 population does not have other components in western Alaska, the loss of the AT1 group could represent a serious overall loss of genetic diversity.

Some environmental contaminants such as PCBs and DDTs have been linked to reproductive dysfunction in mammals and immune system dysfunction. We have discovered very high levels of these contaminants in the transient (marine mammal eating) killer whales, including the non-reproducing AT1 group. When compared to other cetacean populations, these levels appear to be in a range that could result in reproductive dysfunction and reduced immune response or other effects that might impede recovery of this group.

B. Rationale/Link to Restoration

The final report from previous monitoring (FY2002) will detail the status of AB pod and the AT1 transient group. However, the status of AB pod is considered not recovered at this time, the group numbers 26 whales and one subpod (AB25) continues to travel primarily with AJ pod. AB pod numbered 36 whales before the spill and was a unified pod. The recent growth in the pod suggests a recovery is under way.

An annual killer whale behavioral database of spanning 18 years now exists in a GIS format. This will be continued as part of the proposed monitoring. It is accompanied by a photographic database that includes identifications of all individuals from each frame of film for every encounter logged in the GIS system. This will facilitate development of potential critical habitats for killer whales, particular in the Kenai Fjords region where data of this type has been collected in recent years and where GIS analysis/publication is currently in process.

Continued development of acoustic monitoring and a dialect directory has provided a cost-effective year-round extension of the monitoring program. We will continue to work cooperatively with the Alaska Sea Life Center, Kenai Fjords National Park, and See More Wildlife Systems in this endeavor, although no funds for this aspect of the project are requested here. The signal is broadcast 24 hours a day on local FM in Seward. Our program directly involves residents and visitors in the process of monitoring and restoration through connection with Alaska Sea Life Center and Kenai Fjords tour and charter boat industry.

C. Location

This project is part of an ongoing killer whale research in Prince William Sound and the Kenai Fjords region, Alaska. The project now involves the Alaska Sea Life Center, Kenai Fjords National Park village of Chenega, Port San Juan Hatchery, and other residents and visitors to the region. It operates cooperatively with the Kenai Fjords and Prince William Sound tourboat industry.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

There is great public concern and interest for killer whales in Prince William Sound and in Kenai Fjords. The expanding tourboat industry depends on a healthy killer whale population to attract and satisfy visitors and residents and the research and its results enrich the experience of visitors and residents. We have been closely involved with tourboat and recreational operators and residents by exchanging sighting information on a daily basis and providing a catalogue of individual whales to enhance enjoyment of whale observation. We have provided and continue to provide workshops detailing whale biology. We are involved in the Youth Area Watch program, taking young students out to participate in our research. Recent publication of an updated identification catalogue that includes details of our research results and viewing guidelines has further sparked interest in these whales. Killer whales now draw thousands of visitors to the region each year.

We continue to collect observations and stories from native residents and others that will provide background for interpretation of our findings and place the work in a historical and cultural perspective. Some of these legends and stories are used to place our research in a broader context in our publication: “Killer Whales of Southern Alaska” (Matkin et al 1999).

PROJECT DESIGN

A. Objectives

1. To extend field time and allow monitoring of resident killer whale pods, including the non-recovered AB pod.
2. Continue population, feeding habits, acoustics, genetics and contaminant studies that will be funded as part of cooperative agreements.
3. To provide for analysis and development and GIS input of data and to provide a report on the status of AB pod and resident killer whales in the region as well as the AT1 transient group.

B. Methods

The portion of study funded by the EVOS Trustee Council will rely on the photoidentification of each individual in each pod/group, that regularly uses the Sound, particularly AB pod. It is important that researchers maximize the time actually spent with resident killer whales (particularly AB pod and other resident whales) to insure thorough identification of all individuals. We will use the field time provided under the Trustee Council portion of the study to work with AB pod and other resident pods when they are present. Methods proposed to obtain photographic data necessary to meet monitoring objectives will be similar to those used by the NGOS in Prince William Sound/Kenai Fjords for the past eighteen consecutive years. Searches for whales will not be made on random transects, but based on current and historical sighting information. In addition whales will be located by listening for killer whale calls with a directional hydrophone (calls can be heard up to 10 miles away), or by responding to VHF radio

calls from other vessels reporting sightings of whales. We have developed network of cooperating vessel owners and tour boat operators that regularly report whale sightings. In addition, requests for recent killer whale sightings will be made routinely on hailing Channel 16 VHF and working channel 77.

A vessel log and chart of the vessel track will kept for each day the research vessels operate. Nobletech software and a laptop computer configured with GPS will automatically record the research vessel track in real time. The elapsed time and distance traveled will be recorded and vessel track plotted. Record will be made of the time and location of all whale sightings and the weather and sea state noted at regular intervals.

The Nobletech system will also be used to record specifics of each encounter with killer whales including the trackline during these encounters. This data system will be used in 2002 to log all encounters and summarize effort. Additional attention will be made to relate behavior to location using a Nobletech data recording system which relates precise geographic location to behavioral events. The new data collection system will be based killer whale encounter data sheets developed in 1995 and specifically tailored to GIS data entry. Data recorded will include date, time, duration, and location of the encounter. Rolls of film exposed and the estimated number of whales photographed will also be recorded. A chart of the whales' trackline during the encounter will be completed and the distance traveled by the vessel with the whales will be calculated by the Nobletech system on a daily basis. The new system will make it much simpler to link general behavior of the whales (i.e. feeding, resting, traveling, socializing, milling) to location and time.

Photographs for individual identification will be taken of the port side of each whale showing details of the dorsal fin and gray saddle patch. Photographs will be taken at no less than 1/1000 sec using Fuji Neopan 1600, a high speed black and white film,. A Nikon 8008 or Nikon N70 autofocus camera with internal motor drive and a 300 mm f4.5 autofocus lens will be used. When whales are encountered, researchers will systematically move from one subgroup (or individual) to the next keeping track of the whales photographed. If possible, individual whales will be photographed several times during each encounter to insure an adequate identification photograph. Whales will be followed until all whales are photographed or until weather and/or darkness makes photography impractical.

All photographic negatives will be examined under a Wild M5 stereomicroscope at 9.6 power. Identifiable individuals in each frame will be recorded. When identifications are not certain, they will not be included in the analysis. Unusual wounds or other injuries will be noted. Photographic negatives will be analyzed using a photographic database that spans sixteen years. Identities of each whale that appears in every frame of usable film will be recorded and stored in VAX computer system. Final analysis and assessment will follow Matkin et al. (1994).

The primary vessel used to secure identification photographs will be a 34' diesel inboard powered vessel capable of 20 knots, that can sleep 3-4 individuals (R.V. *Natoa*). With sleeping accommodations and large fuel capacity, the R.V. *Natoa* can remain in the field for extended periods photographing whales.. This vessel will operate a total of 10 days under funding from this project, with days selected to maximize encounters with resident whales (AB pod) during the late July through early September period. From historical data these dates are judged to be to be the most likely time to encounter AB pod

as well as many of the other resident pods that use the Prince William Sound and Kenai Fjords.

The report for the monitoring segment will include a summary of all field effort including that funded outside of this DPD, and will include a summary of the pods and individuals encountered and a status report on AB pod and the AT1 group. Changes within AB pod will be examined with consideration for the age and sex structure of the pod and maternal groups within the pod and related to the population model now under development. Trends in transient killer whale sighting rates and demographics will also be presented. Frame by frame input of identification data from exposed film into VAX and IBM PC computer systems will occur and identifications tabulated by pod and by individual. Copies of killer whale encounter data and vessel logs will be made available to the EVOS Trustee Council and/or lead agency and this data will be archived in the GIS database for potential future analysis. Frame by frame identification data will also be made available on disk. Copies of the GIS program and data base will be available by request to NGOS.

PC (Windows) compatible computers owned by NGOS will be used to analyze field data. The GIS system at Alaska Pacific University (Dr. David Scheel) and U.F.W.S, Marine Mammal Management Division in Anchorage (Doug Burn) and VAX data system at the Pacific Biological Station, Nanaimo also will be used for data storage and analysis.

C. Contracts and Other Agency Assistance

The *Exxon Valdez* Trustee Council is asked to supply only a portion of the overall killer whale research project in Prince William Sound/Kenai Fjords, with primary funding coming from the Alaska Sea Life Center. EVOS Trustee Council funding will allow the continuation of field work and analyses focused on resident killer whales. The entire project will be completed under the auspices of the North Gulf Oceanic Society (NGOS) under federal research permits held by NGOS and issued under the Marine Mammal Protection Act. NGOS will provide for data entry into the GIS database housed at Alaska Pacific University and U.S.Fish and Wildlife Service, Marine Mammal Research in Anchorage using the a pre-existing menu interface and for input of frame by frame identification data into the VAX system.

SCHEDULE

A. Measurable Project Tasks for FY2002

July-September 2003: Field work focusing on AB pod and other resident pods.

Nov 2003 - Jan. 31, 2004: Analysis of photographs from 2003 fieldwork. Input data into GIS system.

January-March 2004: Prepare report summarizing field activities and interpreting data

January 2004: Attend EVOS Trustee Council/GEM annual workshop

B. Project Milestones and Endpoints

The FY2003 killer whale project will transition monitoring of resident killer whales (AB pod) and AT1 transients into the GEM program. The secondary funding requested from the Trustee Council combined with other funding sources provide for continuing long term killer whale monitoring program.

C. Completion Date

Annual report will be submitted by April 30, 2004

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The monitoring of killer whales and analysis of current data is part of a long-term program to investigate killer whale recovery, monitor populations and the examine the interactions of killer whales with other species. It will be integrated with harbor seal and sea otter studies as well as with other GEM projects as appropriate. In FY2003 this project will rely on approximately \$72,000 in funds from other sources and cooperative agreements to complete the program. As a non-profit research institution familiar with private funding sources and cooperative programs, NGOS can work with the Trustee Council cooperation to maximize potential for funding in the future.

PROPOSED PRINCIPAL INVESTIGATOR:

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KEY PERSONNEL

Craig Matkin (M.S. University of Alaska), is the project leader. Matkin will be responsible for supervising the completion of all fieldwork and insuring successful operation of boats and equipment. He will be the operator of the R.V. *Natoa* and supervise directly all work completed from that platform. He will direct data analysis and assemble all material for annual reports and be responsible for completion and submission of these reports. He will represent this project and present the work to the EVOS Trustee Council.

Matkin has studied killer whales in Prince William Sound since 1977. He initiated systematic killer whale photoidentification in Prince William Sound, and is a founding member of NGOS. In 1994 he completed the "The Biology and Management of Killer

Whales in Alaska" for the U.S. Marine Mammal Commission. Other pertinent publications include EVOS killer damage assessment results ("The Status of Killer Whales in Prince William Sound 1984-1992", Craig O. Matkin, G. M. Ellis, M.E. Dahlheim, and J. Zeh in T.R. Loughlin. ed. Marine Mammals and the *Exxon Valdez* and Matkin and C.O., Matkin, D.R., Ellis, G.M., Saulitis, E. and McSweeney, D. 1997. Movements of resident killer whales in Southeastern Alaska and Prince William Sound, Alaska. *Marine Mammal Science*, 13(3):469-475. Mr. Matkin also teaches at the University of Alaska, Lower Kenai Peninsula Campus.

Eva L. Saulitis (M.S. University of Alaska), a director of NGOS, has conducted fieldwork on killer whales in Prince William Sound each season since 1987. She is a principal field biologist for the monitoring segment of this project (photoidentification) and will co-operate the research vessel *Natoa*. She will make ready and maintain all necessary equipment, complete photoidentification work and all logs and data sheets as required. She will provide entry of field data into the GIS system.

Saulitis completed her MS thesis "The Behavior and Vocalizations of the AT Group of Killer Whales in Prince William Sound, Alaska." in 1993. She coauthored the "Biology and Management of Killer Whales in Alaska" for the U.S. Marine Mammal Commission and "Killer Whales" for the EVOS Restoration notebook series and authored Saulitis, E.L., C.O. Matkin, K. Heise, L. Barrett Lennard, and G.M. Ellis. 2000. Foraging strategies of sympatric killer whale (*Orcinus orca*) populations in Prince William Sound, Alaska. *Marine Mammal Science* 16 (1):94-109. She has done extensive analysis of killer whale calls and has operated research vessels in Prince William Sound since 1988.

LITERATURE CITED

- Matkin, C.O., D. Scheel, G. Ellis, L. Barrett-Lennard, H. Jurk, and E. Saulitis. 2000. Photographic and Acoustic Monitoring of Killer Whales in Prince William Sound and Kenai Fjords, Alaska (Restoration Project 99012), North Gulf Oceanic Society, Homer, Alaska
- Matkin, C.O., Ellis, G.M., Saulitis, E.L., Barrett-Lennard, L.G., & Matkin, D. 1999. *Killer Whales of Southern Alaska*. North Gulf Oceanic Society, Homer, Alaska.
- Saulitis, E.L., F. H. Fay, C O. Matkin, in review. Acoustical Behavior of the AT1 Transient Killer Whale Population in Prince William Sound and Kenai Fjords, Alaska. *Animal Behavior*.
- Scheel, D., C. Matkin, E. Saulitis. 2001. Distribution of killer whale pods in Prince William Sound, Alaska over a thirteen-year period, 1984-1996. *Marine Mammal Science* 17(3).
- Ylitalo, G.M., C.O. Matkin, J. Buzitis, M. M. Krahn, L. L. Jones, T. Rowles, and J. Stein. 2001. Influence of Life-History Parameters on Organochlorine Concentrations in Free-Ranging Killer Whales (*Orcinus orca*) from Prince William Sound, Alaska.. *The Science of the Total Environment*.

Yurk, H., L. Barrett-Lennard, J.K.B. Ford, And C.O.Matkin. in press. Parallel cultural and genetic lineages in resident killer whales off the coast of Southern Alaska. *Animal Behavior*.

Proposed Project Manager
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FY 03 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Budget Category:	Authorized FY 02	Proposed FY 03					
Personnel		\$8,420.0					
Travel		\$540.0					
Contractual		\$4,600.0					
Commodities		\$1,500.0					
Equipment		\$0.0	LONG RANGE FUNDING REQUIREMENTS				
Subtotal	\$0.0	\$15,060.0	Estimated				
Indirect		\$1,506.0	FY 04				
Project Total	\$30,000.0	\$16,566.0	\$17,000.0				
Full-time Equivalent (FTE)		0.2					
Dollar amounts are shown in thousands of dollars.							
Other Resources							
<p>Comments: This budget is part of a cooperative program with the Alaska Sea Life Center.</p> <p>NOTE: NOAA GA (9%) of \$1.5 needs to be added to this project, for total of \$18.1</p>							

FY03

Prepared:

Project Number: 030012
 Project Title: Photographic Monitoring of Resident Killer Whales
 In Prince
 William Sound and Kenai Fjords, Alaska
 Name: North Gulf Oceanic Society

FY 03 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Personnel Costs:			Months Budgeted	Monthly Costs	Overtime	
Name	Position Description					
Craig Matkin	PI, Field Biologist, Boat Operator		1.4	4800.0		
Eva Saultis	Field Biologist, Data		0.5	3400.0		
		Subtotal	1.9	8200.0	0.0	
Personnel Total						
Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	
Description						
1 RT Homer/Anchorage		180.0	1	3	120.0	
Travel Total						

FY03

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Prepared:

FY 03 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

Contractual Costs:	
Description	
Vessel Contract (34' Natoa, deisel inboard) 10 days @ 460/day	
Contractual Total	
Commodities Costs:	
Description	
Communications Field Food (30/day for 10 days) Fuel Film Processing/Printing	
Commodities Total	

FY03

Prepared:

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FY 03 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2002 - September 30, 2003

New Equipment Purchases:		Number of Units	Unit Price	
Description				
Those purchases associated with replacement equipment should be indicated by placement of an R.			New Equipment Total	
Existing Equipment Usage:		Number of Units		
Description				

FY03

Project Number: 00312
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 Name: North Gulf Oceanic Society

Prepared: