Numerical and Functional Response of Seabirds to Fluctuations in Forage Fish Density

Project Number:	02163 M
Restoration Category:	Research
Proposed By:	U.S. Geological Survey (PI- John F. Piatt)
Lead Trustee Agency:	DOI
Cooperating Agencies:	N/A
Duration:	1 year
Cost FY 02:	$50,000 (data analysis, reporting)
Geographic Area:	Cook Inlet, Gulf of Alaska
Injured Resource:	Multiple resources

ABSTRACT

Cook Inlet Seabird and Forage Fish Studies (CISeaFFS) was established in 1995 with EVOSTC (APEX) and USGS funding to measure the foraging (functional) and population (numerical) responses of seabirds to fluctuating forage fish densities around three seabird colonies in lower Cook Inlet. This involved at-sea surveys for forage fish (hydroacoustics, trawling, seining) and seabirds (line transects), and some characterization of oceanography (AVHRR satellite imagery, CTD profiles, moored thermographs), while measuring aspects of seabird breeding biology (egg and chick production, chick growth, population trends) and foraging behavior (diets, feeding rates, foraging time) at adjacent colonies. Following completion of a final report and data archive, we are now trying to finalize some synthetic papers on the work.

INTRODUCTION

Some seabird populations in the Gulf of Alaska declined markedly during the past few decades. Whereas human impacts such as those from the *Exxon Valdez* oil spill can account for some proportion of these declines, natural changes in the abundance and species composition of forage fish stocks have also affected seabird populations. Marine fish communities in the Gulf of Alaska changed dramatically during the past 20 years. Coincident with cyclical fluctuations in sea-water temperatures, the abundance of small forage fish species such as capelin (*Mallotus villosus*) declined precipitously in the late 1970's while populations of large predatory fish such as walleye pollock (*Theragra chalcogramma*) and cod

(*Gadus pacifica*) increased dramatically. Correspondingly, capelin virtually disappeared from seabird diets in the late 1970's, and were replaced by juvenile pollock and other species in the 1980's. Seabirds and marine mammals exhibited several signs of food stress (population declines, reduced productivity, die-offs) throughout the 1980's and early 1990's.

NEED FOR THE PROJECT

A. Statement of the Problem

Factors that regulate seabird populations are poorly understood, but food supply is clearly important. In many cases, anthropogenic impacts on seabird populations cannot be distinguished from the consequences of natural variability in food supplies. Thus, 'management' of seabird populations remains an uncertain exercise. For example, how can we enhance or predict recovery of seabird populations lost to the *Exxon Valdez* oil spill if food supplies in the Gulf of Alaska limit reproduction?

B. Rationale

To address these questions, the EVOSTC initiated APEX (Apex Predator Ecosystem Experiment) in 1995. In Cook Inlet, pilot studies were initiated with USGS and MMS support in 1995, and expanded in 1996 with substantial APEX support. The overall objective was to quantify and contrast seabird-forage fish relationships at three seabird colonies in lower Cook Inlet: Chisik Island, Gull Island (Kachemak Bay), and the Barren Islands (research there conducted and reported by the Alaska Maritime National Wildlife Refuge). The abundance and species composition of forage fish schools around each colony were quantified with hydroacoustic surveys, mid-water trawls, and beach seines. At each colony, we measured breeding success, diet composition, and foraging effort of several seabird species including: common murres, black-legged kittiwakes, pigeon guillemots, pelagic cormorants, glaucous-winged gulls, tufted puffins and horned puffins.

In 1997 and 1998, this research program was refined and expanded where appropriate. For example, we included benthic trawling nearshore since 1997, increased study effort on pigeon guillemots, added nearshore sampling for zooplankton, phytoplankton and nutrients (in collaboration with Peter McRoy, UAF), studied physiological responses of adult and chick seabirds to food stress, begun to measure adult survival of murres and kittiwakes on Gull and Chisik islands, and increased coordination of seabird studies at the three colonies using protocols developed in collaboration with other principal investigators in the EVOS/APEX program. The basic components of this study have not changed, however, and we measured the same fundamental parameters of forage fish and seabird biology for the duration of the study (1995-1999).

C. Location

The remaining work will take place at the Alaska Biological Science Center and University of

Washington.

COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

None in this phase which draws only upon existing data and reports

PROJECT DESIGN

A. Summary of field work and findings to date

The main field program occurred in 1995-1999, however, we continued to collect data on seabird survival and stress in 2000 and 2001. Main results of the main study can be found in the final report to the EVOSTC. In summary, populations, productivity, diets and foraging behavior of murres and kittiwakes were studied at three seabird colonies in lower Cook Inlet (Chisik, Gull and Barren islands). Ancillary data were also collected on Tufted and Horned Puffins, Cormorants (spp.) and Glaucous-winged Gulls. Pigeon Guillemots were studies in Kachemak Bay only. Here we focus on the two main study species: Common Murres and Black-legged Kittiwakes. Oceanographic measurements, seabird and hydroacoustic surveys, trawls, and beach seines were conducted in waters around (<45 km) each colony.

In all years, offshore and southern waters of Cook Inlet were dominated by juvenile walleye pollock, important prey for murres and puffins. Nearshore waters of Cook Inlet were dominated by sandlance, which were consumed by seabirds (e.g., kittiwakes, guillemots, murres) in proportion to their local abundance. Other important prey species included capelin, smelts, and herring. More than 80 fish were captured in nets during the study. The CPUE of forage fish in either mid-water trawls or beach seines around Chisik Island was typically 1-2 orders of magnitude less than around the Barren Islands or in Kachemak Bay. Acoustically-measured forage fish biomass was lowest around Chisik Island, moderate around the Barrens and highest in Kachemak Bay. Water temperatures throughout the summers of 1995-1999 were similar and near long-term averages, except that temperatures in winter of 1997/98 were about 1-2 C higher than in previous years owing to warming from El Niño.

The breeding biology of seabirds differed markedly among colonies owing to differences in food supply, which in turn reflect differences in oceanography among areas. Over all years, breeding success of murres and kittiwakes was highest and least variable at Gull Island, high and more variable at the Barrens, and lowest at Chisik. Breeding success in most species (including gulls, cormorants, puffins) was lower in 1998 than in other years. Murres on Chisik Island had a near reproductive failure. Measures of baseline corticosteroid levels suggest that murres on Chisik were highly stressed even before they attempted to lay eggs in July. A large die-off of murres was observed in Cook Inlet in April and May of 1998, and although most birds affected were subadults, this die-off foreshadowed the poor breeding season for murres during summer of 1998.

Population censusing revealed that seabirds at Chisik Island continue in a long-term decline (ca. -4% to

-9% per annum), whereas populations at Gull and Barren islands are increasing (ca. 5% to 9% p.a.). Behavioral studies reveal that seabirds work harder (longer foraging trips, less "free" time) at colonies or in years when nearby fish densities are lower. Preliminary results of survival studies suggest that the survival rate of adult kittiwakes on Chisik Island (where parental investment is low owing to typical failure to raise young) is substantially higher than on Gull Island (where chick fledging is typically high). In contrast, survival of adult murres-- which usually manage to fledge chicks at both colonies-- is lower at Chisik than at Gull, presumably because the cost of raising and fledging chicks is higher at Chisik.

Overall, the results show that seabird parameters (breeding success, foraging effort, diets, etc.) vary most between islands, and least between years. We attribute this regional stability in biological responses to distinct oceanographic regimes around each colony that tend to strongly influence the biology of birds within those areas. Thus, all measured seabird parameters varied some between years, but, for example, kittiwakes at Gull Island always fared much better than those at Chisik. While each colony responded differently to the ENSO perturbation of 1997/98, responses were commensurate with the underlying physical and biological regime observed in each area.

As predicted, the numerical and functional responses of seabirds to food density was generally non-linear. There were fundamental differences in response of murres and kittiwakes, owing to inter-species differences in metabolic demands and foraging abilities. In general, kittiwakes are hard-pressed throughout breeding to meet energy demands. They lay multiple-egg clutches and try to hatch and raise as many chicks possible, but pairs must forage 16 or more hours a day on average even when food supplies are good. Consequently, they have little discretionary time to buffer against change in food supply, and therefore fledging success is strongly correlated (in sigmoidal fashion) with local food density. In contrast, murres lay and hatch only one egg, and pairs spend only about 12 hours per day foraging when food supplies are average to good. When food supplies become scarce, murres compensate by spending more discretionary time foraging, and therefore fledging success in murres is not correlated with local food supply, whereas discretionary "loafing time" is strongly correlated (in sigmoidal fashion) with food density.

Aside from these differences in foraging time budgets and in their ability to buffer reproductive success against changes in prey density, murres and kittiwakes actually responded to prey variability in some similar ways. In the face of high variability (CV=80%) in prey abundance among 3 colonies and 5 years, both species minimized variability in their own body condition (CV<10%), variability in attendance by at least one adult at nest sites (<10%) and growth of young (CV<15%) . In both species, foraging behaviors (trip duration, chick feeding rate) were moderately variable (CV = 15-25%); as were some breeding parameters (laying success, hatching success, CV= 20-40%). In both species, variability in density of adults foraging at sea was similar (CV = 70-75%) to variability in prey abundance. In both species, variability in co-attendance of both adults at nest sites (index of discretionary "loafing time") was of a similar or higher magnitude (CV = 65-140%) to variability in prey abundance. As noted above, the only real difference among species was that murres were able to use discretionary time to buffer breeding success (CV <30%) against variability in prey abundance whereas kittiwakes could not (breeding success CV = 90%, i.e., the same variability as prey abundance).

In general, these results are consistent with life history theory which suggests that long-lived, iteroparous seabirds should not invest so much in any one breeding attempt that adult survival is disproportionately affected. In the face of environmental variability, adults of both species tend to maintain their own body condition first, and maintain their chicks second. Flexibility is found in their behavioral responses to fluctuations in prey density, including foraging effort, prey selection (quality and quantity), use of discretionary time, etc., allowing birds to moderate effects of food variability on predation, food acquisition and chick feeding rates.

Considering the functional and numerical responses of murres and kittiwakes to prey abundance at the three study colonies, the average abundance of prey around each colony, and the deviation of seabird parameters (e.g., breeding success, foraging effort, attendance, etc.) from averages of all colony-years studied, it appears that food supplies at Gull and Barren islands, but not at Chisik, are presently adequate to support recovery of losses from the Exxon Valdez oil spill.

B. Objectives for FY02

In FY 2000 and 2001 we completed our data archive and our final report which included all significant findings and provides a preliminary synthesis and interpretation of results. After revisions based on reviewer's comments, this report will constitute a final repository for raw and summarized data, provide documentation of methods for the entire project, and serve as a useful reference for researchers who may wish to conduct research in lower Cook Inlet in the future.

Our main objective in FY 2002 is to write and publish a number of synthetic papers. The following lists indicate priority products for FY02, as well as products completed to date.

Cook Inlet related manuscripts proposed for write-up in FY02:

"The role of food supply and environmental variability in the regulation of seabird populations" (adapted from Chapter 14 in Final Report, synthesis of major findings on Cook Inlet environment, fish, and seabird biology and behavior) {Piatt, Shultz, van Pelt, Harding et al.} Ecological Monographs

"Feeding ecology of Common Murres and Black-legged Kittiwakes in relation to food availability in lower Cook Inlet". (details of adult and chick diet composition, prey characteristics, prey selection versus availability, energy delivered to chicks) {Van Pelt, Shultz, Litzow et al.} Marine Ecology Progress Series

"Chick feeding rates, foraging time budgets, and nest site attendance of Common Murres and Black-legged Kittiwakes at three colonies with differing food regimes" (details and synthesis of behavioral data in relation to food) {Shultz, van Pelt, Harding et al.} Behavioral Ecology

"Breeding biology of Common Murres and Black-legged Kittiwakes in relation to food availability" (details and synthesis of data on laying, hatching, fledging and overall breeding success, chick growth

and body condition of adults and chicks, in relation to food). {Litzow, Shultz, Harding, et al.} Ecology

"Spatial associations of seabirds and their prey around three colony sites in Lower Cook Inlet, Alaska" (measure and compare degrees of aggregation of birds and prey at varying scales to examine how seabird foraging patterns and strategies vary with changes in prey abundance, distribution, and species composition) {Speckman, Harding, Shultz et al.} Marine Ecology Progress Series

"Foraging ecology of seabirds in Lower Cook Inlet, Alaska" (Ph.D. dissertation, University of Washington, School of Fisheries. Will consist of 3 main chapters, each addressing different aspects of the foraging ecology of seabirds, i.e., oceanographic influences on prey dispersion, characteristics of prey schools used by seabirds, temporal and spatial association of seabirds and their prey) {Speckman, van Pelt, Shultz}

"Costs of egg production in common murres" (from M.Sc. thesis, results of manipulative experiment to assess reproductive costs of egg production at a food stressed colony) {Van Pelt et al.} Oecologia

"Breeding biology and feeding ecology of horned puffins at Chisik Island, Alaska" (from M.Sc. thesis, self-explanatory, details of 5 years of research) {Harding, Piatt, et al.} Condor

Cook Inlet related manuscripts, papers, and theses completed or in final stages of preparation:

Piatt, J.F., et al. 2001. Can seabirds recover from effects of the Exxon Valdez oil spill? (adapted from Chapter 14 of Final Report, consideration of ecological factors limiting recovery, current status of colonies in Cook Inlet, and forecast of future) for Biological Conservation

USGS and USFWS. 2001. Numerical and Functional Response of Seabirds to Fluctuations in Forage Fish Density. Exxon Valdez Oil Spill Restoration Project Final Report (Restoration Project 00163M), Alaska Biological Science Center, U.S. Geological Survey, Anchorage, Alaska. 450 pp.

Harding, A., J.F. Piatt, T. Van Pelt and A. Kitaysky. 2001. Parental Flexibility: An experimental reduction of provisioning effort in response to chick nutritional status in the Horned Puffin (*Fratercula corniculata*). Mss. submitted to Behavioural Ecology and Sociobiology.

Harding, A. M. 2001. The breeding ecology of Horned Puffins *Fratercula corniculata*. M.Sc. Thesis, University of Durham, England. 74 pp.

Abookire, A.A., J.F. Piatt, and B.L. Norcross. 2001. Summer habitat of juvenile groundfishes in Kachemak Bay, Alaska. *Accepted*. Alaska Fisheries Research Bulletin.

Litzow, M. A., J. F. Piatt, A. K. Prichard and D. D. Roby. 2001. Quality- predictability tradeoffs: Reproductive consequences of prey availability for the pigeon guillemot. Submitted to Ecologia.

Litzow, M. A. and J. F. Piatt. 2001. Time budgets of breeding Pigeon Guillemots: Effects of foraging ecology, body size and life history. *In prep.*, for submission Behavioural Ecology.

Litzow, M., J. Fischer, G. Golet, J. Piatt. 2001. Foraging effort of breeding Pigeon Guillemots: are high quality prey harder to catch? *In preparation*. For submission to Auk.

Kitaysky, A., J. Wingfield, and J. Piatt. 2000.Corticosterone facilitates begging and affects resource allocation in the Black-legged Kittiwake. *In Press.* Behavioral Ecology.

Litzow, M.A. 2000. Food limitation in a generalist seabird: reproductive consequences of fodd quality and prey switching in the Pigeon Guillemot (*Cepphus columba*). M.Sc. Thesis, University of California, Santa Cruz, CA. 36 pp.

Van Pelt, T.I. 2000. Reproductive costs and their expression in the Common Guillemot *Uria aalge*. M.Sc. Thesis, University of Glasgow, Scotland. 119 pp.

Romano, M.D. 2000. Effects of diet on growth and development of nestling seabirds. M.Sc. Thesis, Oregon State University, Corvallis OR. 59 pp.

Abookire, A.A., J. F. Piatt and M.D. Robards. 2000. Nearshore fish distributions in an Alaskan estuary in relation to stratification, temperature and salinity. Estuarine, Coastal and Shelf Science 51: 45-59.

Piatt, J.F. and A.S. Kitaysky. 2000. Horned Puffin (*Fratercula corniculata*). *In* The Birds of North America (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists Union. Mss. *Accepted.*

Litzow, M.A., J.F. Piatt, A.A. Abookire, A.K. Prichard, and M.D. Robards. 2000. Monitoring temporal and spatial variability in sandeel (*Ammodytes hexapterus*) abundance with pigeon guillemot (*Cepphus columba*) diets. ICES Journal of Marine Science 57: 976-986.

Seiser, P. E., L. K. Duffy, A. D. McGuire, D. D. Roby, G. H. Golet, and M. A. Litzow. 2000. Comparison of pigeon guillemot, *Cepphus columba*, blood parameters from oiled and unoiled areas of Alaska eight years after the *Exxon Valdez* oil spill. Marine Pollution Bulletin 40:152-164.

Robards, M.D. 2000. Ecology and demographics of Pacific sand lance, *Ammodytes hexapterus* Pallas, in lower Cook Inlet, Alaska. M.Sc. Thesis, Memorial University of Newfoundland, St. John's, Canada. 105 pp.

Robards, M.D., G.A. Rose, and J.F. Piatt. 2000. Oceanographic effects on abundance, somatic growth and otolith development of Pacific sand lance in lower Cook Inlet, Alaska. Environmental Biology of Fishes. *Accepted.*

Ostrand, W. D., T. A. Gotthardt, S. Howlin, J. Kern, and M. D. Robards. 2000. Habitat selection by Pacific sand lance in Prince William Sound, Alaska. *In preparation.* To be submitted to Fishery Bulletin.

Anderson, P.J., and J.F. Piatt. 1999. Community reorganization in the Gulf of Alaska following ocean climate regime shift. Marine Ecology Progress Series 189:117-123.

Piatt, J.F., G. Drew, T.Van Pelt, A. Abookire, A. Nielsen, M. Shultz, and A. Kitaysky. 1999. Biological effects of the 1997/1998 ENSO event in lower Cook Inlet, Alaska. PICES Scientific Report No. 10:93-100.

Robards, M.D., J.F. Piatt, A.B. Kettle, and A.A. Abookire. 1999. Temporal and geographic variation in fish communities of lower Cook Inlet, Alaska. Fisheries Bulletin 97: 962-977.

Kuletz, K. and J.F. Piatt. 1999. Juvenile Marbled Murrelet nurseries and the productivity index. Wilson Bulletin 111:257-261.

Piatt, J.F., N.L. Naslund, and T.I. van Pelt. 1999. Discovery of a new Kittlitz's Murrelet nest: Clues to habitat selection and nest-site fidelity. Northwestern Naturalist *80:8-13.*

Robards, M.D., J.F. Piatt, and G.A. Rose. 1999. Maturation, fecundity and intertidal spawning of Pacific Sand Lance (*Ammodytes hexapterus*) in the northern Gulf of Alaska. Journal of Fish Biology 54: 1050-1068.

Robards, M.D., J. Anthony, J.F. Piatt, and G. Rose. 1999.Changes in proximate composition and

somatic energy content for Pacific sand lance (*Ammodytes hexapterus*) relative to maturity and season in Kachemak Bay, Alaska. Journal of Experimental Marine Biology and Ecology. 242: 245-258.

Robards, M. D., Willson, M. F. Armstrong, R.H., Piatt, J.F., (eds). 1999. Sand lance: a review of biology and predator relations and annotated bibliography. Research Paper PNW-RP-521. Portland, OR, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 327 p. [http://www.fs.fed.us/pnw/pubs.htm]

Kitaysky, A.S. 1999. Metabolic and developmental responses of alcid chicks to experimental variation in food intake. Physiological and Biochemical Zoology 72: 462-473.

Kitaysky, A.S., J.F. Piatt, J.C. Wingfield, and M. Romano. 1999. The adrenocortical stress-response of Black-legged Kittiwake chicks in relation to dietary restrictions. Journal of Comparative Physiology (B):303-310.

Kitaysky, A.S., J.C. Wingfield, and J.F. Piatt. 1998. Dynamics of food availability, body condition and physiological stress response in breeding Black-legged kittiwakes. Functional Ecology 13:577-584.

Litzow, M.A., J.F. Piatt, and J.D. Figurski. 1998. Hermit crabs in the diet of Pigeon Guillemots at Kachemak Bay, Alaska. Colonial Waterbirds. 21:242-244.

Zador, S., and J.F. Piatt. 1998. Time-budgets of Common Murres at a declining and increasing colony in Alaska. Condor 101:149-152.

Ostrand, W. D., K. O. Coyle, G. S. Drew, J. M. Maniscalco, and D. B. Irons. 1998. Selection of forage fish schools by murrelets and Tufted Puffins in Prince William Sound, Alaska. Condor. 100:286-297.

Ostrand, W.D, G. S. Drew, R. M. Suryan, and L. L. McDonald. 1998. Evaluation of radio-tracking and strip transect methods for determining foraging ranges of Black-legged Kittiwakes. Condor. 100:709-718.

Piatt, J.F., D.D. Roby, L. Henkel, and K. Neuman. 1998. Habitat use, diet, and breeding biology of Tufted Puffins in Prince William Sound, Alaska. Northwestern Naturalist 78:102-109.

Van Pelt, T., J.F. Piatt, B.K. Lance, and D.D. Roby. 1997. Proximate composition and energy density of some North Pacific forage fishes. Comparative Biochemistry and Physiology 118(A): 1393-1398.

Kuletz, K.J., D.Irons, J.F. Piatt, B. Agler and D.C. Duffy. 1997. Long-term changes in populations and diets of piscivorous birds and mammals in Prince William Sound, Alaska. Proceedings, Forage Fishes in Marine Ecosystems. Alaska Sea Grant College Program, University of Alaska Fairbanks, AK-SG-97-01: 703-706.

Piatt, J.F. 1997. Alternative interpretations of oil spill data. Bioscience 47:202-203.

Piatt, J.F., and P. J. Anderson. 1996. Response of Common Murres to the *Exxon Valdez* oil spill and long-term changes in the Gulf of Alaska marine ecosystem. Pp. 720-737 in: Exxon Valdez Oil Spill Symposium Proceedings. Rice, S. D., R. B. Spies, D. A. Wolfe and B. A. Wright (Eds). American Fisheries Society Symposium 18, Bethesda, Maryland.

Piatt, J.F., and R. G. Ford. 1996. How many seabirds were killed by the *Exxon Valdez* oil spill? Pp. 712-719 in: Exxon Valdez Oil Spill Symposium Proceedings. Rice, S. D., R. B. Spies, D. A. Wolfe and B. A. Wright, (Eds). American Fisheries Society Symposium 18, Bethesda, Maryland.

Piatt, J. 1995. Water over the bridge. American Scientist 83:396-398.

C. Cooperating Agencies, Contracts, and Other Agency Assistance

Writing of papers will be conducted in collaboration with personnel at the Alaska Maritime National Wildlife Refuge, USFWS. Contracts will be issued to support Suzann Speckman and Ann Harding.

SCHEDULE

A. Measurable Project Tasks for FY 02

June 30, 2003 Final Synthesis Manuscripts Completed.

B. Project Milestones and Endpoints

September 30, 2003 All final manuscripts for synthesis submitted for journal publication.

C. Completion Date

September 30, 2003

PUBLICATIONS AND REPORTS

See objectives above for publications.

PROFESSIONAL CONFERENCES

None budgeted

NORMAL AGENCY MANAGEMENT

N/A

COORDINATION AND INTEGRATION OF RESTORATION EFFORT

This project integrates studies conducted as part of the EVOSTC APEX project with those funded by the USGS and MMS.

EXPLANATION OF CHANGES IN CONTINUING PROJECT

N/A

PRINCIPAL INVESTIGATOR

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PRINCIPAL INVESTIGATOR

Dr. John F. Piatt, Research Biologist (GS-14) with the Alaska Science Center, Biological Resources Division, USGS in Anchorage. Obtained a Ph.D. in Marine Biology from Memorial University of Newfoundland in 1987 (dissertation on seabird-forage fish interactions). Since 1987, studied seabirds at colonies and at sea in Gulf of Alaska, Aleutians, Bering and Chukchi seas. Author on 90 peer-reviewed scientific publications about seabirds, fish, marine mammals, and effects of oil pollution on marine birds. Responsible for coordination and oversight of the project.

FY 02 BUDGET

The FY02 budget (see attached) includes only requests for support of staff needed to complete the above reports and manuscripts.

In particular, we need continuing support for Suzann Speckman at the University of Washington. The Ph.D. program at UW is rigorous, and Suzann spent the first three years there doing extensive course-work and exams. Her summers were busy with collecting hydroacoustic and bird survey data. During the past year, Suzann had to completely reanalyze all the acoustic data using new software (EchoView) and contribute to the final report. Now she is busy working on her actual thesis papers, and with no other obligations, should make good progress during the remainder of 2001 and 2002. Suzann is supported through a cooperative agreement with UW, and it is essential that we continue to support her so she can finish what she has started.

Other support is needed to pay staff to complete preparation of manuscripts for publication, some of which is from thesis work recently completed.

No funds are requested for field work, travel or supplies.

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002						
Personnel		$32.3						
Travel		$0.0						
Contractual		$12.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$44.3		FY2003				
General Administration		$5.7		0				
Project Total	$0.0	$50.0						
Full-time Equivalents (FTE)		0.7						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

Final year funds for writing of publications synthesizing results of Cook Inlet reasearch for APEX

FY02

Prepared:

Project Number: 00163M
Project Title: Response of Seabirds to Forage Fish Density
Agency: USGS

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:		GS/Range/	Months	Monthly		P
Name	Position Description	Step	Budgeted	Costs	Overtime	
T. van Pelt	Wildlife Biologist	GS9	2.8	4,062		
M. Shultz	Wildlife Biologist	GS7	2.8	3,400		
M. Litzow	Wildlife Biologist	GS9	2.8	4,062		
	Subtotal		8.4	11524.0	0.0	
					Personnel Total	

Travel Costs:	Ticket	Round	Total	Daily	P
Description	Price	Trips	Days	Per Diem	
				Travel Total	

FY02

Prepared:

Project Number: 00163M
Project Title: Response of Seabirds to Forage Fish Density
Agency: USGS

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

Contractual Costs:	P
Description	
4A L S. Speckman, Research Work order with the University of Washington Final year of support for PhD thesis in School of Fisheries A. Harding, contract with Durham Univ. to complete publications	
When a non-trustee organization is used, the form 4A is required. **Contractual Total**	
Commodities Costs:	F
Description	
Commodities Total	

FY02

Prepared:

Project Number: 00163M
Project Title: Response of Seabirds to Forage Fish Density
Agency: USGS

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET
October 1, 2001 - September 30, 2002

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

Existing Equipment Usage:	Number of Units	I
Description		

FY02

Prepared:

Project Number: 00163M
Project Title: Response of Seabirds to Forage Fish Density
Agency: USGS

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Budget Category:	Authorized FY 2001	Proposed FY 2002						
Personnel		$0.0						
Travel		$0.0						
Contractual		$0.0						
Commodities		$0.0						
Equipment		$0.0	LONG RANGE FUNDING REQUIREMENTS					
Subtotal	$0.0	$0.0						
Indirect								
Project Total	$0.0	$0.0						
Full-time Equivalents (FTE)		0.0						
	Dollar amounts are shown in thousands of dollars.							
Other Resources								

Comments:

FY02

Prepared:

Project Number:
Project Title:
Name:

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Personnel Costs:				Months	Monthly		P
	Name	Position Description		Budgeted	Costs	Overtime	
		Subtotal		0.0	0.0	0.0	
						Personnel Total	

Travel Costs:		Ticket	Round	Total	Daily	P
	Description	Price	Trips	Days	Per Diem	
					Travel Total	

FY02

Prepared:

Project Number:
Project Title:
Name:

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

Contractual Costs:	P
Description	
Contractual Total	

Commodities Costs:	F
Description	
Commodities Total	

FY02

Prepared:

Project Number:
Project Title:
Name:

2002 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET

October 1, 2001 - September 30, 2002

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

Existing Equipment Usage:	Number of Units
Description	

FY02

Prepared:

Project Number:
Project Title:
Name: