T
AERIAL SURVEYS

Aerial Survey Support for the APEX Project

Project Number:	99163-T
Restoration Category:	Research
Proposer:	University of Alaska Fairbanks
Lead Trustee Agency:	NOAA
Cooperating Agencies:	ADFG
Alaska SeaLife Center:	no
Duration:	1st year, 2-year project
Cost FY 99:	$54,400
Cost FY 00:	$41,900
Geographic Area:	Prince William Sound
Injured Resource/Service:	Forage fish (including Pacific herring) and Sea birds

ABSTRACT

The objective of this project is to provide information on pelagic schooling fishes in the surface waters of Prince William Sound (PWS), focusing on the study areas of the APEX project. The project will be closely coordinated with sea bird surveys, fish catcher vessels, and acoustic vessels. The data delivered will include numbers and surface areas of schools along with biomass estimates, pending synoptic measurements of schools using aerial and acoustic techniques. The database also includes numbers and behaviors of foraging gull species, marine mammals, jellyfish aggregations, and tidal fronts. Data sharing is expected. This is an extension of data collected since 1995 and adds to the slim base of knowledge on forage fish species in PWS.

INTRODUCTION

The objective of this project is to provide information on pelagic schooling fishes in the surface waters of Prince William Sound, Alaska, in order to better understand reproductive and foraging dynamics of various sea bird species. The project focuses on the study areas of the APEX project within the Sound.

Little was known about the distribution and relative abundance of juvenile Pacific herring (*Clupea pallasi*) and other forage fishes in Prince William Sound prior to the *Exxon Valdez* oil spill in 1989. Herring, sardines, anchovy, capelin, and sandlance are now known to school in tight aggregations with distinctive shapes and are often found in oceanic surface waters (Mais 1974; Squire 1978; Fresh 1979; Blaxter and Hunter 1982; Hara 1985; Misund 1993; Carscadden et al. 1994). Many pelagic fishes form shoals or school groups (Cram and Hampton 1976; Smith 1978; Fiedler 1978). Distribution of herring and capelin is contiguous. Known areas of seasonal aggregations are unique to particular populations (Templeman 1948; Campbell and Winter 1973; Sinclair 1988; Stocker 1993). Given that these forage species form distinct, easily identifiable schools, the visual aerial technique described in this proposal is promising. Since 1995, aerial surveys have added considerably to the base of knowledge on forage fish in PWS and the immediate vicinity.

Both aerial and acoustic surveys have been used to measure forage fish distribution and abundance in PWS, where it appears that foraging sea birds are targeting surface-schooling fishes (Bill Ostrand and Dave Irons, DOI-FWS, personal communication). Many of these schools occur in very shallow (less than 10 m) near-shore waters within the Sound. This near-shore distribution of the targeted schools has been problematic for use of the acoustic technique because of depth limitations for the vessels and sonar. (Signals attenuate at very shallow depths.) In addition, the total area surveyed has been small due to the width (sampling volume) of the sonar beam. This also hinders determination of exact distribution and abundance of contiguously distributed schooling fishes. The aerial technique solves both problems since depth is not a limitation and the area covered is large. The shortcomings of the aerial technique are that the measurements are two-dimensional and that schools occurring deeper than approximately 20 m are generally not measured. In addition, the aerial technique cannot provide measurements of non-schooling forage species. Clearly, the best solution would be a marriage of the two techniques; coordination of aerial and acoustic methods is a goal for this project in FY99.

The main foraging species within Prince William Sound include Pacific herring, sandlance (*Ammodytes hexapterus*), capelin (*Mallotus villosus*), eulachon (*Thaleichthys pacificus*), juvenile pollock (*Theragra chalcogramma*) and juvenile salmon (*Onchorynchus* sp.). The first four species form distinct schools, easily spotted from aircraft, in surface waters during the summer (June and July). However, capelin and eulachon are visible for only a narrow window of time (June) after which they disperse and move to deeper waters. Distinct foraging patterns of birds, seen from aircraft, form over post-spawn adult capelin; if those observations are coupled with net catch figures, information about capelin may be refined. The main target species for this project are juvenile herring and sandlance since aerial surveys will be conducted mainly in July.

Methodology for this project was developed in 1995–1996, but the database extends through 1997 (Brown and Norcross, in prep.). Broadscale measurements of forage fishes' distribution and abundance were completed for June and July of all three years. However, in 1995–1996, other months were also sampled. In addition, fine scale and repeat measurements were taken for a subset of herring nursery bays in eastern, northern, southwestern, and central PWS. All of these data have been made available to the APEX project for analyses of earlier data. In 1999, we plan to restrict surveys for this project to the months of July and early August.

For this project, a single broadscale survey will be conducted in July 1999, to include all APEX study areas. In addition, we will conduct daily, repeat surveys over a smaller area in central PWS which comprises the foraging range of a single sea bird colony (black-legged kittiwakes). We will also direct net catches on schools observed from the air for validation. However, data collected will be available to all bird researchers within APEX and we will coordinate with them to ensure that their needs are met.

There is no working hypothesis for this project. The main data products will be descriptive.

NEED FOR THE PROJECT

A. Statement of Problem

It has been hypothesized that injured sea bird and marine mammal species (including harbor seals, marbled murrelets, and pigeon guillemots) are not recovering because of a problem with the prey base. The prey base includes Pacific herring, which is a key forage species in the marine ecosystem of Prince William Sound. This project, as part of a larger ecosystem project (APEX), will provide information leading to a better understanding of the link between prey and predator (both injured by the spill) and of the population dynamics of Pacific herring and other forage species.

B. Rationale/Link to Restoration

The techniques in this project provide a snapshot of year-class strength of herring and other forage species, indicating trends in abundance and the potential for population recovery. Although this project falls under the general category of research, the techniques included are perfectly suited to cost-effective, long-term monitoring of critical forage species such as Pacific herring. This project builds on three years of existing data, and if continued, will be invaluable to any analysis of long-term trends in the ecosystem because of the key position of the forage species. In addition, summarized data from this project can feed into a number of projects besides those directly involved with apex species. Fishery managers can use the information to indicate year-class strength of herring; the result may be improved management techniques. Also, miscellaneous information such as location and size of jellyfish aggregations is collected incidentally and used to further our understanding of ecological processes in PWS. The multi-purpose use of the data results in cost-effectiveness for this proposal.

C. Location

The study region is limited to PWS. However, dynamics between the forage fish prey base and the predator species may be of interest and applicable to areas outside the Sound.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

The Principal Investigator, Evelyn Brown, is directly involved with a TEK project (98320-T supplement, "Documenting Forage Fish Natural History through Local and Traditional Ecological Knowledge") and will assist with publication preparation. The findings of this study will be shared with interested participants in the TEK project, as well as with all interested communities. The results of the TEK study will be incorporated into retrospective discussions of forage fish in PWS,

to be included in herring and other forage fish analyses and publications.

PROJECT DESIGN

A. Objectives

In 1999 we have the following objectives:

1. Coordinate with sea bird researchers and other investigators from the APEX project to develop field survey plans addressing the overall objectives of APEX.

2. Conduct daily repeat surveys over the APEX study area which corresponds with the foraging range of the black-legged kittiwake; set small catcher and sea bird observers on schools with foraging flocks in order to obtain more detailed observations.

3. Overfly the entire APEX study region during times when acoustic vessels are performing surveys, to obtain a broadscale data set which will include near-shore schools invisible to acoustics devices.

4. During broadscale flights, coordinate with other sea bird researchers to enable synoptic measurements of bird distributions from ground surveys and fish/bird distributions from the air.

5. Process data during and after the field season, and build it into the three-year database of aerial data already in place; obtain a data set of field net-catches.

6. Work with modelers and other researchers to deliver the data appropriately, accurately, and in a timely manner.

7. Work with APEX projects to finalize annual reports, prepare presentations, and complete publications.

B. Methods

Prior to each survey, radio communications will be established for weather checks and to confirm a start/end point for each survey. In order to minimize the effect of survey condition bias on accuracy of the results, criteria have been established for determining whether or not to proceed with a survey. We will not fly if winds are over 25 knots (creating a sea state of over 1 on the Beaufort wind scale or wave heights over 1 m); if the average ceiling (cloud cover) is at or below 250 m, or on rainy days. Weather conditions not meeting these criteria may significantly affect the quality and accuracy of the survey data. Methods similar to those documented by Brown and Norcross (in prep.) will be applied.

During the survey, both flight path (transect) and features along the path will be recorded. A hand-held GPS connected to a laptop computer with a flight log program will record latitude, longitude, and time of day at 2-second intervals. At the beginning of each flight, information detailing pilot, weather, water visibility, wind, wind direction, tide stage, wave height, and other notes concerning the survey are recorded in the log program. Information or "sightings" such as numbers of schools, species of fishes, surface areas of schools, numbers of birds or mammals, behavior of birds, or oceanographic features (tidal fronts) are recorded on the computer log program. Net captures, acoustic surveys, diver surveys, validation via landing on top of schools,

or observations recorded on film are also recorded on the log program. However, school validation is often a post-processing procedure since net catch, acoustic, or other validation data collected are not always directly observed by the aerial surveyor. However, this year a skiff will be dedicated to catches directed from the air. Single or double letter codes (such as h for herring, sd for sandlance, kw for kittiwakes, hs for harbor seals, etc.) have been developed for fish, bird, and mammal species. Bird behavior is recorded as foraging or plunging (pl), resting on water (rw), resting on shore (rs), aggregated tightly on water over school (tw), traveling (tr) or flying in a "broad area search" (bs). We will use gridded maps to facilitate communication between aerial and ground crews concerning the location of birds and fish.

Fish schools will be counted and surface areas estimated using a sighting tube, which is constructed of PVC pipe with a grid drawn on mylar on the end. The focal length of the tube is 216 mm and it can be calibrated for ground distance covered by reference line (X) for any survey altitude, when length of the grid reference line (L), focal length of the tube (F), and survey altitude (A) are known, by using the following equation per Lebida and Whitmore (1985) and Brady (1987).

$$X = A\ (L/F)$$

The use of the grid is particularly important for large schools. For elliptically shaped schools, maximum length and maximum width provided a rough estimate of surface area; for irregularly shaped schools (U-shaped, long wavy bands, etc.) length and width of separate sections are measured and combined to give a total estimate. Video or still cameras are taken as often as possible to provide validation of school recognition when matched with catches and for measurement of recognition error (explained below).

A series of statistical techniques and models has been developed to obtain an understanding of the variability of the data due to the technique itself (Brown and Norcross, in prep.). Discriminant function methods are used to sort aerial sighting data based on school size, shape, distance from shore, and depth of water column (under the school). The function provides a non-biased method for sorting aerial observations free of surveyor bias. The model is based on schools that were captured by nets or on underwater videos, but which had been previously identified and measured from the air. In 1996–1997, double counts (Seber 1982; Rivest et al. 1995) and repeat surveys were performed to obtain estimated individual surveyor error. Finally, abundance estimates obtained from the aerial techniques described here have been compared with those obtained using independent measurement techniques. In 1997, a compact airborne spectrographic imager (CASI; Borstad et al. 1992) was used to provide comparison school counts and surface area measurements. The estimate of total cumulative error introduced by the visual aerial survey methods was less than 15%. This error rate can be applied to the foraging model being produced by APEX to estimate a level of confidence in model prediction results. New validation data (collected via directed catches) will be added to the model to improve estimates of precision and accuracy.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

The University of Alaska Fairbanks is the main entity included in this proposal. The lead agency for the APEX project is NOAA and we will coordinate with them. The contracting agency will be ADFG. Other agencies participating in the APEX project and coordinating with us are DOI-FWS and independently contracted statisticians and modelers.

SCHEDULE

A. Measurable Project Tasks for FY 99 (October 1, 1998 – September 30, 1999)

January:	Attend APEX annual review
March 24–28:	Attend EVOS symposium
March 31:	Prepare project annual report as part of APEX
April 20:	Complete development of field planning
July–August:	Complete collection of field data
September:	Deliver final version of data

B. Project Milestones and Endpoints

FY 99

March 31:	Objective 7 – assist APEX with FY98 annual report
April 20:	Objective 1 – plan field season
July 1–August 15:	Objective 2 – daily field surveys
Between July 10–20:	Objective 3 – broadscale survey
July:	Objective 4 – coordination with bird researchers
September 10:	Objective 5 – complete editing and compilation of data sets
September 20:	Objective 6 – work with APEX modelers

FY 00

November 30:	Finalize analysis of 1998–1999 field data
January:	Participate in the International Herring Symposium and the annual EVOS workshop
March 31:	Prepare and finalize project final report; participate in planning and proposals concerning long-term monitoring
July 31:	Finalize any publications prepared for the project

C. Completion Date

September 30, 2000

PUBLICATIONS AND REPORTS

An annual report will be prepared for the April 1999 deadline. Although a primary publication is not expected as a result of this project, it is anticipated that the Principal Investigators will participate as co-authors on an array of publications with other APEX researchers. The Principal Investigators are involved with other EVOS projects that will result in primary publications.

For closeout in FY00, the Principal Investigators on this project will author a publication; however, at this time we cannot define that product.

PROFESSIONAL CONFERENCES

During FY99 we will attend the EVOS symposium scheduled for March 1999 and in FY00, the International Herring Symposium held in January 2000.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project represents a partial extension of work initiated by the SEA project. A portion of the data collected here will add a fourth year to that data set. Data sharing has occurred to the extent that data from this project are being used by other EVOS researchers to study jellyfish (Purcell), sea birds (Ostrand, Irons, Ford, and Kuletz), and marine mammals (Gothardt). Information on interannual variability of forage species, of interest to commercial fisheries, has been shared with ADFG (Wilcock and Morstad, Cordova).

PROPOSED PRINCIPAL INVESTIGATORS

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PRINCIPAL INVESTIGATOR

Evelyn D. Brown

The Principal Investigator is responsible for all project tasks and objectives.

Education:
B.S. Zoology and Chemistry, University of Utah, Salt Lake City, 1977
M.S. Fisheries Biology and Aquacultural Engineering, Oregon State University, Corvallis, 1980

Experience:
Project Manager, University of Alaska Fairbanks, 1995 to present.
Herring Research Biologist, Alaska Department of Fish and Game, Cordova, Alaska 1988–1995.
Principal Investigator, Injury to Prince William Sound Herring, NRDA FS 11, 1989–1992.
Fisheries Biologist, Alaska Department of Fish and Game, Cordova, Alaska, 1985–1987. Sonar projects, stream surveys, aerial surveys, and net sampling.
Commercial Fisherperson, various skippers, 1982–1984.
Fisheries Consultant, self-employed. Contracts included Prince William Sound Aquaculture Corporation for fish tagging and stream surveys; Metlakatla Indian Community on Annette Island for salmon stream survey manual and estimate of production potential and for environmental impact statement for logging activity.
Fisheries Biologist, Florida Department of Natural Resources, St. Petersburg, Florida, 1987–1988. Employed for one winter to conduct a hydroacoustic survey of mullet in the Manistee River and in Tampa Bay; also worked on a mullet tagging project encompassing the entire west coast of Florida.
Fisheries Management Biologist, Metlakatla Indian Community, Annette Island, Alaska, 1980–1982. Completed an oyster culture feasibility study, provided management recommendations on shellfish harvests, participated in herring egg deposition survey and salmon management through the use of commercial fish traps.

Current Research Interests:
- Juvenile herring population dynamics; interactions of biological and physical parameters
- Spatial patterns of forage fish distribution and related ecological parameters
- Prince William Sound herring stock model

Field Experience:
From 1978 to the present, I have participated in numerous field programs, from ground surveys of streams out of skiffs, to aerial surveys of salmon streams and herring aggregations, to SCUBA surveys of herring egg deposition and shellfish resources, to open ocean cruises aboard large research platforms performing large scale fisheries oceanography surveys (R/V *Oshoro Maru*, 1983). I have operated fish weirs and fixed-site sonars from remote field camps and from trailers located in urban areas (Bradenton, Florida). I have repaired outboards, carried firearms for protection from dangerous animals (brown bears and wolves), and assisted in construction of structures including cabins and tent platforms. I have operated vessels ranging from 12 to 72 ft by myself and assisted in skippering vessels up to 84 ft (crabber out of Kodiak, Alaska). I have experience operating navigational equipment including GPS, Loran, Radar, and Searchlight sonar, and using nautical charts, compasses, parallels, etc.

Publications, Contributed Publications, and Reports:
Final Reports Submitted to Trustee Council:
Biggs, E.D. and T.T. Baker. Studies on Pacific herring in Prince William Sound following the *Exxon Valdez* oil spill, 1989–1992 (former FS11 G-egg loss and H-fecundity are included

with this report).
E.D. Brown, T.T. Baker, F. Funk, J.E. Hose, R.M. Kocan, G.D. Marty, M.D. McGurk, B.L. Norcross and J.W. Short. 1994. Injury to Prince William Sound herring following the *Exxon Valdez* oil spill: Final Report for Natural Damage Assessment Fish/Shellfish Study No. 11; EVOC T., Anchorage, AK, 310 pp.
Baker, T.T. and E.D. Biggs. 1993. Measurements of the survival of Pacific herring eggs in the field following the *Exxon Valdez* oil spill, 1989–1991.

Journal Articles:
Brown, E.D., T.T. Baker, J.E. Hose, R.M. Kocan, G.D. Marty, M.D. McGurk, B.L. Norcross and J. Short. 1996. Injury to the early life history stages of Pacific herring in Prince William Sound after the *Exxon Valdez* oil spill. Am. Fish. Soc. Symp. 18, pp. 448–462.
Brown, E.D., B.L. Norcross and J.W. Short. 1996. An introduction to studies on the effects of the *Exxon Valdez* oil spill on early life history stages of Pacific herring, *Clupea pallasi*, in Prince William Sound, Alaska. *Can. J. Fish. Aq. Sci.* 53: 2337–2342.
Brown, E.D. and E.M. Debeves. In press. Effects of the *Exxon Valdez* oil spill on in situ survival of Pacific herring (*Clupea pallasi*) eggs. *Can. J. Fish. Aq. Sci.*
McGurk, M.D. and E.D. Brown. 1996. Egg-larval mortality of Pacific herring in Prince William Sound, Alaska, after the *Exxon Valdez* oil spill. *Can. J. Fish. Aq. Sci.* 53: 2343–2354.
Hose, J.E., M.D. McGurk, G.D. Marty, D.E. Hinton, E.D. Brown and T.T. Baker. 1996. Sublethal effects of the *Exxon Valdez* oil spill on herring embryos and larvae: Morphologic, cytogenetic, and histopathological assessments, 1989–1991. *Can. J. Fish. Aq. Sci.*
Kocan, R.M., J.E. Hose, E.D. Brow, and T.T. Baker. 1996. Pacific herring (*Clupea pallasi*) embryo sensitivity to Prudhoe Bay petroleum hydrocarbons: Laboratory evaluation and *in situ* exposure at oiled and unoiled sites in Prince William Sound. *Can. J. Fish. Aq. Sci.* 53: 2366–2375.
Norcross, B.L., J.E. Hose, M. Frandsen and E.D. Brown. 1996. Distribution, abundance, morphological condition and cytogenetic abnormalities of larval herring in Prince William Sound, Alaska, following the *Exxon Valdez* oil spill. *Can. J. Fish. Aq. Sci.* 53: 2376–2387.
Kocan, R.M., G.D. Marty, M.S. Okihiro, E.D. Brown and T.T. Baker. 1996. Reproductive success and histopathology of individual Prince William Sound Pacific herring three years after the *Exxon Valdez* oil spill. *Can. J. Fish. Aq. Sci.* 53: 2388–2393.
Marty, G.D., J.E. Hose, M.D. McGurk, E.D. Brown and D. E Hinton. In press. Histopathology and cytogenetic evaluation of Pacific herring larvae exposed to petroluem hydrocarbons in the laboratory or in Prince William Sound, Alaska, after the *Exxon Valdez* oil spill. *Can J. Fish. Aq. Sci.*

CO-PRINCIPAL INVESTIGATOR

Brenda L. Norcross

The Co-Principal Investigator will review survey design, data, and analysis; review reports and publications.

Education:
A.B., Biology, MacMurray College, Jacksonville, Illinois, 1971
M.S., Biology, St. Louis University, St. Louis, Missouri, 1976
Ph.D., Marine Science, Virginia Institute of Marine Science, School of Marine Science, College of William and Mary, Gloucester Point, Virginia, 1983

Experience:
Associate Professor, Institute of Marine Science, School of Fisheries and Ocean Sciences,

University of Alaska Fairbanks, 1989–present
Sabbatical leave, Caribbean region, 1997–1998
Assistant Professor, Institute of Marine Science, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, 1989–1996
Assistant Professor, Division of Biological Oceanography and Fisheries Science, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia, 1986–1988
Assistant Professor, Computer Center, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia, 1984–1986
Research Biologist/Oceanographer, Ocean Research and Education Society, Inc., Gloucester, Massachusetts, 1984
Graduate Research Assistant, Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia, 1978–1983
Research Associate and Laboratory Supervisor, Renal Division, Department of Pediatrics, Washington University, School of Medicine, St. Louis, Missouri, 1973–1978
Science and Math Teacher, Andrew Jackson Junior High School, Prince George's County Public Schools, Suitland, Maryland, 1971–1973

Field Experience:

- S/V *Phaedrus,* 52-foot ketch, Sabbatical leave – live aboard, Sailing techniques, applied oceanography, meteorology, climatology and fisheries (Florida, The Bahamas, Turks and Caicos, Dominican Republic, Puerto Rico, U.S. Virgin Islands, British Virgin Islands, St. Martin, Anguilla, St. Barths, St. Eustatius, St. Kitts, Nevis, Antigua, Montserrat, 9 months), 1997–98.
- One fisheries vessel, Principal Investigator, Pelagic fish, zooplankton, hydroacoustics, oceanography, underwater camera (Prince William Sound, 7 days), 1998.
- One–five fisheries vessels, Principal Investigator, Pelagic fish, zooplankton, hydroacoustics, oceanography, underwater camera, aerial surveys (Prince William Sound, 34 days), 1997.
- 26-foot Boston whaler, Principal Investigator, Inshore demersal fish and crabs, sediment, and CTD (Kodiak Island, 10 days), 1997.
- R/V *Tiglax*, Principal Investigator, Near-shore demersal fish, mid-water fish, sediment, CTD, and underwater camera (Aleutians to Homer, AK, 26 days), 1997.
- F/V *Tracy Ann*, Principal Investigator, Near-shore demersal fish, mid-water fish, sediment, CTD, and underwater camera (Forrester Island, 7 days), 1997.
- Five fisheries vessels, Principal Investigator, Pelagic fish, zooplankton, hydroacoustics, oceanography, aerial surveys (Prince William Sound, 60 days), 1996.
- F/V *Bering Explorer*, Chief Scientist and Principal Investigator, Near-shore demersal fish, sediment, underwater camera, and CTD (Lower Cook Inlet, 8 days), 1996.
- 26-foot Boston whaler, Principal Investigator, Inshore demersal fish and crabs, sediment, and CTD (Kodiak Island, 12 days), 1996.
- R/V *Tiglax*, Principal Investigator, Near-shore demersal fish, sediment, and water samples (Aleutians to Homer, AK, 34 days), 1996.
- 28-foot skiff, Principal Investigator, Inshore demersal fish and crabs, benthos, sediment, and CTD (Kachemak Bay, 30 days), 1996.
- Six fisheries vessels, Principal Investigator, Pelagic fish, hydroacoustics, oceanography, aerial surveys (Prince William Sound, 22 days), 1995.
- 28-foot skiff, Chief Scientist and Principal Investigator, Inshore fish and crabs, benthos and sediment (Kachemak Bay, 7 days), 1994.
- 26-foot Boston whaler, Chief Scientist and Principal Investigator, Inshore fish and crabs, benthos and sediment (Kodiak Island, 12 days), 1994.
- 24-foot skiff, Chief Scientist and Principal Investigator, Inshore fish, benthos and sediment (Afognak Island, 8 days), 1994.
- F/V *Maritime Maid*, Fisheries Scientist, Distribution of juvenile fishes (Aleutian Islands, 16

days), 1994.

- 26-foot Boston whaler, Chief Scientist and Principal Investigator, Inshore fish and crabs, benthos and sediment (Kodiak Island, 9 days), 1993.
- F/V *Big Valley*, Chief Scientist and Principal Investigator, Inshore fish, benthos, sediment, ROV and water samples (Kodiak Island, 14 days), 1992.
- 24-foot skiff, Chief Scientist and Principal Investigator, Inshore fish, benthos, sediment and water samples (Kodiak Island, 6 days), 1992.
- 21-foot Boston whaler, Scientist, Inshore fish (Auke Bay, 2 days), 1992.
- F/V *Big Valley*, Chief Scientist and Principal Investigator, Inshore fish, benthos, sediment and water samples (Kodiak Island, 7 days), 1991.
- 24-foot skiff, Chief Scientist and Principal Investigator, Inshore fish, benthos, sediment and water samples (Kodiak Island, 12 days), 1991.
- R/V *Alpha Helix*, Associate Scientist and Principal Investigator, Distribution of larval fish (Alaska to Hawaii, 17 days), 1991.
- R/V *Alpha Helix*, Associate Scientist, Distribution of larval fish (Gulf of Alaska, 3 cruises, 9 days), 1990.
- R/V *Alpha Helix*, Chief Scientist and Principal Investigator (One cruise), Associate Investigator (three cruises), Distribution of larval fish, oil spill (Prince William Sound, 27 days), 1989.
- F/V *Jennie Girl*, Principal Investigator, Distribution of larval fish, oil spill (Prince William Sound, 10 days), 1989.
- NOAA Ship *John Cobb*, Chief Scientist and Principal Investigator, Distribution of larval fish, oil spill (Prince William Sound, 7 days), 1989.
- R/V *Little Dipper*, Chief Scientist and/or Principal Investigator, Distribution and transport of larval fish (Resurrection Bay, 4 cruises, 20 days), 1989.

Selected Publications:

Norcross, B. L., A. Blanchard and B. A. Holladay. In press. Models for defining near-shore nursery areas of flatfishes in Alaskan waters. *Fish.Oceanog.*

Moles, A. and B. L. Norcross. 1998. Effects of oil-laden sediments on growth and health of juvenile flatfishes. *Can. J. Fish. Aquat. Sci.* 55: In press.

Norcross, B. L., F. -J. Müter and B. A. Holladay. 1997. Habitat models for juvenile flatfishes around Kodiak Island, Alaska. *Fish. Bull.* (U.S.) 95(3): 504–520.

Norcross, B. L., J. E. Hose, M. Frandsen, and E. D. Brown. 1996. Distribution, abundance, morphological condition, and cytogenetic abnormalities of larval herring in Prince William Sound, Alaska, following the *Exxon Valdez* oil spill. Can. J. Fish. Aquat. Sci. 53: 2376–2387.

Brown, E. D., B. L. Norcross and J. W. Short. 1996. Conditions affecting the distribution of oil from the *Exxon Valdez* spill and exposure of Pacific herring, *Clupea pallasi*, in Prince William Sound, Alaska. *Can. J. Fish. Aquat. Sci.* 53: 2337–2342.

Norcross, B. L. and M. Frandsen. 1996. Distribution and abundance of larval fishes in Prince William Sound, Alaska, during 1989 after the *Exxon Valdez* oil spill. In S. D. Rice, R. B. Spies, D. A. Wolfe and B. A. Wright [eds.]. *Exxon Valdez* Oil Spill Symposium Proceedings. Am. Fish. Soc. Symp. 18: 463–486.

Brown, E. D., T. T. Baker, J. E. Hose, G. D. Marty, M. D. McGurk, B. L. Norcross, and J. F. Short. 1996. The *Exxon Valdez* oil spill and Pacific herring in Prince William Sound, Alaska: A summary of injury to the early life history stages. *In* S. D. Rice, R. B. Spies, D. A. Wolfe and B.A. Wright (eds.). *Exxon Valdez* Oil Spill Symposium Proceedings. *Am. Fish. Soc. Symp.* 18: 448–462.

Norcross, B. L., B. A. Holladay, and F. -J. Müter. 1995. Nursery area characteristics of pleuronectids in coastal Alaska, USA. *Neth. J. Sea Res.* 34(1–3): 161–175.

Holladay, B. H. and B. L. Norcross. 1995. Diet of age-0 Pacific halibut in near-shore waters of Kodiak Island, Alaska. *Env. Biol. Fish.* 44: 403–416.
Severin, K. P., J. Carroll, and B. L. Norcross. 1995. Electron microprobe analysis of juvenile walleye pollock (*Theragra chalcogramma*). *Env. Biol. Fish.* 43: 269–283.
Müter, F. -J., B. L. Norcross and T. C. Royer. 1995. Do cyclic temperatures cause cyclic fisheries? *Can. Spec. Pub. Fish. Aquat. Sci. Monograph Ser.* 121: 123–132.
Moles, A., S. Rice and B. L. Norcross. 1994. Non-avoidance of hydrocarbon laden sediments by juvenile flatfishes. *Neth. J. Sea Res.* 32(3/4): 361–367.
Müter, F. -J. and B. L. Norcross. 1994. Distribution, abundance, and growth of larval walleye pollock (*Theragra chalcogramma*) in an Alaskan fjord. Fish. Bull. (U.S.) 92(3): 582–590.
Norcross, B. L. 1992. Responding to an oil spill: Reflections of a fisheries scientist. Fisheries (Bull. Am. Fish. Soc.) 17(6): 4–5.
Norcross, B. L. and R. F. Shaw. 1984. Oceanic and estuarine transport of fish eggs and larvae: A review. *Trans. Am. Fish Soc.* 113(2): 153–165.

LITERATURE CITED

Brown, E.D. and B.L Norcross. In prep. Assessment of forage fish distribution and abundance using aerial surveys: survey design and methodology. To be submitted to *Ecological Applications.*

Blaxter, J.H.S. and J.R. Hunter. 1982. The biology of clupeoid fishes. *Adv. Mar. Biol.* 20: 1–223.
Borstad. G.A., D.A. Hill, R.C. Kerr and B.S. Nakashima. 1992. Direct digital remote sensing of herring schools. *Int. J. Remote Sensing* 13(12): 2191–2198.

Brady, J. A. 1987. Distribution, timing, relative biomass indices for Pacific herring as determined by aerial surveys in Prince William Sound 1978–1987. Prince William Sound Data Report No. 87–14. Alaska Department of Fish and Game, Div. of Commercial Fisheries, Juneau, AK. 11 pp.

Carscadden, J., B. Nakashima and D.S. Miller. 1994. An evaluation of trends in abundance of capelin (*Mallotus villosus*) from acoustics, aerial surveys and catch rates in NAFO Division 3L, 1982–89. *J. Northw. Atl. Fish. Sci.* 17: 45–57.

Campbell, J.S. and G.H. Winter. 1973. Some biological characteristics of capelin, *Mallotus villosus*, in the Newfoundland area. ICNAF Redb. 1973 (III): 137–144 (also ICNAF Res. Doc. 73/90, Ser. No. 3048).

Cram, D.L. and I. Hampton. 1976. A proposed aerial/acoustic strategy for pelagic fish stock assessment. *J. Const. Int. Explor. Mer.* 37(1): 91–97.

Fiedler, P.C. 1978. The precision of simulated transect surveys of northern anchovy, *Engraulis mordax*, school groups. *Fish. Bull., U.S.* 76(3): 679–685.

Fresh, J.L. 1979. Distribution and abundance of fishes occurring in the nearshore surface waters of Northern Puget Sound, Washington, M.S. Thesis, Univ. of Washington, Seattle, 120 pp.

Hara, I. 1985. Shape and size of Japanese sardine school in the waters off the southeastern Hokkaido on the basis of acoustic and aerial surveys. *Bull. Jap. Soc. Sci. Fish.* 51(1): 41–46.

Lebida, R.C. and D.C. Whitmore. 1985. Bering Sea herring aerial survey manual. Bristol Bay Data Report No. 85-2. Alaska Department of Fish and Game, Div. Commercial Fisheries,

Anchorage AK.

Mais, K.F. 1974. Pelagic fish surveys in the California Current. Calif. Dept. Fish Game, *Fish. Bull.* 162: 1–79.

Misund, O.A. 1993. Abundance estimation of fish schools based on a relationship between school area and school biomass. *Aquat. Living Resour.* 6: 235–241.

Rivest, L-P., F. Potvin, H. Crépeau and G. Daigle. 1995. Statistical methods for aerial surveys using the double-count technique to correct visibility bias. *Biometrics* 51: 461–470.

Seber, G.A.F. 1982. The Estimation of Animal Abundance and Related Parameters, 2nd Ed. Griffin, London.

Sinclair, M. 1988. Marine Populations. An Essay on Population Regulation and Speciation. Washington Sea Grant, Seattle, WA. 252 pp.

Smith, P.E. 1978. Precision of sonar mapping for pelagic fish assessment in the California Current. *J. Const. Int. Explor. Mer.* 38(1): 33–40.
Squire, J.L., Jr. 1978. Northern anchovy school shapes as related to problems in school size estimation. *Fish. Bull., U.S.* 76(2): 443–448.

Stocker, M. 1993. Recent management of the British Columbia herring fishery, pp. 267–293. In L.S. Parsons and W.H. Lear [eds.] Perspectives on Canadian marine fisheries management. *Can. Bull. Fish. Aquat. Sci.* 226.

Templeman, W. 1948. The life history of the capelin (*Mallotus villosus*) in Newfoundland waters. Res. Bull. Newfoundland Govt. Lab. No. 17, pp. 1–151.

APEX BUDGET (updated 4/7/98)

Project Number	Title	Investigator(s) (Agency)	FY94 Budget	FY95 Budget	FY96 Budget	FY97 Budget	FY98 Budget	FY99 Project Budget	FY99 Budget Total
98163 A	Forage Fish Assessment	Lew Haldorson and Tom Shirley (UAF)	606.6	482.5	406.6	406.5	389.7	245.5	272.4
99163 B	Bird/Fish Interaction	Bill Ostrand (USFWS)	------	83.3	132.2	118.4	89.9	120.9	120.9
98163 C	Fish Diet Overlap	Molly Sturdevant (NOAA)	------	NOAA 21.0 ADFG 34.5 total 55.5	NOAA 17.7 ADFG 51.3 total 69.0	88.3	29.9	0.0	0.0
96163 D	Puffins as Samplers	John Piatt (NBS)	------	41.5	12.0	0.0	0.0	0.0	0.0
99163 E	Black-legged Kittiwakes	Dave Irons and Rob Suryan (USFWS)	------	105.7	164.4	170.0	181.3	246.8	246.8
99163 F	Pigeon Guillemots	Greg Golet (USFWS)	------	127.2	148.3	134.5	127.9	188.5	188.5
99163 G	Energetics	Dan Roby and Jill Anthony (OSU)	------	158.8	171.2	171.0	221.3	167.4	179.1
97163 H	Proximate Composition	Graham Worthy (TA&M)	------	0.0	0.0	29.3	0.0	0.0	0.0
99163 I	Project Leader	Dave Duffy (UAA)	------	150.0	186.7	139.2	160.6	92.3	98.8
99163 J	Barren Is. Murres & Kittiwakes	Dave Roseneau and Art Kettle (USFWS)	------	36.1	104.0	107.0	112.5	115.7	115.7
99163 K	Fish as Samplers	Dave Roseneau (FWS)	------	15.1	4.7	9.2	9.6	12.0	12.0

Project Number	Title	Investigator(s) (Agency)	FY94 Budget	FY95 Budget	FY96 Budget	FY97 Budget	FY98 Budget	FY99 Project Budget	FY99 Budget Total
99163 L	Historical Data Review	Paul Anderson (NOAA) John Piatt (NBS) Jim Blackburn (F&G) Bill Becktol (F&G)	------	NBS 28.8 NOAA 7.0 ADFG 19.0 total 54.0	NBS 20.0 NOAA 45.1 ADFG 32.3 total 97.4	NBS 19.3 NOAA 43.3 ADFG 28.8 total 91.4	NBS 24.8 NOAA 31.6 ADFG 35.0 total 91.4	NBS 22.8 NOAA 38.3 ADFG 29.1 total 90.2	NBS 22.8 NOAA 38.3 ADFG 29.1 total 90.2
99163 M	Lower Cook Inlet	John Piatt (NBS)	------	-------	214.0	214.0	267.7	267.7	267.7
98163 N	Kittiwake Feeding Exp.	Marc Romano and John Piatt (NBS)	------	-------	21.4	30.0	30.0	0.0	0.0
99163 O	Statistical Review	Lyman McDonald (WET)	------	-------	21.4	21.4	21.4	30.0	32.1
96163 P	Sand Lance HC Exposure	Jack Anderson (CAS)	------	-------	21.4	0.0	0.0	0.0	0.0
99163 Q was 97253	APEX Modeling	Dave Ainley (HTH&A) Glenn Ford (ECI) Dave Schneider (MUN)	------	-------	-------	69.8	69.8	67.5	72.2
99163R was 98231	Marbled Murrelets	Kathy Kuletz (FWS)	------	-------	-------	120.0	112.7	114.7	114.7
99163S	Jellies	Jenny Purcell (UM)	------	-------	-------	-------	96.5	109.2	116.8
99163T	Aerial Surveys	Evelyn Brown (UAF) Glenn Ford (ECI)	------	-------	-------	-------	-------	54.4	58.2
TOTALS	20		$ 606.6K	$1,310.5K	$1,774.7K	$1,920.0K	$2,012.2K	$1,922.8K	$1,986.1K

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	PROPOSED FFY 1999 TRUSTEE AGENCIES TOTALS					
			ADEC	ADF&G	ADNR	USFS	DOI	NOAA
			$0.0	$87.3	$0.0	$0.0	$1,089.1	$809.7
Personnel	$584.0	$599.8						
Travel	$37.9	$29.5						
Contractual	$1,091.6	$1,018.4						
Commodities	$128.7	$152.7						
Equipment	$12.0	$24.8	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$1,854.2	$1,770.8	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
General Administration	$158.0	$160.9						
Project Total	$2,012.2	$1,986.1	$1,218.8	$250.1	$0.0	$0.0	$0.0	$0.0
Full-time Equivalents (FTE)	14.8	15.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$250.0	$250.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0

Comments: The primary objective of the 1994 Forage Fish Study was to test techniques and collect data in PWS to aid in designing sampling methods for subsequent years. In 1995 the Apex Predator Ecosystem Experiment (APEX) conducted simultaneous seabird and hydroacoustic surveys in conjunction with collections of seabird productivity and energetics data. The 1996 APEX project will include related monitoring and research of seabirds and their forage fish prey. Additional components of APEX will continue analysis of historic Gulf of Alaska trawl data, ecosystem modeling, and investigating continued exposure of sand lance to Exxon Valdez oil. The FY97 APEX study incorporates marbled murrelet (163R) investigations. The FY98 APEX study incorporates jellyfish (163S) investigations. The FY98 APEX study incorporates aerial surveys (163T) investigations.

163D, Puffins as Samplers, was closed out in FY96. 97163H PI withdrew from the project, and 163C and 163N were closed out in FY98. The funds are slated to be redirected within the project.

1999

Project Number: 99163A-P
Project Title: APEX
Lead Agency:

FORM 2A
PROJECT
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$0.0	$0.0						
Travel	$3.4	$3.4						
Contractual	$366.5	$251.5						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$369.9	$254.9						
General Administration	$19.8	$17.5						
Project Total	$389.7	$272.4	$100.0	$0.0				
Full-time Equivalents (FTE)	0.2	0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: This project was first funded as a component of the Forage Fish Ecosystem Study (94163) then as the APEX project (95163A , 96163A, 97163A, then 98163A). The contract budget details are still pending university approval.

1999

Project Number: 99163A
Project Title: APEX/Forage Fish Assessment
Agency: NOAA

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		0.0	0	0	
						Personnel Total	$0.0

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
	Juneau to Anchorage (APEX planning and review meetings)	444	3	9	225	3.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$3.4

1999

Project Number: 99163A
Project Title: APEX/Forage Fish Assessment
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FFY 1999
printing of APEX annaul report, DPD, and detailed budgets (100 copies each)	6.0
Forage Fish Assessment Contract	245.5
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$251.5

Commodities Costs:	Proposed
Description	FFY 1999
Commodities Total	$0.0

1999

Project Number: 99163A
Project Title: APEX/Forage Fish Assessment
Agency: NOAA

FORM 3B
Contractual & Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1999

Project Number: 99163A
Project Title: APEX/Forage Fish Assessment
Agency: NOAA

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999
Personnel	$90.6	$0.0
Travel	$20.9	$0.0
Contractual	$123.1	$0.0
Commodities	$4.8	$0.0
Equipment	$12.4	$0.0
Subtotal	$251.8	$0.0
Indirect (50.0%)	$108.7	$0.0
Project Total	$360.5	$245.5
Full-time Equivalents (FTE)	2.3	0.0
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
$90.0	$0.0				

Dollar amounts are shown in thousands of dollars.

Comments: This project was first funded as a component of the Forage Fish Ecosystem Study (94163) then as the APEX project (95163A, 96163A, 97163A, and 98162A). The primary objective of this project is to collect hydroacoustic and net sampling data and to analyze these data. Indirect costs as a UAF contract are 50.0% of total except equipment and student tuition. The budget details are still pending university approval.

1999

Project Number: 99163A
Project Title: APEX/Forage Fish Assessment
Name: University of Alaska Fairbanks

FORM 4A
Non-Trustee
DETAIL

1999 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FFY 1999
L. Haldorson	PI			8,555	0	0.0
T. Shirley	fish biologist			7,328	0	0.0
K. Coyle	fish biologist			5,250	0	0.0
	technician			3,455	0	0.0
	M.S. student			1,096	0	0.0
	MS student			1,096	0	0.0
	tuition (4 semesters @ $2770/semester)					0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.0	26,780	0	
					Personnel Total	$0.0

Travel Costs:	Ticket	Round	Total	Daily	Proposed
Description	Price	Trips	Days	Per Diem	FFY 1999
Fairbanks to Cordova	454	0	0	103	0.0
Juneau to Cordova	352	0	0	103	0.0
Juneau to Seattle	752	0	0	113	0.0
Fairbanks to Seattle	1,248	0	0	113	0.0
Juneau to Anchorage	444	0	0	170	0.0
Fairbanks to Anchorage	218	0	0	170	0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

1999

Project Number: 99163A
Project Title: APEX/Forage Fish Assessment
Name: University of Alaska Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed FFY 1999
Description	
communications	0.0
vessel charters: acoustic vessel @ 1,200/day for 21 days (July cruise)	0.0
seine vessel @ 1,050/day for 21 days (July cruise)	0.0
Pandalas @ 1,350/day for 24 days (spring process cruise)	0.0
process vessel @ 1,350/day for 24 days (fall cruise)	0.0
Biosonics field contract and equipment maintenance	0.0
shipping	0.0
Contractual Total	$0.0

Commodities Costs:	Proposed FFY 1999
Description	
calorimeter supplies	0.0
chemicals (formalin STF substitute, formalin, and gasses)	0.0
office supplies	0.0
sample bottles and jars	0.0
computer supplies	0.0
shipping containers (20 @ $22.50 ea.)	0.0
Commodities Total	$0.0

1999

Project Number: 99163A
Project Title: APEX/Forage Fish Assessment
Name: University of Alaska Fairbanks

FORM 4B
Contractual & Commodities
DETAIL

1999 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FFY 1999
gillnets (2 @ $250 ea.)	0	250	0.0
Kodiak trawl	0	1,500	0.0
micro-bomb calorimeter	0	6,400	0.0
color video camera	0	1,500	0.0
mid-water trawl	0	2,500	0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number
Description	of Units

1999

Project Number: 99163A
Project Title: APEX/Forage Fish Assessment
Name: University of Alaska Fairbanks

FORM 4B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$76.0	$104.0						
Travel	$1.2	$1.0						
Contractual	$1.0	$0.0						
Commodities	$0.2	$0.3						
Equipment	$0.0	$0.0						
Subtotal	$78.4	$105.3						
General Administration	$11.5	$15.6						
Project Total	$89.9	$120.9	$50.0	$0.0				
Full-time Equivalents (FTE)	1.5	2.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: Collect seabird activity data while simultaneously monitoring fish abundance to determine seabirds' relationship to forage resources, how seabird's foraging behavior responds to change in the forage resource, and if forage availability is limiting population recovery. By collecting long term data on seabird activity while simultaneously monitoring forage fish abundance and distribution this project will determine relationship to forage resources, how seabirds' foraging behavior responds to change in the forage resource, and if forage availability is limiting population recovery.

1999

Project Number: 99163B
Project Title: APEX/Seabird Interactions
Agency: DOI

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
Name	Position Description					
B. Ostrand	PI	GS11-4	12.0	5,367		64.4
L. Joyal	Research Assistant	GS7-1	12.0	3,300		39.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Subtotal			24.0	8,667	0	
					Personnel Total	$104.0

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
Description					
travel to Pacific Seabird Group scientific meeting					0.0
(USFWS will cover the expected costs above $1,000)	650	1	5	70	1.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$1.0

1999

Project Number: 99163B
Project Title: APEX/Seabird Interactions
Agency: DOI

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed FFY 1999
Description	
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed FFY 1999
Description	
scientific supplies (film, waterproof notebooks, charts)	0.1
rain gear, rubber boots, and gloves	0.2
Commodities Total	$0.3

1999

Project Number: 99163B
Project Title: APEX/Seabird Interactions
Agency: DOI

FORM 3B
Contractual & Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1999

Project Number: 99163B
Project Title: APEX/Seabird Interactions
Agency: DOI

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999
Personnel	$24.1	$0.0
Travel	$2.2	$0.0
Contractual	$0.0	$0.0
Commodities	$0.0	$0.0
Equipment	$0.0	$0.0
Subtotal	$26.3	$0.0
General Administration	$3.6	$0.0
Project Total	$29.9	$0.0
Full-time Equivalents (FTE)	0.4	0.0
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
$0.0	$0.0				

Dollar amounts are shown in thousands of dollars.

Comments: This project was designed to understand diet overlap of forage fish species in Prince William Sound. This project was closeed out in FY98.

1999

Project Number: 99163C
Project Title: APEX/Fish Diet Overlap
Agency: NOAA

FORM 3A
AGENCY
PROJECT
DETAIL

4/7/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
	Name	Position Description					
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		0.0	0	0	
						Personnel Total	$0.0

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
	Description					
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.0

1999

Project Number: 99163C
Project Title: APEX/Fish Diet Overlap
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed FFY 1999
Description	
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed FFY 1999
Description	
Commodities Total	$0.0

1999

Project Number: 99163C
Project Title: APEX/Fish Diet Overlap
Agency: NOAA

FORM 3B
Contractual & Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1999

Project Number: 99163C
Project Title: APEX/Fish Diet Overlap
Agency: NOAA

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$107.0	$118.0						
Travel	$7.1	$7.1						
Contractual	$18.2	$58.2						
Commodities	$22.0	$32.0						
Equipment	$9.7	$9.7						
Subtotal	$164.0	$225.0						
General Administration	$17.3	$21.8						
Project Total	$181.3	$246.8	$100.0	$0.0				
Full-time Equivalents (FTE)	2.4	2.6						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: This component will collect information on kittiwake foraging and reproductive parameters that indicate food stress. The cost of this project is being shared by the EVOS Trustee Council and the US Fish and Wildlife Service (FWS). The FWS is providing funding for most of the data collection at the Shoup Bay colony. This includes salaries for the camp leader, and two biotechnicians, travel cost and cost associated with running the field camp. The FWS is also providing funding for population size and productivity surveys of all 26 PWS kittiwake colonies. The APEX budget will provide funding for one Shoup Bay biotech.

1999

Project Number: 99163 E
Project Title: APEX/Kittiwakes
Agency: DOI

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
	R. Suryan	co-PI	GS11/3	12.0	5,300		63.6
	D. Irons	co-PI	GS12/5	0.5	6,800		3.4
		biotech. (Eleanor Is.)	GS5	10.0	2,500		25.0
		graduate student (Icy Bay)		6.0	2,500		15.0
		volunteer			2,001		2.0
		volunteer			2,001		2.0
		biotech. (kittiwake foraging)	GS5	1.4	2,500		3.5
		biotech. (kittiwake foraging)	GS5	1.4	2,500		3.5
							0.0
							0.0
							0.0
							0.0
		Subtotal		31.3	26,102	0	
						Personnel Total	$118.0

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
	Anchorage to Whittier: transport boat, 2 trips @ $1,200/round trip plus	1200	2	360	4	3.8
	Anchorage to Whittier	100	13			1.3
	float plane trips to study site	250	4			1.0
	travel to Pacific Seabird Group scientific meeting					0.0
	(USFWS will cover the expected costs above $1,000)	650	1	5	70	1.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$7.1

1999

Project Number: 99163E
Project Title: APEX/Kittiwakes
Agency: DOI

FORM 3B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FFY 1999
delivery of equipment and supplies to study site (split w/163 F and 163R)	1.3
delivery of fuel to study site (split with 163F and 163R)	0.6
maintenance and cleaning of radio telemetry equipment	2.0
boat maintenance and repair (Whalers and solid-hull boats)	5.0
telephone services in offices and in field	0.7
computer, printer, and network repair and maintenance	0.5
film processing, postage and freight	0.6
publication page charges	0.5
maintenance and cleaning of camping equipment, and optics	1.2
maintenance and cleaning of 2 inflatable boats ($400/boat) and 2 motors ($400/motor)	0.6
aircraft charter (aerial surveys) 40 days, 4hrs./day @ $250/hr	40.0
safety training ($550/person, 2 for 163E and 2 for 163G)	2.2
analysis of kittiwake diets (200 x $15)	3.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$58.2

Commodities Costs:	Proposed
Description	FFY 1999
food for 3 people for 120 days @ $12/day	4.4
boat fuel: 150 gal/day for 60 days @ $1.50/gal. + 150 gal/day for 35 days @ $1.50/gal (aerial survey support)	21.4
camp supplies (stove and lantern fuel, mantles, head nets, bug spray, batteries, and cleaning materials)	0.4
scientific supplies (batteries for radios, film, waterproof notebooks, sample bags, scales, calipers, rulers)	1.2
rain gear, rubber boots, and gloves for 3 people @ $200/person	0.6
lines, anchors, and propellers for boats	1.5
software updates for computers	0.4
first aid kits	0.1
purse seine (for support of aerial survey)	2.0
Commodities Total	$32.0

1999

Project Number: 99163E
Project Title: APEX/Kittiwakes
Agency: DOI

FORM 3B
Contractual & Commodities
DETAIL

4/7/98

New Equipment Purchases:	Number of Units	Unit Price	Proposed FFY 1999
Description			
radio tags			8.5
camp equipment (stoves, lanterns, tents, tools, batteries, dishes)			1.2
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.	**New Equipment Total**		$9.7

Existing Equipment Usage:	Number of Units	Inventory Agency
Description		
FWS lending telemetry equipment		USFWS

1999

Project Number: 99163E
Project Title: APEX/Kittiwakes
Agency: DOI

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999
Personnel	$85.8	$103.8
Travel	$6.2	$6.3
Contractual	$9.0	$22.0
Commodities	$12.1	$25.2
Equipment	$1.3	$14.1
Subtotal	$114.4	$171.4
General Administration	$13.5	$17.1
Project Total	$127.9	$188.5
Full-time Equivalents (FTE)	1.2	2.4
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
$140.0	$0.0				

Dollar amounts are shown in thousands of dollars.

Comments: This study will monitor the feeding and breeding ecology of pigeon guillemots on Naked Island in Prince William Sound and census their population there and at other designated study areas.

1999

Project Number: 99163F
Project Title: APEX/Guillemots
Agency: DOI

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
Name	Position Description					
G. Golet	PI	GS 9/11	12.0	4,940		59.3
	bio. tech.	GS 5	6.0	2,000		12.0
	bio. tech.	GS 5	6.0	2,000		12.0
	bio. tech.	GS 7	5.0	2,600		13.0
	volunteer					2.5
	volunteer					2.5
	volunteer					2.5
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		29.0	11,540	0	
					Personnel Total	$103.8

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
Description					
Anchorage to Whittier to transport boat	1250	2			2.5
Anchorage to Whittier for 4 people	100	16			1.6
field per diem: 4 people, 100 days @ $3/day					1.2
travel to Pacific Seabird Group scientific meeting					0.0
(USFWS will cover the expected costs above $1,000)	650	1	5	70	1.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$6.3

1999

Project Number: 99163F
Project Title: APEX/Guillemots
Agency: DOI

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed FFY 1999
Description	
delivery of equipment and supplies to study site, $4.0K (spilt w/163E)	2.0
delivery of fuel to study site (spilt w/163E)	2.0
maintenance and repair of camping equipment	1.2
boat maintenance and repair (Whaler or other solid-hull boat)	4.5
telephone services in office and in field	2.1
computer, printer, network repair and maintenance	0.5
film processing, postage and freight	0.2
outboard maintenance	1.6
maintenance and repair of 3 inflatable boats and 2 motors	3.0
'safety training ($830/person x 6)	4.9
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$22.0

Commodities Costs:	Proposed FFY 1999
Description	
food for 7 people for 120 days @ $12/day	10.1
boat fuel: 65g/day for 120 days @ $1.50/gal.	11.7
camp supplies (stove/lantern fuel, bug spray, batteries, tarps)	2.0
rain gear, gloves and boots for 2 people	1.4
	0.0
	0.0
	0.0
	0.0
	0.0
Commodities Total	$25.2

1999

Project Number: 99163F
Project Title: APEX/Guillemots
Agency: DOI

FORM 3B
Contractual & Commodities
DETAIL

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FFY 1999
data collection computer, model D5041 (DCCII)	1	3,100	3.1
telemetry receivers (2)	2	2,800	5.6
radio transmitters	40	135	5.4
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.	**New Equipment Total**		$14.1

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

1999

Project Number: 99163F
Project Title: APEX/Guillemots
Agency: DOI

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$0.0	$0.0						
Travel	$0.0	$0.0						
Contractual	$206.8	$167.4						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$206.8	$167.4						
General Administration	$14.5	$11.7						
Project Total	$221.3	$179.1	$100.0	$0.0				
Full-time Equivalents (FTE)	0.0	0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

1999

Project Number: 99163G
Project Title: APEX/Seabird Energetics
Agency: NOAA

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
	Name	Position Description					
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		0.0	0	0	
						Personnel Total	$0.0

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
	Description					
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.0

1999

Project Number: 99163G
Project Title: APEX/Seabird Energetics
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed FFY 1999
Description	
Contract with Oregon University Cooperative Research Unit.	167.4
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$167.4

Commodities Costs:	Proposed FFY 1999
Description	
Commodities Total	$0.0

1999

Project Number: 99163G
Project Title: APEX/Seabird Energetics
Agency: NOAA

FORM 3B
Contractual & Commodities
DETAIL

4/7/98

1999 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1999

Project Number: 99163G
Project Title: APEX/Seabird Energetics
Agency: NOAA

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$71.5	$77.2						
Travel	$10.9	$7.5						
Contractual	$36.6	$18.9						
Commodities	$40.5	$21.2						
Equipment	$0.0	$0.0						
Subtotal	$159.5	$124.8						
Indirect (26% or 42.5%)	$47.3	$42.6						
Project Total	$206.8	$167.4	$80.0	$0.0				
Full-time Equivalents (FTE)	3.1	2.8						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: Assess the taxonomic and biochemical composition of seabird diets and determine the relationship of diet to nestling provisioning rates, chick growth energetics, and the reproductive success of seabirds in the EVOS area. For FY98 increased effort by doing doubley labeled water experiments.

1999

Project Number: 99163G
Project Title: APEX/Seabird Energetics
Name: Oregon State University

FORM 4A
Non-
Trustee
DETAIL

1999 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FFY 1999
	postdoctoral research associate		12.0	3,040		36.5
	research assistant, field		3.0	1,920		5.8
	research assistant, field		3.0	1,920		5.8
	research assistant, field		3.0	1,920		5.8
	research assistant, field		3.0	1,907		5.7
	research assistant, field		3.0	1,907		5.7
	research assistant, field		3.0	1,907		5.3
	research assistant, lab.		3.0	2,200		6.6
			0.0	0		0.0
			0.0	0		0.0
			0.0	0		0.0
						0.0
	Subtotal		33.0	16,721	0	
					Personnel Total	$77.2

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FFY 1999
presentation at Pacific Seabird Group meetings and/or Rest. Worksho		1,000	2			2.0
Anchorage to Cordova to field station		700	6	10	130	5.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$7.5

1999

Project Number: 99163G
Project Title: APEX/Seabird Energetics
Name: Oregon State University

FORM 4B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed FFY 1999
'maintenance of propane freezer and accessories	0.6
personal services contract to FALCO for fish ID and processing	9.0
duplication/computer fees	1.0
publication: page charges, reports, visual aids	1.5
telephone services (long distance)	2.0
barge charter to study sites	2.0
maintenance of field equipment	0.8
shipping for samples	0.5
maintenance of laboratory equipment	1.5
	0.0
	0.0
	0.0
	0.0
Contractual Total	$18.9

Commodities Costs:	Proposed FFY 1999
lab. supplies, chemicals, extraction thimbles, and sample bags	1.9
float coats and mustang suits (2 ea.)	2.6
tents (VE25 Northface)	0.8
Pesols spring scales (5 @ $40 each)	0.2
binoculars (10X40, Steiner low light)	0.8
camp & field supplies (food, sleeping bags, pads & cots, propane heaters, MSR Waterwork filtration system, rite-in rain supplie	11.4
boat fuel (20 gallons/day @ 2.00/gallon for 87 days)	3.5
	0.0
	0.0
	0.0
Commodities Total	$21.2

1999

Project Number: 99163G
Project Title: APEX/Seabird Energetics
Name: Oregon State University

FORM 4B
Contractual & Commodities
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units

1999

Project Number: 99163G
Project Title: APEX/Seabird Energetics
Name: Oregon State University

FORM 4B
Equipment
DETAIL

4/7/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$0.0	$0.0						
Travel	$0.0	$0.0						
Contractual	$150.1	$92.3						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$150.1	$92.3						
General Administration	$10.5	$6.5						
Project Total	$160.6	$98.8	$98.0	$98.0	$0.0			
Full-time Equivalents (FTE)	1.7	1.7						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: This component of the APEX project will provide scientific oversight, coordination, performance tracking, and integration of results. The project management will have elements that have been used effectively in other large, multidisciplinary programs for ecosystem assessment. This is a proposal submitted under the Broad Agency Announcement.

1999

Project Number: 99163I
Project Title: APEX/Project Management
Agency: NOAA

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		0.0	0	0	
						Personnel Total	$0.0

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.0

1999

Project Number: 99163I
Project Title: APEX/Project Management
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed FFY 1999
Description	
contract (BAA)	92.3
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$92.3

Commodities Costs:	Proposed FFY 1999
Description	
Commodities Total	$0.0

1999

Project Number: 99163I
Project Title: APEX/Project Management
Agency: NOAA

FORM 3B
Contractual & Commodities
DETAIL

4/7/98

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1999

Project Number: 99163I
Project Title: APEX/Project Management
Agency: NOAA

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$88.7	$22.9						
Travel	$4.3	$11.0						
Contractual	$15.0	$45.0						
Commodities	$5.0	$5.0						
Equipment	$0.0	$0.0						
Subtotal	$113.0	$83.9						
Indirect (10.0%)	$37.1	$8.4						
Project Total	$150.1	$92.3	$95.0	$95.0	$0.0			
Full-time Equivalents (FTE)	1.8	0.2						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: This component of the APEX project will provide scientific oversight, coordination, performance tracking, and integration of results. The program management employed will have elements that have been used effectively in other large, multidisciplinary programs for ecosystem assessment. This is a proposal submitted under the Broad Agency Announcement.

1999

Project Number: 99163I
Project Title: APEX/Project Management
Name: University of Alaska Anchorage

FORM 4A
Non-Trustee
DETAIL

1999 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FFY 1999
D. Duffy	PI		2.0	11,450		22.9
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.0	11,450	0	
					Personnel Total	$22.9

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FFY 1999
Hawaii to Anchorage (August field visit and Rest. Workshop)		800	2	12	225	4.3
Anchorage to Homer (August field visit)		200	1	0	0	0.2
Anchorage to Valdez (August field visit)		200	1	0	0	0.2
Pacific Seabird Group meeting to present APEX paper		750	1	4	200	1.6
Colonial Waterbird Society meeting to present APEX paper		1,200	1	6	215	2.5
Society of Conservation Biology meeting		1,200	1	5	200	2.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$11.0

1999

Project Number: 99163I
Project Title: APEX/Project Management
Name: University of Alaska Anchorage

FORM 4B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FFY 1999
GIS and graphics contract	15.0
fish stomach analysis contract (check herring for dinoflagellates)	5.0
Bird biochemical analysis (mitochondria)	25.0
Contractual Total	$45.0

Commodities Costs:	Proposed
Description	FFY 1999
computer software and associated GIS supplies	4.5
field equipment for site visits	0.5
Commodities Total	$5.0

1999

Project Number: 99163I
Project Title: APEX/Project Management
Name: University of Alaska Anchorage

FORM 4B
Contractual & Commodities
DETAIL

4/7/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number
Description	of Units
computers	2

1999

Project Number: 99163I
Project Title: APEX/Project Management
Name: University of Alaska Anchorage

FORM 4B
Equipment
DETAIL

4/7/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$73.3	$76.4						
Travel	$2.8	$2.5						
Contractual	$12.2	$12.2						
Commodities	$12.4	$12.4						
Equipment	$0.0	$0.0						
Subtotal	$100.7	$103.5						
General Administration	$11.8	$12.2						
Project Total	$112.5	$115.7	$80.0	$0.0				
Full-time Equivalents (FTE)	1.8	1.8						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: This component is designed to collect data on common murres, kittiwakes, and puffins on the Barren Islands (which is in the EVOS area) that will be used in a multi-species analysis of seabird productivity and energetics.

1999

Project Number: 99163J
Project Title: APEX/Barren Islands Seabird Studies
Agency: DOI

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TR[illegible]E COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
Name	Position Description					
D. Roseneau	PI	GS11/5	6.5	4,900		31.9
A. Kettle	camp leader/bio. tech.	GS7/1	10.0	3,100		31.0
S. Zuniga	bio. tech..	GS5/1	5.0	2,700		13.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		21.5	10,700	0	
					Personnel Total	$76.4

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
Description					
Homer to Anchorage	150	2	4	150	0.9
per diem @ $3/day x 200 days					0.6
Pacific Seabird Conference					1.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$2.5

1999

Project Number: 99163J
Project Title: APEX/Barren Islands Seabird Studies
Agency: DOI

FORM 3B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FFY 1999
2 SCA volunteer in Homer, 3 months @ $3.9 each	7.8
2 vessel charter days @ $2.2K/day	4.4
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$12.2

Commodities Costs:	Proposed
Description	FFY 1999
gas, oil, Blazo, and propane	0.7
field, climbing, and camping gear	0.6
replace climbing ropes, pitons, carabiners, chokes, webbing	0.5
boating supplies	0.4
camping supplies	0.4
replacement boots, rain gear and sleeping bags	1.0
food habits sample analysis (75 samples @ $18/each)	1.3
upgrade and purchase of computer software	0.3
posters at public meetings (4 posters @ $.2 each)	0.8
notebooks and film	0.3
Food	3.2
cleaning, repair, and service of outboard motors, boats, radios, tents, and binoculars)	2.9
Commodities Total	$12.4

1999

Project Number: 99163J
Project Title: APEX/Barren Islands Seabird Studies
Agency: DOI

FORM 3B
Contractual & Commodities
DETAIL

New Equipment Purchases:			
Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		New Equipment Total	$0.0

Existing Equipment Usage:		
Description	Number of Units	Inventory Agency

1999

Project Number: 99163J
Project Title: APEX/Barren Islands Seabird Studies
Agency: DOI

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRU[illegible]E COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999
Personnel	$4.5	$4.9
Travel	$0.5	$0.5
Contractual	$2.5	$4.0
Commodities	$1.2	$1.6
Equipment	$0.0	$0.0
Subtotal	$8.7	$11.0
General Administration	$0.9	$1.0
Project Total	$9.6	$12.0
Full-time Equivalents (FTE)	0.1	0.1
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
$10.0	$0.0				

Dollar amounts are shown in thousands of dollars.

Comments: Forage fish will be obtained from the stomachs of sport caught large fish predators to test the feasibility and effectiveness of obtaining low cost, spatial and relative abundance data on forage fish in the Gulf of Alaska. This study will concentrate on Lower Cook Inlet. Based on peer review and Chief Scientist recommendations, this project was discontinued for FY96.

1999

Project Number: 99163K
Project Title: APEX/Large Fish as Samplers
Agency: DOI/USFWS

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
	Name	Position Description					
	D Roseneau	PI	GS11/5	1.0	4,900		4.9
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		1.0	4,900	0	
Those costs associated with program management should be indicated by placement of an *.						**Personnel Total**	$4.9

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
	Description					
	Homer to Anchorage	275	1	1	225	0.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.5

1999

Project Number: 99163K
Project Title: APEX/Large Fish as Samplers
Agency: DOI/USFWS

FORM 3B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUS[illegible]COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FFY 1999
1 SCA volunteer in Homer for 3.5 months	2.5
1 volunteer to id samples and enter data (1 o. @ $1.5K)	1.5
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$4.0

Commodities Costs:	Proposed
Description	FFY 1999
sampling supplies and freight	1.6
Commodities Total	$1.6

1999

Project Number: 99163K
Project Title: APEX/Large Fish as Samplers
Agency: DOI/USFWS

FORM 3B
Contractual & Commodities
DETAIL

4/7/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1999

Project Number: 99163K
Project Title: APEX/Large Fish as Samplers
Agency: DOI/USFWS

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999
Personnel	$21.6	$19.8
Travel	$0.0	$0.0
Contractual	$0.0	$0.0
Commodities	$0.0	$0.0
Equipment	$0.0	$0.0
Subtotal	$21.6	$19.8
General Administration	$3.2	$3.0
Project Total	$24.8	$22.8
Full-time Equivalents (FTE)	0.3	0.3
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
$10.0	$0.0				

Dollar amounts are shown in thousands of dollars.

Comments: This component will also coordinate the continuation of the historic review of the ecosystem structure in the Prince William Sound/Gulf of Alaska complex. Included in this review will be obtaining and synthesizing several forage fish data sets.

1999

Project Number: 99163L
Project Title: APEX Historic Review
Agency: DOI

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
Name	Position Description					
J. Piatt	PI	GS13/6	1.6	7,300		11.7
B. Johnson	tech.		2.3	3,500		8.1
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Subtotal			3.9	10,800	0	
					Personnel Total	$19.8

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
Description					
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

1999

Project Number: 99163L
Project Title: APEX Historic Review
Agency: DOI

FORM 3B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed FFY 1999
Description	
	0.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed FFY 1999
Description	
	0.0
Commodities Total	$0.0

1999

Project Number: 99163L
Project Title: APEX Historic Review
Agency: DOI

FORM 3B
Contractual & Commodities
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1999

Project Number: 99163L
Project Title: APEX Historic Review
Agency: DOI

FORM 3B
Equipment
DETAIL

4/7/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$17.6	$20.3						
Travel	$1.6	$1.6						
Contractual	$8.7	$10.0						
Commodities	$0.5	$2.7						
Equipment	$0.0	$0.0						
Subtotal	$28.4	$34.6						
General Administration	$3.2	$3.7						
Project Total	$31.6	$38.3	$10.0	$0.0				
Full-time Equivalents (FTE)	0.3	0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: This component will continue the historic review of the ecosystem structure in the Prince William Sound/Gulf of Alaska complex. Included in this review will be obtaining and synthesizing several forage fish data sets.

1999

Project Number: 99163L
Project Title: APEX/Historic Review of Forage Fish Data
Agency: NOAA

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
	Name	Position Description					
	P. Anderson	biologist	GS12/4	3.5	5,800		20.3
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		3.5	5,800	0	
						Personnel Total	$20.3

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
	Description					
	Kodiak to Anchorage	250	1	6	225	1.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1.6

1999

Project Number: 99163L
Project Title: APEX/Historic Review of Forage Fish Data
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed FFY 1999
Description	
electronic distributed database design	10.0
	0.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$10.0

Commodities Costs:	Proposed FFY 1999
Description	
software upgrades	0.7
presentation materials and preparation	2.0
Commodities Total	$2.7

1999

Project Number: 99163L
Project Title: APEX/Historic Review of Forage Fish Data
Agency: NOAA

FORM 3B
Contractual & Commodities
DETAIL

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency
GIS equipment and software	1	NOAA

1999

Project Number: 99163L
Project Title: APEX/Historic Review of Forage Fish Data
Agency: NOAA

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$28.2	$24.3						
Travel	$2.6	$1.2						
Contractual	$0.0	$0.0						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$30.8	$25.5						
General Administration	$4.2	$3.6						
Project Total	$35.0	$29.1	$10.0	$0.0				
Full-time Equivalents (FTE)	0.4	0.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments: This component will continue the historic review of the ecosystem structure in the Prince William Sound/Gulf of Alaska complex. Included in this review will be obtaining and synthesizing several forage fish data sets.

1999

Project Number: 99163L
Project Title: APEX/Historic Review of Forage Fish Data
Agency: ADF&G

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
	Name	Position Description					
	J. Blackburn	biologist III (Kodiak)	18	1.8	7,200		13.0
	B. Bechtol	biologist II (Homer)	16	2.1	5,400		11.3
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		3.9	12,600	0	
						Personnel Total	$24.3

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
	Description					
Homer to Anchorage		250	1	4	225	1.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1.2

1999

Project Number: 99163L
Project Title: APEX/Historic Review of Forage Fish Data
Agency: ADF&G

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed FFY 1999
Description	
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed FFY 1999
Description	
Commodities Total	$0.0

1999

Project Number: 99163L
Project Title: APEX/Historic Review of Forage Fish Data
Agency: ADF&G

FORM 3B
Contractual & Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1999

Project Number: 99163L
Project Title: APEX/Historic Review of Forage Fish Data
Agency: ADF&G

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$51.9	$51.9						
Travel	$0.0	$0.0						
Contractual	$130.0	$130.0						
Commodities	$68.9	$68.9						
Equipment	$0.0	$0.0						
Subtotal	$250.8	$250.8						
General Administration	$16.9	$16.9						
Project Total	$267.7	$267.7	$125.0	$0.0				
Full-time Equivalents (FTE)	1.7	1.7						
	Dollar amounts are shown in thousands of dollars.							
Other Resources	$250.0	$370.0	$110.0	$110.0				

This study is designed to measure the foraging (functional) and population (numerical) responses of six seabird species to fluctuating forage fish densities at three colonies in Cook Inlet.

Funding for this project is from three major sources: EVOS Trustee Council, Minerals Management Service ,and National Biological Service .

1999

Project Number: 99163M
Project Title: Response of Seabirds to Forage Fish Density
Agency: NBS

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
	Name	Position Description					
	G. Drew	Wildlife Biologist	GS11/2	4.0	5,031		20.1
	S. Zador	Wildlife Biologist	GS5/1	8.0	1,983		15.9
	M. Litzow	Wildlife Biologist	GS5/1	8.0	1,983		15.9
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		20.0	8,997	0	
						Personnel Total	$51.9

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
	Description					
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.0

1998

Project Number: 98163M
Project Title: Response of Seabirds to Forage Fish Density
Agency: NBS

FORM 3B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FFY 1999
M/V Pandalus (ADF&G research vessel)	43.2
Research Work Order, UC Irvine	26.8
University of Alaska, Kasitina Bay Lab.	35.0
FALCO, prey id and stomach analysis	25.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$130.0

Commodities Costs:	Proposed
Description	FFY 1999
food, camp, and field supplies for Chisik Is. field camp	25.0
food, camp, and field supplies for Kastina Is. field camp	25.0
satellite imagery	5.0
fuel (gas, diesel, and Blazo)	8.0
Whaler operations (repair and maintenance)	1.9
Kulak Clipper operations	4.0
Commodities Total	$68.9

1999

Project Number: 99163M
Project Title: Response of Seabirds to Forage Fish Density
Agency: NBS

FORM 3B
Contractual & Commodities
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases: Description			Number of Units	Unit Price	Proposed FFY 1999
Those purchases associated with replacement equipment should be indicated by placement of an R.				**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1999

Project Number: 99163M
Project Title: Response of Seabirds to Forage Fish Density
Agency: NBS

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$19.6	$0.0						
Travel	$4.1	$0.0						
Contractual	$1.5	$0.0						
Commodities	$1.8	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$27.0	$0.0						
General Administration	$3.0	$0.0						
Project Total	$30.0	$0.0	$0.0	$0.0				
Full-time Equivalents (FTE)	1.3	0.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								

This study will help determine: 1) Which parameters of breeding performance are most sensitive to food supply?
2) At what stage or stages of the breeding season are the effects of food limitation most evident?
3) Is food limiting the productivity of kittiwakes on Middleton Island?

FY98 is the closeout and final report preparation year.

1999

Project Number: 99163N
Project Title: Black-Legged Kittiwake Controlled Feeding Experiment
Agency: NBS

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
	Name	Position Description					
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		0.0	0	0	
						Personnel Total	$0.0

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
	Description					
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.0

1999

Project Number: 99163N
Project Title: Black-Legged Kittiwake Controlled Feeding Experiment
Agency: NBS

FORM 3B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed FFY 1999
Description	
	0.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$0.0

Commodities Costs:	Proposed FFY 1999
Description	
Commodities Total	$0.0

1999

Project Number: 99163N
Project Title: Black-Legged Kittiwake Controlled Feeding Experiment
Agency: NBS

FORM 3B
Contractual & Commodities
DETAIL

1999 EXXON VALDEZ TRUS[illegible] COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases:	Number	Unit	Proposed
Description	of Units	Price	FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number	Inventory
Description	of Units	Agency

1999

Project Number: 99163N
Project Title: Black-Legged Kittiwake Controlled Feeding Experiment
Agency: NBS

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$0.0	$0.0						
Travel	$0.0	$0.0						
Contractual	$20.0	$30.0						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$20.0	$30.0						
General Administration	$1.4	$2.1						
Project Total	$21.4	$32.1	$37.5	$0.0	$0.0			
Full-time Equivalents (FTE)	0.0	0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

This project will provide guidance on study design, insure appropriate statistical inferences, and assistance during statistical analysis of data and in report preparation.

The total FY96 budget for this project increased by $10,000 to accommodate additional projected project statistical review. The $10,000 was transferred from 96163I. These additional costs will be reflected in personnel and travel.

1999

Project Number: 99163O
Project Title: APEX: Statistical Review
Agency: NOAA

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		0.0	0	0	
						Personnel Total	$0.0

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.0

1999

Project Number: 99163O
Project Title: APEX: Statistical Review
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FFY 1999
Statistical review contract	30.0
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$30.0

Commodities Costs:	Proposed
Description	FFY 1999
Commodities Total	$0.0

1999

Project Number: 99163O
Project Title: APEX: Statistical Review
Agency: NOAA

FORM 3B
Contractual & Commodities
DETAIL

New Equipment Purchases:			
Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:		
Description	Number of Units	Inventory Agency

1999

Project Number: 99163O
Project Title: APEX: Statistical Review
Agency: NOAA

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999
Personnel	$15.3	$25.8
Travel	$3.6	$3.6
Contractual	$0.0	$0.0
Commodities	$1.1	$0.6
Equipment	$0.0	$0.0
Subtotal	$20.0	$30.0
Indirect	$0.0	$0.0
Project Total	$20.0	$30.0
Full-time Equivalents (FTE)	0.1	0.2
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
$35.0	$0.0	$0.0			

Dollar amounts are shown in thousands of dollars.

This project will provide guidance on study design, insure appropriate statistical inferences, and assistance during statistical analysis of data and in report preparation. The PI is a member of the Nearshore Vertebrate Predator project and will coordinate nearshore sampling in so far as possible.

The total FY96 budget for this project was increase by $10,000 to accommodate additional projected project statistical review (start-up costs). The $10,000 was transferred from 96163I. These additional costs were reflected in personnel and travel. .

1999

Project Number: 99163O
Project Title: APEX: Statistical Review
Agency: Western EcoSystems Technology

FORM 4A
Non-Trustee
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FFY 1999
L. McDonald	Senior Biometrician		1.0	14,400		14.4
	Biometrician II		1.1	10,400		11.4
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		2.1	24,800	0	
					Personnel Total	$25.8

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FFY 1999
DIA to Anchorage		950	2			1.9
meal per diem				10	45	0.5
hotel per diem (winter)				4	75	0.3
hotel per diem (summer)				4	110	0.4
car rental				10	45	0.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$3.6

1999

Project Number: 99163O
Project Title: APEX: Statistical Review
Agency: Western EcoSystems Technology

FORM 4B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed FFY 1999
Description	
Contractual Total	$0.0

Commodities Costs:	Proposed FFY 1999
Description	
long distance telephone	0.4
shipping, postage, supplies	0.2
Commodities Total	$0.6

1999

Project Number: 99163O
Project Title: APEX: Statistical Review
Agency: Western EcoSystems Technology

FORM 4B
Contractual & Commodities
DETAIL

4/7/98

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units

1999

Project Number: 99163O
Project Title: APEX: Statistical Review
Agency: Western EcoSystems Technology

FORM 4B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$0.0	$0.0						
Travel	$0.0	$0.0						
Contractual	$65.2	$67.5						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$65.2	$67.5						
General Administration	$4.6	$4.7						
Project Total	$69.8	$72.2	$88.0	$77.0				
Full-time Equivalents (FTE)	0.0	0.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								

A contract for a project designed to develop models of foraging effort and success as it relates to breeding productivity. Results will test the degree to which food limitation is affecting recovery, indicate the mechanisms by which this could come about, and identify the scale at which interactions are occurring between food availability and the colonies being studied by APEX.

1999

Project Number: 99163Q
Project Title: APEX Modeling
Agency: NOAA

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		0.0	0	0	
						Personnel Total	$0.0

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.0

1999

Project Number: 99163Q
Project Title: APEX Modeling
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

4/7/98

Contractual Costs:	Proposed FFY 1999
Description	
contract to H.T. Harvey and Associates for modeling	67.5
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$67.5

Commodities Costs:	Proposed FFY 1999
Description	
Commodities Total	$0.0

1999

Project Number: 99163Q
Project Title: APEX Modeling
Agency: NOAA

FORM 3B
Contractual & Commodities
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1999

Project Number: 99163Q
Project Title: APEX Modeling
Agency: NOAA

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999
Personnel	$16.2	$17.5
Travel	$6.8	$5.3
Contractual	$40.6	$44.7
Commodities	$1.6	$0.0
Equipment	$0.0	$0.0
Subtotal	$65.2	$67.5
Indirect (0%)	$0.0	$0.0
Project Total	$65.2	$67.5
Full-time Equivalents (FTE)	0.1	0.1
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
$80.0	$70.0				

Dollar amounts are shown in thousands of dollars.

This project will develop models of foraging effort and success as it relates to breeding productivity. Results will test the degree to which food limitation is affecting recovery, indicate the mechanisms by which this could come about, and identify the scale at which interactions are occurring between food availability and the colonies being studied by APEX.

1999

Project Number: 99163Q
Project Title: APEX Modeling
Agency: H.T. Harvey & Associates

FORM 4A
Non-Trustee
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FFY 1999
D. Ainley	Co-PI		1.0	15,000		15.0
S. Terrill	Co-PI		0.1	8,450		0.8
	admin. support		0.1	8,000		0.8
	graphic artist		0.1	9,150		0.9
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Subtotal			1.3	40,600	0	
					Personnel Total	$17.5

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FFY 1999
SFO-Anchorage (one trip for science workshop)		1,000	1	4	125	1.5
Portland-Anchorage		900	1	4	125	1.4
St. Johns, NFLD to Anchorage		1,000	1	6	125	1.8
conference		250	1	3	110	0.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$5.3

1999

Project Number: 99163Q
Project Title: APEX Modeling
Agency: H.T. Harvey & Associates

FORM 4B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FFY 1999
subcontract: ECI (Glenn Ford) 2.5 months @ $12,610/mo.	31.5
GIS tech., 0.4 month @ $10,100/mo.	4.0
Memorial Univ., D.C., Schneider, .4mo. @ $12,610/mo.	5.0
subcontract fee	4.2
Contractual Total	$44.7

Commodities Costs:	Proposed
Description	FFY 1999
Commodities Total	$0.0

1999

Project Number: 99163Q
Project Title: APEX Modeling
Agency: H.T. Harvey & Associates

FORM 4B
Contractual & Commodities
DETAIL

4/7/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units

1999

Project Number: 99163Q
Project Title: APEX Modeling
Agency: H.T. Harvey & Associates

FORM 4B
Equipment
DETAIL

4/7/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$74.4	$76.4						
Travel	$6.2	$5.9						
Contractual	$9.7	$9.7						
Commodities	$9.6	$9.6						
Equipment	$1.0	$1.0						
Subtotal	$100.9	$102.6						
General Administration	$11.8	$12.1						
Project Total	$112.7	$114.7	$85.0	$0.0				
Full-time Equivalents (FTE)	1.5	1.5						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

This project will continue to refine the Marbled Murrelet productivity index developed in FY95-FY96.

1999

Project Number: 99163R
Project Title: Marbled Murrelet Productivity
Agency: USFWS

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRU[illegible] COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
Name	Position Description					
K. Kuletz	PI	GS 11/5	10.0	5,600		56.0
Kendall	GIS/Biologist	GS 7/1	4.0	2,600		10.4
	bio. tech.	GS 5	4.0	2,000		8.0
	volunteer					2.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
Subtotal			18.0	10,200	0	
					Personnel Total	$76.4

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
Description					
train, truck, and boat, Anchorage to Whittier	0.6	1			0.6
train, 3 people, Anchorage to Whittier (driver+vehicle @$123 ea.	0.1	12			1.2
field per diem for boat surveys ($3/day/person 3 people @40 days)			40	0	0.4
per diem for diet studies ($3/day/person people @20 days)			20	0	0.2
per diem (travel Rate), 3 people, 3 d training, 4 d summer			7	0	1.5
lodging, 3 people, 6 nights (Valdez)			18		1.0
travel to Pacific Seabird Group scientific meeting					0.0
(USFWS will cover the expected costs above $1,000, ticket $650,)	650	1	5	70	1.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$5.9

1999

Project Number: 99163R
Project Title: Marbled Murrelet Productivity
Agency: USFWS

FORM 3B
Personnel
& Travel
DETAIL

Contractual Costs:	Proposed FFY 1999
Description	
delivery of equipment and supplies to PWS study site: ($4.0K split with 163E and 163F)	1.3
delivery of fule to PWS study site ($2.0K split w/163E and 163F)	0.6
safety training for two new people @ $830/person, includes travlel and per diem to Whittier	2.5
boat maintenance and repair	3.0
telephone services in office and in the field	0.3
film processing	0.1
publication page charges	0.6
maintenance and cleaning of camp equipment for 4 people @ $200/person	0.8
maintenance and cleaning of binoculars, scopes, and cameras	0.5
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$9.7

Commodities Costs:	Proposed FFY 1999
Description	
food: 4 people, 176 people days @ $10/day (during boat surveys)	1.8
food: 2 peole, 20 days during diet study @ $10/day	0.4
boat fuel: 100 gal/day for 35 survey and travel days, i boat in PWS @ $1.50/gal, plus oil (2 gal/day) @ $12/gal	6.0
camp supplies (stove and lantern fuel, mantles, head nets, bug spray, batteries, cleaning materials)	0.4
scientific supplies (batteries for radios, film, waterproof notebooks, sample bags, preservatives, scales, calipers)	0.5
lines, anchors, propellers for boats	0.5
Commodities Total	$9.6

1999

Project Number: 99163R
Project Title: Marbled Murrelet Productivity
Agency: USFWS

FORM 3B
Contractual & Commodities
DETAIL

New Equipment Purchases:	Number of Units	Unit Price	Proposed FFY 1999
Description			
camp equipment (stoves, laterns, tents, tools, batteries, dishes)			1.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.	**New Equipment Total**		$1.0

Existing Equipment Usage:	Number of Units	Inventory Agency
Description		
survival suits	5	USFWS
mustang suits	5	USFWS

1999

Project Number: 99163R
Project Title: Marbled Murrelet Productivity
Agency: USFWS

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$0.0	$0.0						
Travel	$0.0	$0.0						
Contractual	$90.2	$109.2						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$90.2	$109.2						
General Administration	$6.3	$7.6						
Project Total	$96.5	$116.8	$118.3	$75.1	$0.0			
Full-time Equivalents (FTE)	0.0	0.0						
Dollar amounts are shown in thousands of dollars.								
Other Resources								

Comments: This project will investigate forage fish distribution using aerial surveys.

1999

Project Number: 99163S
Project Title: Jellyfish as Competitors and Predators of Fishes
Agency: NOAA

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRU[redacted] COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
	Name	Position Description					
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		0.0	0	0	
						Personnel Total	$0.0

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
	Description					
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.0

1999

Project Number: 99163S
Project Title: Jellyfish as Competitors and Predators of Fishes
Agency: NOAA

FORM 3B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:		Proposed FFY 1999
Description		
jelly fish as competitors and predators contract with Horn Point Environmental Laboratory		109.2
When a non-trustee organization is used, the form 4A is required.	**Contractual Total**	$109.2
Commodities Costs:		Proposed FFY 1999
Description		
	Commodities Total	$0.0

1999

Project Number: 99163S
Project Title: Jellyfish as Competitors and Predators of Fishes
Agency: NOAA

FORM 3B
Contractual & Commodities
DETAIL

4/7/98

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1999

Project Number: 99163S
Project Title: Jellyfish as Competitors and Predators of Fishes
Agency: NOAA

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999						
Personnel	$46.3	$54.6						
Travel	$10.9	$15.8						
Contractual	$3.0	$3.5						
Commodities	$0.0	$2.5						
Equipment	$1.2	$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$63.9	$76.4	Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Indirect (43%) (not on equipmen	$26.3	$32.8						
Project Total	$90.2	$109.2	$70.2	$67.0	$0.0			
Full-time Equivalents (FTE)	1.2	1.3						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

This project will investigate Jellyfish as competitors and predators of fishes in Prince William Sound.

1999

Project Number: 99163S
Project Title: Jellyfish as Competitors and Predators of Fishes
Name: Horn Point Environmental Laboratory

FORM 4A
Non-Trustee
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FFY 1999
J. Purcell	PI		3.0	7,000		21.0
K. Black	technician		12.0	2,800		33.6
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		1.3	9,800	0	
					Personnel Total	$54.6

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FFY 1999
Maryland to Juneau (RT)		1,200	2	70	100	9.4
Maryland to Anchorage (RT)		900	2	10	220	4.0
Juneau to Cordova (RT)		260	2	20	2	0.6
ASLO conference, Maryland to Santa Fe		800	1	5	200	1.8
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$15.8

1999

Project Number: 99163S
Project Title: Jellyfish as Competitors and Predators of Fishes
Name: Horn Point Environmental Laboratory

FORM 4B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FFY 1999
photocopying	0.5
shipping	1.5
communications	0.3
computer services	1.2
Contractual Total	$3.5

Commodities Costs:	Proposed
Description	FFY 1999
laboratory supplies	2.5
Commodities Total	$2.5

1999

Project Number: 99163S
Project Title: Jellyfish as Competitors and Predators of Fishes
Name: Horn Point Environmental Laboratory

FORM 4B
Contractual & Commodities
DETAIL

4/7/98

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units
scuba dry suit	1
disecting microscope	2
CUE-2 image analysis system	1

1999

Project Number: 99163S
Project Title: Jellyfish as Competitors and Predators of Fishes
Name: Horn Point Environmental Laboratory

FORM 4B
Equipment
DETAIL

1999 EXXON VALDEZ TRUS[illegible]COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$0.0	$0.0						
Travel	$0.0	$0.0						
Contractual	$0.0	$54.4						
Commodities	$0.0	$0.0						
Equipment	$0.0	$0.0						
Subtotal	$0.0	$54.4						
General Administration	$0.0	$3.8						
Project Total	$0.0	$58.2	$30.0					
Full-time Equivalents (FTE)	0.0	0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

1999

Project Number: 99163T
Project Title: Aerial Surveys
Agency: ADFG

FORM 3A
AGENCY
PROJECT
DETAIL

1999 EXXON VALDEZ TRUST COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FFY 1999
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
							0.0
		Subtotal		0.0	0	0	
						Personnel Total	$0.0

Travel Costs:		Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FFY 1999
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$0.0

1999

Project Number: 99163T
Project Title: Aerial Surveys
Agency: ADFG

FORM 3B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FFY 1999
	54.4
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$54.4

Commodities Costs:	Proposed
Description	FFY 1999
Commodities Total	$0.0

1999

Project Number: 99163T
Project Title: Aerial Surveys
Agency: ADFG

FORM 3B
Contractual & Commodities
DETAIL

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

1999

Project Number: 99163T
Project Title: Aerial Surveys
Agency: ADFG

FORM 3B
Equipment
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FFY 1998	Proposed FFY 1999	LONG RANGE FUNDING REQUIREMENTS					
			Estimated FFY 2000	Estimated FFY 2001	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005
Personnel	$0.0	$24.3						
Travel	$0.0	$6.2						
Contractual	$0.0	$12.7						
Commodities	$0.0	$0.3						
Equipment	$0.0	$0.0						
Subtotal	$0.0	$43.5						
Indirect (25% TDC)	$0.0	$10.9						
Project Total	$0.0	$54.4	$27.0					
Full-time Equivalents (FTE)	0.0	0.4						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

1999

Project Number: 99163T
Project Title: Aerial Surveys
Name: University of Alaska Fairbanks

FORM 4A
Non-Trustee
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FFY 1999
Brown, E.	PI		2.5	6,060		15.2
Moreland, S.	tech.		2.5	3,652		9.1
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.4	9,712	0	
					Personnel Total	$24.3

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FFY 1999
Fairbanks to Cordova		270	2	80	65	5.7
Fairbanks to Anchorage		139	1	3	120	0.5
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$6.2

1999

Project Number: 99163T
Project Title: Aerial Surveys
Name: University of Alaska Fairbanks

FORM 4B
Personnel
& Travel
DETAIL

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed
Description	FFY 1999
vessel charter (10 days @ $1250/day)	12.5
communications	0.2
Contractual Total	$12.7

Commodities Costs:	Proposed
Description	FFY 1999
field supplies	0.3
Commodities Total	$0.3

1999

Project Number: 99163T
Project Title: Aerial Surveys
Name: University of Alaska Fairbanks

FORM 4B
Contractual & Commodities
DETAIL

4/7/98

1999 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FFY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units

1999

Project Number: 99163T
Project Title: Aerial Surveys
Name: University of Alaska Fairbanks

FORM 4B
Equipment
DETAIL

4/7/98

A Genetic Study to Aid in Restoration of Murres, Guillemots and Murrelets to the Gulf of Alaska

Project Number:	99-169
Restoration Category:	Research
Proposer:	Queen's University (V.L. Friesen) & DOI (J.F. Piatt)
Lead Trustee Agency:	DOI
Cooperating Agencies:	U.S. Fish and Wildlife Service
Alaska SeaLife Center:	no
Duration:	3rd year, 4-year project
Cost FY99:	$92.7
Cost FY00:	$14.8
Geographic Area:	Gulf of Alaska and neighboring areas
Injured Resource:	common murre, pigeon guillemot, marbled murrelet, Kittlitz's murrelet

ABSTRACT

Populations of common murres, pigeon guillemots, and marbled and Kittlitz's murrelets suffered high mortalities following the *Exxon Valdez* Oil Spill. We propose to continue our analyses of mitochondrial DNA, microsatellites and introns to measure genetic differentiation and gene flow among colonies of these species. This project will aid restoration by 1) determining the geographic limits of populations affected by the Spill, 2) identifying sources and sinks, and 3) identifying appropriate reference or 'control' sites for monitoring. As incidental results, it will also reveal cryptic species and subspecies, indicate the importance of inbreeding and small effective population sizes in restricting recovery, and suggest suitable source colonies for translocations.

INTRODUCTION

In the present project, we propose to continue our genetic research to aid recovery of common murres (*Uria aalge*), pigeon guillemots (*Cepphus grylle*), marbled murrelets (*Brachyramphus marmoratus*) and Kittlitz's murrelets (*B. brevirostris)* from the *Exxon Valdez* Oil Spill. Specifically, we proposed to measure genetic divergence and gene flow among colonies of each species by comparing sequences of mitochondrial DNA, microsatellites, and nuclear introns among individuals from several sites. We have just completed the first year of this project. Much of the year was spent refining laboratory protocols for each species; however, results of the first population assays indicate that, despite the high dispersal potential of these birds, significant genetic structure exists within all species:

Marbled and Kittlitz's Murrelets.-Our previous studies of geographic variation in allozymes and cytochrome *b* sequences of murrelets indicated that the Asian and North American subspecies of marbled murrelets represent cryptic species that have been genetically isolated for 5-6 million years and that must be managed independently (Friesen et al. 1996a). Preliminary results of this study also suggested that North American populations of marbled murrelets may be genetically differentiated, and that Kittlitz's murrelets from Kachemak Bay and Attu Island are highly divergent and may represent cryptic subspecies or even species. However, both sample sizes and variabilities of these relatively slowly evolving genes were insufficient for assessing fine-scale differentiation. In FY97 we refined protocols for assaying variation in nine introns and three microsatellite loci in marbled murrelets, and screened samples collected previously from within the Spill area and neighboring sites. Results suggest that murrelets from the western Aleutians, Belkofski Bay and Kachemak Bay may differ genetically from those elsewhere (Congdon et al. in prep.). In FY98, we are refining protocols for assaying sequence variation in the mitochondrial control region (mCR) and expanding our analyses to include murrelets from more distant sites, as well as birds from additional sites within the Spill area. Analyses of marbled murrelets should be essentially complete by the end of FY98; analyses of Kittlitz's murrelets will continue through FY99, and are especially critical given the possibility of cryptic species of Kittlitz's murrelets.

Common Murres.-In FY97, we refined protocols for analyses of mCRs, microsatellites and introns in common murres, and screened samples from Alaska for variation in the mCR and cytochrome *b*. Results indicate that murres from Chisik Island and Kachemak Bay maybe genetically different from those elsewhere (Patirana 1998). Preliminary results of a concurrent study of variation in mCRs, microsatellites and introns in common murres from British Columbia south suggest that a genetic discontinuity may exist between Washington and British Columbia (K. Warheit et al. unpubl. data). In FY98 we are screening murres from Alaska for variation in microsatellites and introns. We plan to complete our collections and analyses of DNA samples from common murres in FY99.

Pigeon Guillemots.-Previously, we surveyed variation in the mCR among populations of guillemots (*Cepphus* spp.) from throughout the Northern Hemisphere and found colony-specific sequence differences (Kidd and Friesen 1998). In FY97 we refined protocols for analysis of microsatellites and introns in guillemots. In FY98 we are continuing tissue collections, and assaying DNA samples for variation in microsatellites and introns. We plan to complete our collections and analyses of DNA samples from pigeon guillemots in FY99.

NEED FOR THE PROJECT

A. Statement of Problem

Alcids are highly vulnerable to marine oil pollution due both to the large amount of time they spend resting on the ocean surface, and to their dependence on marine fish and invertebrates for food. Many species of alcids suffered heavy mortality associated with the *Exxon Valdez* Spill; for example, the estimated mortality for common murres was in the hundreds of thousands. Although guillemots and murrelets were declining prior to the Spill, the accident probably increased their rate of decline. Common murres now appear to be recovering from the Spill, but pigeon guillemots and marbled murrelets apparently are not; the state of recovery of Kittlitz's murrelets is unknown. The reasons for the failure of these species to recover (as well as for the prespill declines) are unclear, but may be due to availability and quality of prey (currently being investigated through the APEX Predator Experiment and Nearshore Vertebate Predator Project), and/or genetic problems such as genetic isolation of colonies or inbreeding. We propose to use state-of-the-art genetic techniques to aid in the restoration of these species.

B. Rationale/Link to Restoration

Although the application of molecular methods to fisheries and wildlife management is common (e.g. Ryman and Utter 1987, Hansen and Loeschcke 1994, Allendorf and Waples 1996, Graves 1996), few if any studies have used genetic methods explicitly to aid in seabird conservation (Friesen 1997). Theoretically, measurement of genetic divergence and gene flow among populations of murres, murrelets and guillemots will aid restoration in the following three main ways:

Definition of the geographic limits of the affected populations.-Many seabirds killed by the *Exxon Valdez* Oil Spill were migrating; thus, the 'affected' zone, or the populations that were affected by the Spill and require restoration effort, may be geographically different from the actual Spill zone. Genetic data should enable identification of breeding populations and thus the geographic limits of the populations of birds killed by the Spill. Furthermore, if colonies are essentially panmictic and/or constitute metapopulations, they should recover without assistance within a few generations. However, if colonies constitute numerous localized populations, they may not naturally recolonize sites affected by the Spill, and may require human assistance for recovery.

Identification of sources and sinks.-According to metapopulation theory, 'source' populations are populations that occur in optimal habitat and can act as net exporters of recruits for populations elsewhere; 'sink' populations occur in suboptimal habitat and require immigration to maintain numbers (Pulliam 1996). Genetic data can provide measurements of rates of immigration into and emigration out of colonies, and thus enable identification of sources and sinks. For example, protein data suggest that rock shags (*Stictocarbo magellanicus*) on the Falkland Islands may have served as the main source of breeders for other colonies in southern South America (Siegel-Causey 1997). If colonies affected by the Spill represent sources, then their restoration will be critical. If a colony represents a sink, its restoration may be a waste of resources and may actually prevent recovery of the total population.

Environmental monitoring.-Demographic parameters may be very different for genetically divergent populations, even if they occur in ecologically similar or geographically proximate areas. For example, common murres breeding in Washington have different breeding chronologies from those at neighboring colonies in British Columbia, and may be genetically different (K. Warheit et al. unpubl. data). Genetic data may enable identification of appropriate reference or 'control' sites from which to obtain baseline data for monitoring, restoration and modeling, e.g. to determine if a seabird colony has recovered 'normal' functioning.

Three other types of information that are useful for conservation and restoration are produced incidentally by genetic studies.

Population uniqueness and cryptic species.-A colony's uniqueness (e.g. its endemicity or genetic distinctiveness) may be used to priorize restoration efforts. Most importantly, genetic data enable the identification of 'cryptic' species - populations that are similar in appearance but that represent separate, non-interbreeding species (e.g. long-billed [*Brachyramphus perdix*] and marbled murrelets; Friesen et al. 1996a).

Small effective population size and inbreeding.-The 'effective size' of a population is the size of an idealized population that would have the same amount of genetic drift as the population being considered; the effective size of a population may be one or two orders of magnitude lower than the census size due to such factors as unequal breeding success and population bottlenecks (Futuyma 1998). For example, the North Atlantic population of thick-billed murres (*Uria lomvia*) consists of approximately 2.5 million breeding pairs (Nettleship and Evans 1985), but appears to have a long-term effective size of only ~15,000 females (Friesen et al. 1996b). Theoretically, as a population's effective size decreases, individual fitness declines due to increased inbreeding (Allendorf and Leary 1986, Gilpen and Soulé 1986). Furthermore, several researchers have argued that if effective population size declines below a certain critical level, the population may enter an extinction vortex in which inbreeding, deleterious alleles and stochastic effects combine synergistically to accelerate extinction (Gilpin and Soulé 1986). Genetic information may be used to estimate effective population size (Nei and Li 1979), and thus to determine the extent to which small effective population sizes and inbreeding are preventing or slowing population recovery.

Translocations.-If breeding success within a colony is low due to inbreeding depression, or if recruitment is low, transplantation of small numbers of individuals from other sites may be desirable. Ideally, sources of animals for such introductions should be neighboring colonies within the same population or a closely related population. Genetic data are important for determining which colonies are genetically appropriate sources to prevent both inbreeding (Allendorf and Leary 1986) and outbreeding depression (Templeton 1986).

C. Location

This project will require collection of blood, feather and/or tissue samples from birds breeding thoughout the Pacific Basin, mostly in Alaska (Table 1). As much as possible, tissue will be obtained from museum specimens, and blood and blood feathers ('pin' or growing feathers) will be obtained from chicks or adults during banding. Birds being collected for ongoing diet studies in Alaska (J.F.P.) also will be used as a source of tissue. In year FY98 we hope to obtain samples

from common murres from southeastern Alaska, Middleton Island, the eastern Aleutians and Japan, from marbled murrelets from Washington, Oregon and the central and eastern Aleutians, from Kittlitz's murrelets from the Bering Strait, and from guillemots from British Columbia and Kachemak Bay. Most of these samples will be obtained through contributions from researchers working at specific sites, but special collection trips will be made to British Columbia and Kachemak Bay (for guillemots), Middleton Island (for murres), and the Bering Strait (for Kittlitz's murrelets). Sampling efforts in 1999 will focus on remaining key sites (Table 1).

Laboratory analyses are being undertaken in V.L.F.'s molecular laboratory at Queen's University. This laboratory is fully equipped for the assays described in the present proposal, and analyses of DNA variation in seabirds are routine; few other laboratories have the capability for assaying variation in mCRs, and large numbers of microsatellites and introns in vertebrates, and no other laboratory has this capacity for seabirds. This laboratory receives additional technical and logistical support from the Queen's University Molecular Ecology Lab (run by Dr. Peter Boag), and the Queen's University Core Facility.

Results of this project will aid the identification and restoration of populations of murres, murrelets and guillemots affected by the Spill.

COMMUNITY INVOLVEMENT

The bulk of work involved in the proposed project must be conducted by highly trained personnel in a specially equipped research laboratory. If available, a local student interested in graduate work in conservation genetics may be hired by V.L.F. We will attempt to obtain tissue samples from seabirds harvested for subsistence purposes when possible. Sample collections may require chartering local vessels and paying for assistance from local experts, hunters or vessel operators (see **Methods**). Information about the age of colonies, which is needed for interpretation of genetic results, will be sought from traditional knowledge. Project objectives and interim results will be communicated to local residents through popular reports in the Trustee Council newsletter.

PROJECT DESIGN

A. Objectives

The primary purpose of this project is to conduct a genetic analyses to aid in the restoration of common murres, pigeon guillemots, and marbled and Kittlitz's murrelets to areas affect by the *Exxon Valdez* Oil Spill. We have three main objectives for each species:

1) To determine the geographic extent of the populations affected by the Spill.

2) To identify source and sink colonies.

3) To identify appropriate reference or 'control' sites for monitoring.

As incidental results, we should also be able

4) To identify cryptic species or subspecies.

5) To measure coefficients of inbreeding and effective population sizes.

6) To identify appropriate source populations for translocations, if necessary.

B. Methods

We are comparing variation in two mitochondrial genes, 6-8 microsatellite loci and 8-10 nuclear introns among approximately 30 birds from each of 12-15 colonies each for common murres, marbled murrelets and pigeon guillemots, and as many individuals as possible for Kittlitz's murrelets (Table 1). For each species, we are testing the null hypothesis that colonies are panmictic (i.e. genetic structure is essentially absent) against the alternative hypothesis that significant genetic differences exist among birds from different colonies.

Sampling.-To obtain reliable estimates of genetic differentiation and gene flow within and between the Spill area and neighboring areas, as well as to define the geographic limits of the populations affected by the Spill, we are sampling 4-6 colonies of each species from the Spill area, as well as 4-6 colonies each at increasing distances west and east of the Spill area. A minimum of 30 samples are required from each site for each species for reliable estimation of genetic variation within and between sites (Richardson et al. 1986, Weir 1996). Many of the necessary baseline samples were obtained opportunistically during previous research projects through the assistance of Vern Byrd and Dave Roseneau (Alaska Maritime National Wildlife Refuge), Jay Pitocchelli, Tom van Pelt and Lindsey Hayes (U.S. Geological Survey, Anchorage), Alex Pritchard (University of Alaska), Jan Hodder (Oregon Institute of Marine Biology) and Kathy Martin (Canadian Wildlife Service). Other samples are available from tissue collections at the University of Alaska Museum and the Burke Museum (University of Washington). Permits for collection of seabirds are required from the U.S. Fish and Wildlife Service, the State of Alaska (ADF&G) and the Animal Care Committee of Queen's University, and will be obtained by J.F.P. and V.L.F. prior to collections.

Loci.-Much of southern Alaska was ice-covered during the Pleistocene glaciations, so most seabird colonies from the Spill area were probably only populated within the last ~10,000 years. Measurement of gene flow and genetic divergence among colonies of these birds therefore requires analysis of loci with high mutation rates. Mitochondrial DNA has proven useful for studies of such species since it has a relatively high mutation rate and is more sensitive to population bottlenecks and restricted gene flow than are nuclear loci (Wilson et al. 1985, Avise 1994, Avise and Hamrick 1996, Mindell 1997). The mitochondrial control region is especially useful for analyzing recent evolutionary events since it has a mutation rate 5-10x higher than the mean for mtDNA (Brown et al. 1986, Avise 1994, Avise and Hamrick 1996, Baker and Marshall 1997). Analysis of the mitochondrial cytochrome *b* gene is also useful for estimating population genetic structure and effective population sizes in alcids since its mutation rate has been calibrated for this family (Friesen et al., submitted). However, mtDNA represents a single supergene whose pattern of inheritance is not typical of the rest of the genome (Wilson et al. 1985); results of analyses of mtDNA therefore need to be confirmed with analyses of nuclear

loci. Microsatellite loci have mutation rates higher than those of mtDNA so are being used increasingly for evolutionary studies (Avise 1994, Dowling et al. 1996,McDonald and Potts 1997). However, depending on the age of populations, microsatellite loci may contain high levels of homoplasies (back-, parallel and convergent mutations), which may result in inaccurate estimates of genetic differentiation and gene flow. Nuclear introns have mutation rates equivalent to those of mtDNA (Congdon et al. in prep.), so are also useful for studying recent evolutionary events (Friesen et al. 1996; Congdon et al. in prep.). Because microsatellites and introns are nuclear loci, they are less sensitive to population bottlenecks and restricted gene flow than are mitochondrial genes; Moore (1995) estimated that, due to the larger effective population size of nuclear genes, 8-16 nuclear loci are required to obtain information equivalent to that of one mitochondrial gene. Previous researchers (e.g. Richardson et al. 1986, Weir 1996) have also suggested that information from at least five to six nuclear loci are required to obtain reliable estimates (i.e. to derive robust error estimates) of genetic structure and gene flow. Thus we are analyzing the mitochondrial control region and cytochrome *b* gene, as well as 8-16 nuclear loci, with the specific number of each class of marker depending on observed levels of variability.

Laboratory Assays.-Variation in number of repeating units in microsatellite loci will be assayed using standard protocols (Dowling et al. 1996). To reduce time and cost associated with assaying sequence variation in mitochondrial genes and introns, a two-step procedure will be used. Samples will first be screened for mutations using analysis of single-stranded conformational polymorphisms (SSCPs; Friesen et al. 1996a, 1997). The exact nature of mutations will then be determined by direct sequence analysis of at least one individual with each genotype detected from SSCPs. Previous experience indicates that this combination of techniques provides an efficient and sensitive method for comparing sequence variation among populations (Friesen et al. 1996a, 1997, Congdon et al. in prep.). We estimate that a trained technician can process approximately 4500 sample-loci per year. Analysis of 20 loci (two mitochondrial genes [two parts of the control region], eight microsatellite loci and ten introns) for each of approximately 1200 samples is expected to require approximately 5.5 person-years. Approximately 6700 sample-loci were analyzed in FY97, and 9000 sample-loci will be analyzed in FY98. Funding is required to analyze the remaining 9000 sample-loci in FY99 (~2.0 person-years), and to screening 200 carcasses salvaged from the Spill for population-specific genetic markers (~0.5 person-years).

Statistical Analyses.-Data will be analyzed using standard methods developed for analysis of data from protein electrophoresis and sequencing (e.g. Swofford & Selander 1981; Swofford 1993), as well as a few new techniques that capitalize on the power of combining genotypic and sequence data (e.g. Michalakis and Excoffier 1996):

1) To determine the geographic limits of populations affected by the Spill, the extent of genetic differentiation of colonies will be calculated using Wright's *F* statistics and its analogues (e.g. ϕ_{st}) and tested for significance using randomization procedures (e.g. Excoffier et al. 1992).

2) To identify source and sink colonies, the direction and magnitude of gene flow among colonies will be estimated using coalescence theory (Slatkin and Maddison 1989) and Hedrick's *U* statistic (Hedrick 1971, 1975).

3) Appropriate reference or 'control' sites for monitoring, as well as colony-specific markers for impact assessment, will be apparent from the results of objective (1).

4) Cryptic species may be suggested by (i) fixed allele differences, which indicate prolonged genetic isolation of populations, (ii) paraphyletic relationships among populations from different species, and/or (iii) high sequence divergences between the mitochondrial genomes of individuals from different populations.

5) Coefficients of inbreeding will be estimated from nuclear data using Wright's F statistics, and effective population sizes will be estimated from mitochondrial sequence data using the method of Nei and Li (1979).

6) Appropriate source populations for translocations will be apparent from the results of objective (1).

Alternative Methodologies.-Although gene flow and population genetic structure can be approximated from demographics (e.g. Rockwell and Barrowclough 1987), generation of these data involves long-term banding studies and is extremely labour-intensive, especially for species such as marbled and Kittlitz's murrelets with secretive nesting habits. Furthermore, estimates of genetic divergence from demographic data tend to miss occasional mass migrations, which may be important sources of gene flow in seabirds (e.g. Nettleship and Evans 1985). Traditional molecular methods such as protein electrophoresis also are not usually suitable for measuring genetic subdivision in populations either in birds or in species that breed at high latitudes due to low levels of variability (Evans 1987). Although DNA fingerprinting can reveal high levels of variability, it is expensive, laborious and time-consuming, and exhibits levels of homoplasy (genetic 'noise') too high for comparisons of populations. Finally, analysis of randomly amplified polymorphic DNA (RAPDs) requires high quality DNA, which is not available for many of our samples (e.g. murrelet stomachs preserved in ethanol from Washington); furthermore, many traditional methods of assessing genetic structure and gene flow cannot be applied to RAPD data either because of null alleles or because the exact nature of variation is not known. The approach outlined in the present proposal combines the strengths of classical protein electrophoresis with direct sequence analysis, and provides a powerful method for studies evolutionary genetics and conservation (e.g. Friesen et al. 1997, Congdon et al. in prep.).

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Collections of blood and tissue will be coordinated with other agencies (museums, wildlife agencies, etc.) by V.L.F. and J.F.P. Collections of seabirds for diet studies and genetic samples are coordinated with the USFWS, Alaska Maritime National Wildlife Refuge. No additional contracts or cooperating agencies are required to complete this project.

SCHEDULE

A. Measurable Project Tasks for FY98

Jan. 1 '99 - Jan. 30 '99: Technicians screen samples collected in FY98 for variation in the

	mitochondrial control region
Feb. 1 '99 - Jun. 30 '99:	Technicians screen samples from FY98 for variation at eight microsatellite loci
Jan. 1 '99 - Apr. 30 '99:	PIs arrange logistics for sample collections for FY99
Mar. '99:	PIs attend Annual Restoration Workshop
May 1 '99 - Aug. 30 '99:	Blood, feather and tissue samples collected from various sites (see Location) by J.F.P., V.L.F. and assistants
Jul. '99:	V.L.F. and/or J.F.P. present interim results at conferences
Jul. 1 '98 - Dec. 31 '99:	Technicians screen samples from FY98 for variation in ten introns

B. Project Milestones and Endpoints

Jan. '97:	PIs attend Annual Restoration Workshop
Mar. 31 '97:	Technicians complete development of microsatellite protocols for guillemots, and refine protocols for analysis of introns and control regions for each species as necessary
Aug. 31 '97:	Field collections for FY97 completed
Dec. 31 '97:	Technicians complete screening of samples available up to and including FY97 for variation in the mitochondrial control region, eight microsatellite loci and ten introns
Jan. '98:	PIs attend Annual Restoration Workshop
Apr. 15 '98:	V.L.F. completes annual report for FY97
Aug. 31 '98:	Field collections for FY98 completed
Dec. 31 '98:	Technicians complete screening of samples collected in FY98
Mar. '99:	PIs attend Annual Restoration Workshop
Apr. 15 '99:	V.L.F. completes annual report for FY98
Aug. 31 '99:	Field collections for FY99 completed
Dec. 31 '99:	Technicians complete screening of samples collected in FY99
Jan. '00:	PIs attend Annual Restoration Workshop
Apr. 15 '00:	V.L.F. completes annual report for FY99
Jun. 30 '00:	V.L.F. and technicians complete data analysis (including all analyses outlined in **Objectives**) and manuscripts
Jul. '00:	V.L.F. reports results of studies at annual meetings of the *Evolution Society* and *Society for Conservation Biology*
Apr. 15 '01:	V.L.F. submits final report

C. Completion Date

Data collection and analysis will be completed for all species by the end of 1999; final reports and manuscripts summarizing results of the completed projects for each species will be prepared during FY00.

PUBLICATIONS AND REPORTS

Four major publications will be prepared for publication following completion of the project in FY00; each will report estimates of genetic variability, genetic structure and gene flow for one

target species. These papers will form the basis for the final report, and will be submitted to international peer-reviewed journals such as *Evolution*, *Molecular Ecology*, or *Auk*, as well as to managers involved with restoration.

PROFESSIONAL CONFERENCES

Interim results from FY99 will be presented as contributed papers by the principal investigators at the annual meetings of the Society for Conservation Biology, the Society for the Study of Evolution and/or the American Ornithological Union in 1999 (locations and dates to be announced).

NORMAL AGENCY MANAGEMENT

Not applicable.

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

Collection of samples will be coordinated with ongoing studies of seabird feeding ecology in Alaska conducted by the Alaska Biological Science Center, USGS (J.F.P.) and the U.S. Fish and Wildlife Service (Alaska Maritime National Wildlife Refuge). Tissues and skeletons obtained from seabirds will be archived at the American Museum of Natural History (New York), and tissues also will be collected for use in ongoing studies of seabird trophic relationships using stable isotope ratios (K. Hobson, Canadian Wildlife Service, Saskatoon). Samples from carcasses salvaged from the Spill will be obtained from the Burke Museum. This project is made possible by previous contracts awarded to V.L.F. and Dr. Tim Birt by the Environmental Innovations Program of Public Works and Government Services Canada and the Lindbergh Foundation, which enabled the development of primers and protocols for 30 nuclear introns. The present project also is made possible through the donation of tissue samples from murres, murrelets and guillemots by field researchers in Canada and the United States (see **Methods - *Population surveys***); these samples are worth an estimated $12,500.

EXPLANATION OF CHANGES IN CONTINUING PROJECTS

In the proposal that was approved in Dec. 1996, we planned to analyze samples from the Spill area and immediately adjacent sites in FY98, to analyze samples from slightly more distant sites in FY99, and to analyze samples from the extremes of the species' ranges in FY99. Due to the opportunistic nature of many of our sample collections, we have been analyzing samples as they become available, includinganalyzing samples from colonies distant from Spill area in FY98 and FY99. One technician listed in the previous proposal has been replaced by a post-doctoral fellow, and another has been hired part-time. Otherwise, the present proposal does not differ from that approved in FY98.

PROPOSED PRINCIPAL INVESTIGATORS

Name	Dr. Vicki L. Friesen
Affiliation	Queen's University
Mailing address	Department of Biology, Kingston, Ontario K7L 3N6, Canada
Phone number	613-545-6156
Fax number	613-545-6617
E-mail address	friesenv@biology.queensu.ca

Name	Dr. John F. Piatt
Affiliation	Alaska Biological Sciences Center, USGS
Mailing address	1011 East Tudor Road, Anchorage, AK 99503
Phone number	907-786-3549
Fax number	907-786-3636
E-mail address	john_piatt@nbs.gov

PRINCIPAL INVESTIGATORS

Principal investigator - Dr. Vicki Friesen (Assistant Professor of Biology, Queen's University, Kingston, Ontario) completed undergraduate and graduate work in 1992 on the ecology and genetics of seabirds in the North Atlantic. Her doctoral project involved a molecular study of population differentiation and evolution in common and thick-billed murres. She is an author on 25 publications in peer-reviewed scientific journals, including papers on behavioral ecology, genetics and evolution of various vertebrates, primarily seabirds. On-going projects in her research lab include population genetic and phylogenetic studies of murres, murrelets, guillemots, auklets, shags, storm-petrels, ptarmigan, parrots and warblers. She will be responsible for supervising the laboratory component of the project, and writing interim and final reports and manuscripts for publication; she will contribute to laboratory work as necessary to keep the project on schedule. Her curriculum vitae is appended.

Principal investigator - Dr. John F. Piatt (Research Biologist GS-13, Alaska Biological Sciences Center, USGS, Anchorage, AK) obtained a Ph.D. in Marine Biology from Memorial University of Newfoundland in 1987. His dissertation involved seabird-forage fish interactions. Since 1987, he has studied seabirds both at colonies and at sea in the Gulf of Alaska, Aleutian Islands, and Bering and Chukchi seas. His is an author on over 50 peer-reviewed scientific publications about seabirds, fish, marine mammals, and effects of oil pollution on marine birds. He will act as the liaison between V.L.F., the *EVOS* Trustees and other agencies in Alaska, coordinate collection of samples, and assist with writing of reports and manuscripts for publication.

OTHER KEY PERSONNEL

Post-doctoral Fellow (2 years) - Dr. Tim Birt received his PhD from Memorial University of Newfoundland in 1990. His thesis involved a genetic comparison of landlocked and sea-run Atlantic salmon (*Salmo salar*) from Newfoundland, and included analysis of proteins and mitochondrial DNA as well as rearing and physiological experiments. He also spent three years as a post-doctoral fellow at the Royal Ontario Museum in Toronto, where he used molecular techniques to study the phylogenetic relationships among scolopacid shorebirds, and population genetic structure of caribou. He was hired on Jan. 15 1998 and is responsible for genetic analyses of common murres

Technician I (half-time, 2 years) - Ms. Denise Michaud received an M.Sc. in molecular genetics from Guelph University. She has been working as the head technician for the Queen's University Molecular Ecology Lab for 5 years. She is being hired part-time on May 1 1998 to complete the genetic assays of murrelets, which were initiated by post-doctoral fellow Dr. Brad Congdon. She will also be responsible for management duties necessary for successful completion of the project (e.g. ordering supplies, maintaining radioisotope records, preparing DNA extractions, etc).

Technician II (half-time, 2 years) - Mr. Jeff Moy received his B.Sc. from Guelph University. His thesis involved a population genetic study of trout. He will be responsible for analyses of microsatellites and introns for pigeon guillemots.

LITERATURE CITED

Allendorf, F.W. and R.F. Leary. 1986. Heterozygosity and fitness in natural populations of animals. Pp. 57-76 *in* M.R. Soulé (ed.), Conservation biology, the science of scarcity and diversity. Sinauer, Sunderland.

Allendorf, F.W. and R.S. Waples. 1996. Conservation and genetics of salmonid fishes. Pp. 238-280 *in* J.C. Avise and J.L. Hamrick (eds.), Conservation genetics. Chapman and Hall, New York.

Avise, J.C. 1994. Molecular markers, natural history and evolution. Chapman and Hall, New York.

Avise, J.C. and J.L. Hamrick (eds.). 1996. Conservation genetics. Chapman and Hall, New York.

Baker, A.J. and H.D. Marshall. 1997. Mitochondrial control region sequences as tools for understanding evolution. Pp. 50-82 *in* D.P. Mindell (ed.), Avian molecular evolution and systematics. Academic, London.

Brown, G.G., G. Gadeleta, G. Pepe, C. Saccone and E. Sbisá. 1986. Structural conservation and variation in the D-loop-containing region of vertebrate mitochondrial DNA. *J. Mol. Biol.* 192:503-511.

Dowling, T.E., C. Moritz, J.D. Palmer and L.H. Reiseberg. 1996. Nucleic acids III: analysis of fragments and restriction sites. Pp. 249-320 *in* D.M. Hillis, C. Moritz and B.K. Mable (eds.), Molecular systematics, 2nd ed. Sinauer, Sunderland.

Evans, P.G.H. 1987. Electrophoretic variability of gene products. Pp. 105-162 *in* F. Cooke and P.A. Buckley (eds.), Avian genetics. Academic, London.

Excoffier, L., P.E. Smouse and J.M. Quattro. 1992. Analysis of molecular variance inferred from metric distance among DNA haplotypes: application to human mitochondrial DNA restriction data. *Genetics* 131:479-491.

Friesen, V.L. 1997. Population genetics and the spatial scale of conservation of colonial waterbirds. Colon. Waterbirds 20:353-368.

Friesen, V.L., A.J. Baker and J.F. Piatt. 1996a. Evidence from cytochrome *b* sequences and allozymes for a 'new' species of alcid: the long-billed murrelet (*Brachyramphus perdix*). *Condor* 98:681-690.

Friesen, V.L., B.C. Congdon, H.E. Walsh and T.P. Birt. 1997. Intron variation in marbled murrelets detected using analyses of single-stranded conformational polymorphisms. *Mol. Ecol.* 6:1047-1058.

Friesen,V.L., W. A. Montevecchi, A. J. Baker, R. T. Barrett and W. S. Davidson. 1996b. Population differentiation and evolution in the common guillemot *Uria aalge*. *Mol. Ecol.*5:793-805.

Futuyma, D. 1998. Evolutionary biology. Sinauer, Sunderland.

Gilpin, M.E. and M.E. Soulé. 1986. Minimum viable populations: processes of species extinction. Pp. 19-34 *in* M.R. Soulé (ed.), Conservation biology, the science of scarcity and diversity. Sinauer, Sunderland, MA.

Graves, J.E. 1996. Conservation genetics of fishes in the pelagic marine realm. Pp. 335-366 *in* J.C. Avise and J.L. Hamrick (eds.), Conservation genetics. Chapman and Hall, New York.

Hansen, M.M. and V. Loeschcke. 1994. Effects of releasing hatchery-reared brown trout to wild trout populations. Pp. 273-289 *in* V. Loeschcke, J. Tomiuk and S.K. Jain (eds.), Conservation genetics. Birkäuser Verlag, Basel.

Hedrick, P.W. 1971. A new approach to measuring genetic similarity. Evolution 25: 276-280.
Hedrick, P.W. 1975. Genetic similarity and distance: comments and comparisons. Evolution 29: 362-366.
Kidd, M.G. and V.L. Friesen. 1998. Analysis of mechanisms of microevolutionary change in *Cepphus* guillemots using patterns of control region variation. *Evolution,* in press.
McDonald, D.B. and W.K. Potts. 1997. DNA microsatellites as genetic markers at several scales. Pp. 29-49 *in* D.P. Mindell (ed.), Avian molecular evolution and systematics. Academic, London.
Michalakis, Y. and L. Excoffier. 1996. A generic estimation of population subdivision using distances between alleles with special reference to microsatellite loci. *Genetics* 112:629-647.
Mindell, D.P. (ed.). 1997. Avian molecular evolution and systematics. Academic, London.
Moore, W. S. 1995. Inferring phylogenies from mtDNA variation: mitochondrial -gene trees versus nuclear-gene trees. Evolution 49:718-726.
Nei. M., and W. H. Li. 1979. Mathematical model for studying genetic variation in terms of restriction endonucleases. Proceedings of the National Academy of Scienecs, USA 76:5269-5273.
Nettleship, D.N. and P.G.H. Evans. 1985. Distribution and status of the Atlantic Alcidae. Pp. 53-154 *in* D.N. Nettleship and T.R. Birkhead (eds.), The Atlantic Alcidae. Academic, New York, NY.
Patirana, A. 1998. A conservation genetic study of common murres (*Uria aalge*) in the *Exxon Valdez* spill area through comparison of mitochondrial control region and cytochrome *b* sequences. B.Sc. thesis, Queen's University, Kingston, Ontario.
Pulliam, H.R. 1994. Sources and sinks. *In* O.E. Rhodes, R.K. Chesser and M.H. Smith (eds.), Spatial and temporal aspects of population processes.
Richardson, B.J., P.R. Baverstock and M. Adams. 1986. Allozyme electrophoresis. Academic, London.
Rockwell, R.F. and G.F. Barrowclough. 1987. Gene flow and the genetic structure of populations Pp. 223-256 *in* F. Cooke and P.A. Buckley (eds.), Avian genetics. Academic, London.
Ryman, N. and F. Utter (eds.). 1987. Population genetics and fishery management. University of Washington Press, Seattle.
Siegel-Causey, D. 1997. Molecular variation and biogeography of Rock Shags. *Condor* 99:139-150.
Slatkin, M., and W. P. Maddison. 1989. A cladistic measure of gene flow inferred from the phylogenies of alleles. Genetics 123:603-613.
Swofford, D. L. 1993. PAUP: Phylogenetic analysis using parsimony. Version 3.1.1. Illinois Natural History Surveys, Champaign, IL.
Swofford, D. L., and R. B. Selander. 1981. BIOSYS-1: a Fortran program for the comprehensive analysis of electrophoretic data in population genetics and systematics. Journal of Heredity 72:281-283.
Templeton, A.R. 1986. Coadaptation and outbreeding depression. Pp. 105-116 *in* M. E. Soulé (ed.), Conservation biology. Sinauer, Sunderland.
Weir, B.S. 1996. Intraspecific differentiation. Pp. 385-405 *in* D.M. Hillis, C. Moritz and B.K. Mable (eds.), Molecular systematics, 2nd ed. Sinauer, Sunderland.
Wilson, A. C., R. L. Cann, S. M. Carr et al. (11 co-authors). 1985. Mitochondrial DNA and two perspectives on evolutionary genetics. Biol. J. Linn. Soc. 26:375-400.

Table 1. Sites, numbers of samples available, and numbers of samples needed for genetic analyses of murres, murrelets and guillemots.

Site	Available	Needed
COMMON MURRE		
California (Farallon Islands)	30	0
Washington (Clallam)	30	0
N. Vancouver Island	40	0
Southeastern Alaska	0	30
Prince William Sound (Cordova)	23	7
Middleton Island	0	30
Central Cook Inlet (Kachemak Bay, Chisik I.)	48	0
Lower Cook Inlet (Barren Is.)	27	3
Alaska Peninsula (Semidi, Midun Is.)	18	12
Eastern Aleutians (Aiktak I.)	14	16
Western Aleutians (Attu, Agattu & Buldir Is.)	25	5
Bering Sea (Pribilof, St. Matthew, St. Lawrence Is.)	30	0
Chukchi Sea (Capes Lisburne & Thompson)	33	0
Sea of Okhotsk (Talan I., Magadanskaya)	30	0
Japan (Teuri I.)	0	30
MARBLED MURRELET		
California	40	0
Oregon	12	18
Washington	18	12
British Columbia (Queen Charlotte Is.)	30	0
Southeastern Alaska (Lemesurier I.)	20	10
Prince William Sound (Unakwik Fjord)	20	10
Cook Inlet (Kachemak Bay)	24	6
Kodiak Island	26	4
Mitrofania Bay	26	4
Shumagin Islands (Koniuji Is., Belkofski B., Yakutat P.)	22	8
Eastern Aleutians (Dutch Harbor)	12	18
Central Aleutians (Adak I.)	10	20
Western Aleutians (Attu I.)	18	12

Table 1, cont'd.

Site	Available	Needed
KITTLITZ'S MURRELET		
Prince William Sound	4	*
Kachemak Bay	18	*
Adak Island	6	*
Western Aleutians (Attu I.)	5	*
Bering Strait	*	*
PIGEON GUILLEMOT		
California (Farallon Is.)	20	10
Oregon	25	5
British Columbia (Queen Charlotte Is.)	0	30
Southeast Alaska (Glacier Bay)	0	30
Prince William Sound (Jackpot & Naked Is.)	30	0
Cook Inlet (Kachemak Bay)	9	21
Kodiak Island	0	30
Alaska Peninsula (Semidi and Shumagin Is.)	7	23
Western Aleutians (Attu, Agattu Is.)	0	30
Kuril Is.	0	30
Bering Sea (Pribilof, St. Lawrence Is.)	0	30
Chukchi Sea (Capes Thompson and Lisburne)	0	30

*Samples will be obtained from Kittlitz's murrelets opportunistically.

NOTE: Every effort will be made to obtain samples non-destructively to minimize the need for collections, e.g. as feathers or blood samples collected during banding, or from museum specimens.

Victoria Louise Friesen

Curriculum Vitae - April 13, 1998

Education

7/1992-6/1994	-Postdoctoral Fellow, Ornithology -Royal Ontario Museum and University of Toronto -"A phylogenetic analysis of the family Alcidae"
5/1987-6/1992	-Doctor of Philosophy, Biopsychology -Memorial University of Newfoundland, St. John's, Newfoundland -"Population differentiation and evolution within thick-billed (*Uria lomvia*) and common (*U. aalge*) murres"
4/1984-2/1987	-Master of Science, Biopsychology -Memorial University of Newfoundland, St. John's, Newfoundland -"Parental energy expenditures and activity budgets of northern gannets (*Sula bassanus*)"
9/1980-4/1984	-Bachelor of Science (first class honours), Biology -University of Prince Edward Island, Charlottetown, Prince Edward Island

Scholarships and Awards (last five years)

1994-present	-NSERC Women's Faculty Award -Queen's University
1992-1994	-NSERC Postdoctoral Fellowship -University of Toronto and Royal Ontario Museum

Manuscripts and Grant Proposals Reviewed For

-Auk, Canadian Journal of Zoology, Canadian Society for Endangered Birds, Canadian Wildlife Service Special Publications, Condor, Ecology, Evolution, Marine Ecology Progress Series, National Science Foundation, Proceedings of the XXth International Ornithological Congress, Wilson Bulletin

Major Research Grants and Contracts (last five years)

04/98-03/02	-NSERC Research Grant -$40,000/yr -"Mechanisms of population differentiation and speciation in seabirds"

04/98	-Science Horizons (Environment Canada) -$12,000 -"Population genetic analysis of thick-billed murres"
04/97	-Science Horizons (Environment Canada) -$8,000 -"Genetic profiling of thick-billed murres from Coat's Island, NWT"
11/96	-Advisory Research Council Research Grant -$4,000 -"Development of an innovative molecular technique for the conservation of genetic variation in endangered birds"
06/96	-Lindbergh Foundation -$10,850 US -"Development of an innovative molecular technique to aid in balancing technological progress with wildlife management and environmental conservation"
11/95	-Advisory Research Council Research Grant -$5,000 -"Equipment for development of a molecular genetic technique for studies in ecology and evolution"
08/95-03/97	-Environmental Innovation Program, Public Works and Government Services Canada Contract -$106,000 -"Development of an innovative molecular technique for the conservation of genetic variation in endangered birds"
05/95	-Advisory Research Council Research Grant -$5,000 -"Development of an innovative genetic technique to aid in studies of ecology and evolution"
11/94	-Advisory Research Council Research Grant -$5,000 -"Population differentiation and speciation in guillemots"
04/94-03/97	-NSERC Research Grant -$35,000 -"Mechanisms of population differentiation and speciation in seabirds"
04/94-03/95	-Endangered Species Recovery Fund (World Wildlife Fund) -$12,000 -"Conservation genetics of marbled murrelets"

Refereed Papers

Kidd, M. G. and V. L. Friesen. 1998. Analysis of mechanisms of microevolutionary change in *Cepphus* guillemots using patterns of control region variation. Evolution, in press.

Kidd, M.G. and V.L. FRIESEN. 1998. Sequence variation in the guillemot (Alcidae: *Cepphus*) mitochondrial control region and its nuclear homolog. *Mol. Biol. Evol.*15:61-70.

Friesen, V.L. 1997. Population genetics and the spatial scale of conservation of colonial waterbirds. Colonial Waterbirds 20:353-368.

FRIESEN, V.L., B.C. Congdon, H.E. Walsh and T.P. Birt. 1997. Intron variation in marbled murrelets detected using analyses of single-stranded conformational polymorphisms. *Mol. Ecol* 6:1047-1058.

FRIESEN, V.L. and D.J. Anderson. 1997. Phylogeny and evolution of the Sulidae: A test of alternative modes of speciation. *Mol. Phyl. Evol.* 7:252-260.

FRIESEN, V.L., W.A. Montevecchi, A.J. Baker, A.J. Gaston, R.T. Barrett and W.S. Davidson. 1996. Population differentiation and evolution in the common guillemot *Uria aalge*. *Mol. Ecol.* 5:793-805.

FRIESEN, V.L., J.F. Piatt and A.J. Baker. 1996. Evidence from cytochrome *b* sequences and allozymes for a 'new' species of alcid, the long-billed murrelet (*Brachyramphus perdix*). *Condor 98:*681-690.

FRIESEN, V.L., W.A. Montevecchi, R.T. Barrett and W.S. Davidson. 1996. Molecular evidence for kin groups in the absence of large-scale genetic differentiation in a migratory bird. *Evolution*: 50:924-930.

FRIESEN, V.L., A.J. Baker and J.F. Piatt. Phylogenetic relationships within the Alcidae (Charadriiformes: Aves) inferred using total molecular evidence. *Mol. Biol. Evol.* 13: 359-367.

Birt, T.P., V.L. FRIESEN, J.M. Green and W.S. Davidson. Mitochondrial DNA variation in Newfoundland and Norwegian populations of Atlantic capelin, *Mallotus villosus*, detected using two techniques. *Mol. Ecol.* 4: 771-776.

FRIESEN, V.L., R.T. Barrett, W.A. Montevecchi and W.S. Davidson. 1993. Molecular identification of a backcross between a female common murre/thick-billed murre hybrid and a male common murre. *Can. J. Zool.* 71: 1474-1477.

FRIESEN, V.L., W.A. Montevecchi and W.S. Davidson. 1993. Cytochrome *b* nucleotide sequence variation among the Atlantic Alcidae. *Hereditas* 119: 245-252..

BIRT-FRIESEN, V.L., W.A. Montevecchi, A.J. Gaston and W.S. Davidson. 1992. Genetic structure of thick-billed murre (*Uria lomvia*) populations examined using direct sequence analysis of amplified DNA. *Evolution* 67: 267-272.

Birt, T.P., V.L. FRIESEN, J.M. Green, W.A. Montevecchi and W.S. Davidson. 1992. Cytochrome *b* variation in parrots. *Hereditas* 117: 67-72.

Montevecchi, W.A., V.L. BIRT-FRIESEN and D.K. Cairns. 1992. Reproductive energetics and prey harvest of Leach's storm-petrels in the northwest Atlantic. *Ecology* 73: 823-832.

Cairns, D.K., W.A. Montevecchi, V.L. BIRT-FRIESEN and S.A. Macko. 1990. Energy expenditures, activity budgets, and prey harvest of breeding common murres. *St. Av. Biol.* 14: 84-92.

BIRT-FRIESEN, V.L., W.A. Montevecchi, D.K. Cairns and S.A. Macko. 1989. Activity-specific metabolic rates of free-living northern gannets and other seabirds. *Ecology* 70: 357-367.

Davidson, W.S., S.E. Bartlett, T.P. Birt, V.L. BIRT and J.M. Green. 1989. Identification and purification of serum albumin from rainbow trout (*Salmo gairdneri*). *Comp. Biochem. Physiol.* 93B: 5-9.

Davidson, W.S., V.L. BIRT, T.P. Birt and J.M. Green. 1988. Palmitate-binding, serum albumin-like proteins in salmonids. *FEBS Letters* 233: 299-302.

Montevecchi, W.A., V.L. BIRT and D.K. Cairns. 1988. Dietary changes of seabirds associated with local fisheries failures. *Biol. Oceanogr.* 5: 153-161.

Montevecchi, W.A., D.K. Cairns and V.L. BIRT. 1988. Migration of post-smolt Atlantic salmon, *Salmo salar*, off northeastern Newfoundland, as inferred by tag recoveries in a seabird colony. *Can. J. Fish. Aquat. Sci.* 45: 568-571.

BIRT, V.L., T.P. Birt, D. Goulet, D.K. Cairns and W.A. Montevecchi. 1987. Ashmole's halo: direct evidence for prey depletion by a seabird. *Mar. Ecol. Prog. Ser.* 40: 205-208.

BIRT, V.L. and D.K. Cairns. 1987. Kleptoparasitic interaction of arctic skuas *Stercorarius parasiticus* and black guillemots *Cepphus grylle* in northeastern Hudson Bay, Canada. *Ibis* 29: 190-196.

Cairns, D.K., K.A. Bredin and V.L. BIRT. 1987. A tunnel for hidden access to blinds at high latitude seabird colonies. *J. Field Ornithol.* 58: 69-72.

Cairns, D.K., K.A. Bredin, V.L. BIRT and W.A. Montevecchi. 1987. Electronic activity recorders for aquatic wildlife. *J. Wildl. Manag.* 51: 395-399.

Papers Submitted or In Preparation

FRIESEN, V.L. Contributions of molecular genetics to the understanding of seabird ecology and evolution. Book chapter submitted to Dr. D. Duffy Mar. 1998.

Holder, K., R. Montgomerie and V. L. FRIESEN. Population genetics and phylogeography of rock ptarmigan (*Lagopus mutus*) in Beringia. Submitted to *Evolution* Mar. 1998.

Walsh, H.E., M.G. Kidd, T. Moum and V.L. FRIESEN. Polytomies and the power of phylogenetic inference. Submitted to *Evolution* Feb. 1998.

FRIESEN, V.L., J.F. Piatt and A.J. Baker. Evolution and speciation in the Alcidae (Aves: Charadriiformes). Submitted to *Auk,* Dec. 1997.

FRIESEN, V.L., B.C. Congdon, M.G. Kidd and T.P. Birt. General PCR primers for the amplification and sequencing of nuclear introns in vertebrates. In prep. for *Mol. Ecol.*

Congdon, B.C., J.F. Piatt, K. Martin and V.L. FRIESEN. Rapid population expansion and peripheral isolation in marbled murrelets: contemporary vs historic evolutionary processes. In prep. for *Evolution.*

Congdon, B.C. and V.L. FRIESEN. Population and evolutionary dynamics of introns. In prep. for *Genetics.*

Scientific Presentations

Approximately 50 oral and poster presentations, including one opening presentation and approximately 10 symposium presentations, at conferences including annual meetings of the Society for Conservation Biology, the Society for the Study of Evolution, the Pacific Seabird Group, the American Ornithological Union, and the Colonial Waterbird Society, and the International Ornithological Congresses.

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel	$5.9	$0.0
Travel	$5.5	$0.0
Contractual	$70.5	$86.6
Commodities	$0.5	$0.0
Equipment		$0.0
Subtotal	$82.4	$86.6
General Administration	$2.3	$6.1
Project Total	$84.7	$92.7
Full-time Equivalents (FTE)	0.3	0.0
Other Resources		

LONG RANGE FUNDING REQUIREMENTS

Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		
$14.8				

Dollar amounts are shown in thousands of dollars.

Comments:

The increase in this budget over the projected costs from FY98 results primarily from inclusion of a cost for general administration - an expense overlooked in the budget from FY98.

FY 99

Prepared: 13 April 1998

Project Number: 99-169
Project Title: A genetic study to aid in restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: Queen's University and DOI

FORM 3A
TRUSTEE
AGENCY
SUMMARY

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Personnel Costs:		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime	Proposed FY 1999
Name	Position Description					
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
	Subtotal		0.0	0.0	0.0	
					Personnel Total	$0.0

Travel Costs:	Ticket Price	Round Trips	Total Days	Daily Per Diem	Proposed FY 1999
Description					
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
					0.0
				Travel Total	$0.0

FY 99

Prepared: 13 Apri. 1998

Project Number: 99-169
Project Title: A genetic study to aid in restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: Queen's University and DOI

FORM 3B
Personnel
& Travel
DETAIL

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed FY 1999
Description	
4A Linkage	86.6
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	$86.6

Commodities Costs:	Proposed FY 1999
Description	
Commodities Total	$0.0

FY 99

Prepared: 13 April 1998

Project Number: 99-169
Project Title: A genetic study to aid in restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: Queen's University and DOI

FORM 3B
Contractual & Commodities DETAIL

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases: Description	Number of Units	Unit Price	Proposed FY 1999
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage: Description	Number of Units	Inventory Agency

FY 99

Prepared: 13 April 1998

Project Number: 99-169
Project Title: A genetic study to aid in restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: Queen's University and DOI

FORM 3B
Equipment
DETAIL

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 1998 - September 30, 1999

Budget Category:	Authorized FY 1998	Proposed FY 1999
Personnel		$60.0
Travel		$1.2
Contractual		$0.0
Commodities		$17.0
Equipment		$0.0
Subtotal	$0.0	$78.2
Indirect		$8.4
Project Total	$0.0	$86.6
Full-time Equivalents (FTE)		30.0
Other Resources		

LONG RANGE FUNDING REQUIREMENTS					
	Estimated FY 2000	Estimated FY 2001	Estimated FY 2002		

Dollar amounts are shown in thousands of dollars.

Comments:

All estimates assume a U.S./Canadian exchange rate of $0.714.

Indirect costs include costs of Xeroxing, telephone calls, shipping samples, permits, page charges, etc (approximately $500) and 10% overhead for Queen's University.

1.4% of the project cost is for workshop attendance.

The slight increase in projected costs results from inclusion of page charges for publications - an expense overlooked in the projection from FY98.

FY 99

Prepared: 13 April 1998

Project Number: 99-169
Project Title: A genetic study to aid in restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: Queen's University and DOI

FORM 4A
Non-Trustee
SUMMARY

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Personnel Costs:			Months	Monthly		Proposed
Name	Position Description		Budgeted	Costs	Overtime	FY 1999
						0.0
Dr. Tim Birt	Post-doctoral fellow		12.0	2.2		26.4
Denise Michaud	Technician I		12.0	1.2		14.4
Jeff Moy	Technician II		6.0	3.2		19.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
		Subtotal	30.0	6.6	0.0	
					Personnel Total	$60.0

Travel Costs:		Ticket	Round	Total	Daily	Proposed
Description		Price	Trips	Days	Per Diem	FY 1999
						0.0
Restoration Workshop (V.L.F.)		0.7	1	5	0.1	1.2
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
						0.0
					Travel Total	$1.2

FY 99

Prepared: 13 Apri. 1998

Project Number: 99-169
Project Title: A genetic study to aid in restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: Queen's University and DOI

FORM 4B
Personnel
& Travel
DETAIL

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

Contractual Costs:	Proposed FY 1999
Description	
Contractual Total	$0.0

Commodities Costs:	Proposed FY 1999
Description	
CONSUMABLES AND DISPOSIBLES*	
Post-doctoral fellow	6.8
Technician I	3.4
Technician II	6.8
*The Post-doctoral Fellow and Technician II will each screen DNA from approximately 225 samples for each of 20 genes. Each sample costs $0.90/gene for amplification with incorporation of 33P-dATP, and $0.55/sample for SSCP- or microsatellite gels. Thus, each of these people will require ~$6525 for reagents for population screening. Approximately $250/year will be needed for gloves, etc, for an annual cost of $6775 each. Technician I will be working half-time, so will require approximately $3388 for consumables and disposibles.	
Commodities Total	$17.0

FY 99

Prepared: 13 Apr. 1998

Project Number: 99-169
Project Title: A genetic study to aid in restoration of murres, guillemots and murrelets to the Gulf of Alaska
Agency: Queen's University and DOI

FORM 4B
Contractual & Commodities DETAIL

FY 99 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 1998 - September 30, 1999

New Equipment Purchases:	Number of Units	Unit Price	Proposed FY 1999
Description			
Note: This project is made possible by the existence of equipment valued in excess of $50,000 within V.L.F.'s DNA research laboratory at Queen's University. No additional equipment is required.			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
			0.0
Those purchases associated with replacement equipment should be indicated by placement of an R.		**New Equipment Total**	$0.0

Existing Equipment Usage:	Number of Units	
Description		

FY 99

Prepared: 13 Apri. 1998

Project Number: 99-169
Project Title: A genetic study to aid in restoration of murres, guillemots and murrelets to the Gulf of Alaska
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FORM 4B
Equipment
DETAIL