

## Common Murre Population Monitoring

Project Number: 01144

Restoration Category: Restoration Monitoring

Proposer: DOI-FWS

Lead Trustee Agency: USFWS

Cooperating Agencies: None

Alaska SeaLife Center:

Duration: 1.5 years

Cost FY 01: \$46,500

Cost FY 02: \$14,000

Geographic Area: Field work will be conducted at the Chiswell Islands murre colonies in FY 01.

Injured Resource/Service: Common murres

### ABSTRACT

This proposed common murre (*Uria aalge*) restoration monitoring project is related to Projects 98144 (a murre population monitoring study that censused the Chiswell Islands nesting colonies in FY 98) and 99144 (another murre population monitoring study that censused the Barren Islands nesting colonies in FY 99). It is based on the recommendation made at the conclusion of the FY 98 study to recount the Chiswell Islands murre colonies in FY 00 or FY 01, and it is designed to collect additional murre population numbers data at this injured nesting complex. Data will be compared with counts made at the Chiswell Islands in 1989-1992 and 1998, and the results of these analyses will be used in combination with results from the 1989-1997 and 1999 Barren Islands murre population monitoring studies to help determine the recovery status of common murres in the spill area.

## INTRODUCTION

This proposed restoration monitoring project is designed to collect additional population numbers data on common murres (*Uria aalge*) at the Chiswell Islands. It is related to Project 98144, a study that censused these nesting colonies in FY 98, and it is based on a recommendation made at the conclusion of that study to recount this injured nesting complex in FY 00 or FY 01 (see Roseneau *et al.* 1999). Recounting these colonies in FY 01, well after any lingering affects of the 1997-1998 El Niño and La Niña events have dissipated, will provide a better measurement of the Chiswell Islands postspill murre population. This information, coupled with 1989-1997 and 1999 Barren Islands census data (see Roseneau *et al.* 1999 and 2000) will allow the recovery status of this injured species to be determined more accurately in the spill area.

## NEED FOR THE PROJECT

### A. Statement of Problem

We censused the Chiswell Islands murre colonies in 1998, six years after the last population counts were made, to see if numbers of breeding birds had increased since the spill (see Roseneau *et al.* 1999). No evidence of an increase was found; instead a negative trend was apparent over the 9-year 1989-1998 postspill interval. However, numbers of murres were highly variable at one of the colonies in 1998, compared to previous years, and when these data were excluded from the analysis, the negative trend disappeared. These results, coupled with other observations of unstable bird numbers at the Chiswell and Barren islands nesting cliffs, suggested that our 1998 population estimate was artificially low and did not accurately reflect the number of birds actually breeding at the Chiswell Islands nesting complex (unstable attendance well beyond the time murres have normally settled down and laid eggs on nesting ledges was probably related to the strong 1997-1998 El Niño and La Niña events see Roseneau *et al.* 1999).

### B. Rationale/Link to Restoration

Attendance was unstable at one of the six Chiswell Islands common murre colonies during the 1998 population monitoring counts, and as a result, the 1998 population estimate was artificially low and did not accurately reflect the number of birds actually breeding at this northern Gulf of Alaska nesting complex (unstable attendance well beyond the time murres have normally settled down and laid eggs on nesting ledges was probably related to the strong 1997-1998 El Niño and La Niña events see Roseneau *et al.* 1999). Therefore, additional data are needed to determine the true status of this injured species at this 6-island nesting complex (i.e., is the total population decreasing, as implied by the 1998 counts, or is it actually stable, or even increasing).

### C. Location

The proposed FY 98 common murre population monitoring study will be conducted at the Chiswell Islands, just west of Resurrection Bay near the entrance to Aialik Bay (see Fig. 1).

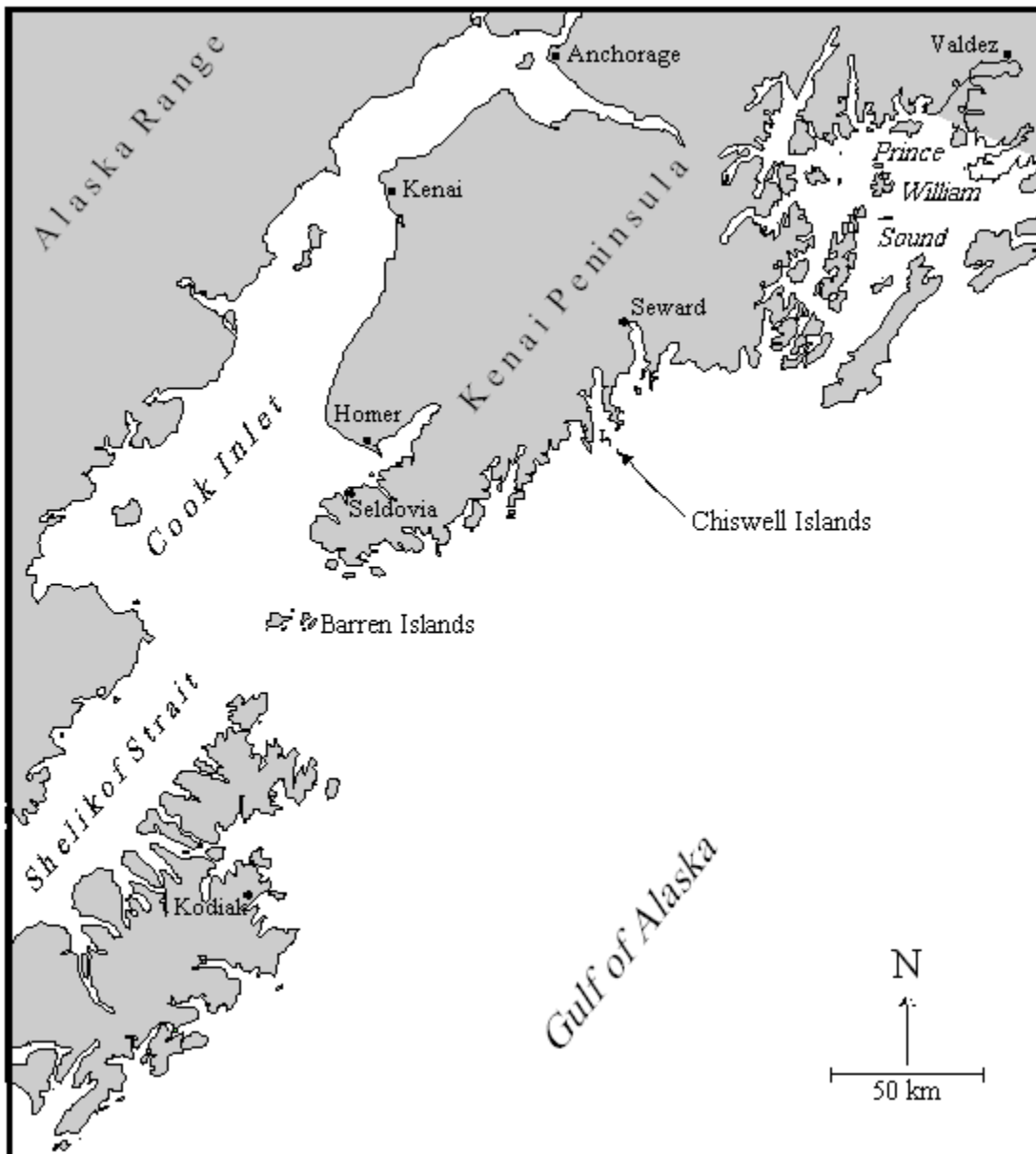


Figure 1. Location of the Chiswell Islands, Alaska.

## COMMUNITY INVOLVEMENT AND TRADITIONAL ECOLOGICAL KNOWLEDGE

A large format, computer-generated color poster summarizing the study results will be prepared and submitted to the Trustee Council for public display after data have been analyzed (similar posters showing results from common murre population monitoring studies 93049, 94039, 96144, 97144, and 99144 have been displayed at the Trustee Council January 1996-2000 restoration workshops). The printed posters are easy to transport and can be used by Trustee Council staff for a variety of purposes, including public displays at oil spill community meetings and schools. The posters and abstracts summarizing annual findings will also be available on-disk for inclusion in any on-line products that the Trustee Council may develop for public display. Copies of annual and final reports will be available to the public in Homer and Anchorage. Study results will also be presented at public Trustee Council-sponsored meetings and workshops, and in scientific publications. If a FWS research vessel is not available to support the work, a vessel will be chartered locally (e.g., Seward, Homer). Most supplies will also be obtained locally (e.g., fuel, food).

### PROJECT DESIGN

#### A. Objectives

The project objective is to determine if murre populations are increasing at the Chiswell Islands nesting colonies. Specific objectives are to:

1. Census the Nataoa, Matuska, Chiswell, Chiswell "B", Beehive, and Beehive "B" murre colonies; pool these counts with 1989-1992 and 1998 FWS scores and 1991 Dames & Moore (D&M) estimates; and analyze the data set for trends and differences among years.
2. Discuss the Chiswell Islands results in context with 1989-1999 Barrens Islands murre population monitoring data.

#### B. Methods

The project is designed to help test the null hypothesis that murre populations have not increased at nesting colonies in the spill area since the time of the event. The hypothesis will be tested by censusing birds at the six Chiswell Islands nesting colonies and statistically testing the updated data set (i.e., FWS counts made in 1989-1992, 1998, and 2001; and D&M counts made in 1991) for differences among years and trends in population size (see Roseneau *et al.* 1999). Results will also be compared with 1989-1999 Barren Islands murre population numbers data (see Roseneau *et al.* 2000).

Data will be collected and analyzed by the same methods used during the 1998 Chiswell Islands murre population monitoring study (Project 98144; see Roseneau *et al.* 1999). Field work will be conducted during about 15-30 July. A 15-20 m vessel will be hired to transport personnel to and from the study area and support the census work (a relatively large vessel is needed to support personnel at this location because of strong tidal flows and exposure to the open Gulf of Alaska, rapid changes in local weather conditions, lack of suitable camp sites, and distances between the colonies and protected coves and bays; working from a support vessel is also more

efficient, because the census team can remain on-station until the job is done, instead of attempting to commute back and forth to the study site).

### ***Data Collection***

The two-person census team will include at least one experienced observer (e.g., D.G. Roseneau, A.B. Kettle, G.V. Byrd). The six islands will be treated as plots, and birds will be counted from an inflatable raft using 7x42 binoculars and hand-held tally meters (see Roseneau *et al.* 1999). One team member will record plot scores without revealing his/her own count to the other observer. The recorder will compare the scores to see if they fall within 10% of each other (i.e., within 5% of their average). If they do not and if time allows, plots will be recounted until both scores fall within this range. Counts will be made by 1's or 10's, depending on plot histories, and they will be made during the part of the nesting season and time of day when attendance is most stable (i.e., between the peak of egg-laying and first sea-going of chicks, and during 1100-2000 hrs; e.g., see Byrd 1989; Hatch and Hatch 1989; Roseneau *et al.* 1995, 1996, 1997, 1998, 1999, 2000). The six colonies (Natoa, Matuska, Chiswell, Chiswell "B", Beehive, and Beehive "B") will be counted at least five separate times on different days to provide adequate power to detect changes in numbers because of daily variation in attendance (e.g., see Byrd 1989, Hatch and Hatch 1989, Roseneau *et al.* 1999).

### ***Data Analysis***

Statistical power to detect significant changes in murre numbers is discussed in Appendix 1. Data will be analyzed by the same methods used during the 1998 Chiswell Island murre population monitoring study (Project 98144; see Roseneau *et al.* 1999). To analyze data, 1-day totals will be calculated for the 6-island nesting complex and then these scores will be averaged to obtain a six-island estimate. Results will be pooled with 1989-1992 and 1998 FWS and 1991 D&M scores (i.e., see Nysewander and Dipple 1990, 1991; Dipple and Nysewander 1992; Nysewander *et al.* 1993, Dragoo *et al.* 1995; Erikson 1995; Roseneau *et al.* 1999), and analyzed for trends and differences among years by running linear regressions and one-sample *t*-tests. The 0.1 significance level will be used to increase the power of the tests and reduce Type II error (the 0.9 confidence interval will be adequate for our purposes; see Roseneau *et al.* 1999 and 2000).

### **C. Cooperating Agencies, Contracts and Other Agency Assistance**

A contract will be required to hire a vessel to support the FY 01 Chiswell Islands murre population monitoring counts.

## **SCHEDULE**

A. Measurable Project Tasks for FY 01 (1 October 2000 - 30 September 2001) and FY 02 (1 October 2001 - 30 September 2002)

Schedules for the proposed FY 01 and FY 02 work are provided below.

### FY 01

- 1 Oct 2000 – 31 Jan 2001: Arrange vessel contract and coordinate plans with Kenai Fjords National Park staff.
- 1 Feb – 31 Mar 2001: Arrange for hiring of seasonal employee.
- 1 – 30 Apr 2001: Check and repair equipment and gear (e.g., boats, outboard motors, radios, binoculars, survival suits).
- 1-31 May 2001: Finalize vessel contract, complete checking and repairing equipment and gear.
- 1-30 Jun 2001: Check and update census plot booklets, purchase supplies.
- 1-14 Jul 2001: Pack equipment and supplies, travel to Seward.
- 15 Jul 2001: Depart Seward for Chiswell Islands study area.
- 16-30 Jul 2001: Collect data at Chiswell Islands, as weather permits.
- 31 Jul 2001: Depart Chiswell Islands study area and return to Seward.
- 1 Aug 2001: Unload vessel, return to Homer.
- 2-31 Aug 2001: Clean and store equipment.
- 1 - 30 Sep 2001: Enter data.

### FY 02

- 1 Oct – 31 Dec 2001: Review and analyze 1989-1992 and 1998 FWS and 1991 D&M data.
- 1 Jan 2002 – 15 Mar 2002: Prepare draft report, submit draft for in-house review.
- 16 Mar - 10 Apr 2002: Finalize project report.
- 11 Apr 2002: Submit final project report to Chief Scientist for peer review.

### B. Project Milestones and Endpoints

Project milestones and endpoints for the proposed FY 01 and FY 02 work are listed below.

January 2001: Vessel contract arranged and plans coordinated with Kenai Fjords National Park staff.

May 2001: Vessel contract finalized.

Mid-July 2001: Field initiated at Chiswell Islands murre colonies.

Late July 2001: Field work completed at Chiswell Islands murre colonies.

March 2002: Draft report on FY 01 Chiswell Islands field activities completed.

April 2002: Final report on FY 01 Chiswell Islands field activities submitted to Chief Scientist.

### C. Completion Date

Field work will be completed in FY 01 and a final report will be submitted to the Chief Scientist by 15 April 2002.

### PUBLICATIONS AND REPORTS

A final report on the 2001 Chiswell Islands murre population monitoring study will be submitted to the Chief Scientist by 15 April 2002. Results of the study will also be included in the annual AMNWR seabird monitoring report, and reported in publications on northern Gulf of Alaska murre populations, as appropriate.

### PROFESSIONAL CONFERENCES

Results from the 2001 Chiswell Islands murre population monitoring study will be presented at the Alaska Bird Conference in 2002. About \$1.5K will be needed to cover the costs of one person to attend this professional meeting (results from the work may also be presented at other conferences in 2002-2003, if they are appropriate forums for the work).

### NORMAL AGENCY MANAGEMENT

The proposed common murre population census work at the Chiswell Islands is not something that AMNWR or the FWS is required to do by statute or regulation. The Chiswell Islands are listed as an intermittent monitoring site for seabirds in the refuge's seabird monitoring program, and as such, these colonies are only censused opportunistically about once every 10 years. Also, because the islands are not part of the FWS's highest priority ecosystem, the Bering Sea, support for this type of work will probably not be available until overall FWS priorities change (i.e., from the Bering Sea to other officially designated ecosystems within Alaska). The proposed project is needed to obtain census data to help determine whether common murre populations are increasing at Gulf of Alaska breeding locations affected by the spill. Results of the study will be

used to re-evaluate the recovery status of common murre in the spill area and help formulate management strategies for this injured species in the Gulf of Alaska.

## COORDINATION AND INTEGRATION OF RESTORATION EFFORT

The proposed restoration monitoring study will be coordinated with Alaska Maritime National Wildlife Refuge work at other locations in the Gulf of Alaska. The refuge will provide several items (e.g., office space and supplies, a vehicle for transporting personnel and equipment between Homer and Seward, survival gear, radios, inflatable rafts, outboard motors, cameras, binoculars) to the project that are not required by these other studies. The project will also be coordinated with Kenai Fjords National Park staff, because the National Park Service may be conducting work in the same general area.

## EXPLANATION OF CHANGES IN CONTINUING PROJECTS

No changes have been made to the project design of the FY 01 Chiswell Islands common murre population monitoring study (i.e., the project design, including methods and schedules, are the same as those proposed in the previously approved Project 98144 DPD and reported by *Roseneau et al.* 1999).

## PROPOSED PRINCIPAL INVESTIGATOR

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## PRINCIPAL INVESTIGATOR

### 1. David G. Roseneau (Principal Investigator)

David Roseneau received his B.S. degree in wildlife management and M.S. degree in biology from the University of Alaska - Fairbanks in 1967 and 1972, respectively. His thesis research was on the numbers and distribution of gyrfalcons, *Falco rusticolus* on the Seward Peninsula, Alaska. He joined the U.S. Fish and Wildlife Service in January 1993 and was project leader of common murre restoration monitoring studies in the Barren Islands during 1993-1994 (Projects 93049 and 94039). Mr. Roseneau was also principal investigator of the 1995-1999 APEX Barren Islands seabird and large fish as samplers studies (Projects 95163J, 95163K, 96163J, 97163J, 97163K, 98163J, 98163K, 99163J, and 99163K), and the 1996-1997 and 1999 Barren Islands and 1998 Chiswell Islands common murre population monitoring studies (Projects 96144, 97144, 98144, and 99144). Currently, he is principal investigator of the 2000 APEX Barren Islands seabird and large fish as samplers studies (Projects 00163J and 00163K) and the 2000



Barren Islands common murre population monitoring project (Project 00144). Prior to 1993, Mr. Roseneau was a consulting biologist for over 20 years. During that time, he conducted and managed marine bird, raptor, and large mammal projects in Alaska and Canada for government agencies and private-sector clients, and he also participated in several large-scale murre (*Uria* spp.) population monitoring projects. In 1976-1983, as co-principal investigator of NOAA/OCSEAP Research Unit 460, he conducted monitoring studies of murres and black-legged kittiwakes (*Rissa tridactyla*) at capes Lisburne, Lewis, and Thompson in the Chukchi Sea, and St. Lawrence, St. Matthew, and Hall islands in the Bering Sea. He also studied auklets (*Aethia* spp.) at St. Lawrence and St. Matthew islands, and participated in murre and kittiwake projects at Bluff in Norton Sound. During 1984-1986, he also participated in monitoring studies of murres and kittiwakes in the northeastern Chukchi Sea, and in 1987-1988, 1991-1992, and 1995-1999, he conducted additional murre and kittiwake monitoring work at capes Lisburne and Thompson, and Chamisso and Puffin islands. Mr. Roseneau is experienced in collecting and analyzing data on numbers, productivity, and food habits of seabirds; relating trends in numbers and productivity to changes in food webs and environmental parameters (e.g., air and sea temperatures, current patterns); and assessing potential impacts of petroleum exploration and development on nesting and foraging marine birds. He has broad knowledge of rock climbing techniques and has operated inflatable rafts and other outboard-powered boats in the Bering, Chukchi, and Beaufort seas and on various Alaskan rivers in excess of 3,000 hrs. He has also accrued several hundred additional hours operating time in small boats and larger, more powerful vessels (e.g. 25 ft, 300-400 hp HydroSports and Boston Whalers) in Kachemak Bay, Prince William Sound, and Kenai Peninsula and Barren Island waters. During his career, Mr. Roseneau has authored and co-authored over 80 reports and publications, including about 30 on Alaskan seabirds.

#### Selected Seabird Publications

- Murphy, E.C., A.M. Springer, and D.G. Roseneau. 1991. High annual variability in reproductive success of kittiwakes (*Rissa tridactyla* L.) at a colony in western Alaska. *J. Anim. Ecol.* 60: 515-534.
- Springer, A.M., E.C. Murphy, D.G. Roseneau, C.P. McRoy, and B.A. Cooper. 1987. Paradox of pelagic food webs in the northern Bering Sea - I. Seabird food habits. *Cont. Shelf Res.* 7: 895-911.
- Murphy, E.C., A.M. Springer, and D.G. Roseneau. 1986. Population status of *Uria aalge* at a colony in western Alaska: results and simulations. *Ibis* 128: 348-363.
- Springer, A.M., D.G. Roseneau, D.S. Lloyd, C.P. McRoy, and E.C. Murphy. 1986. Seabird responses to fluctuating prey availability in the eastern Bering Sea. *Marine Ecol. Prog. Ser.* 32: 1-12.
- Springer, A.M. and D.G. Roseneau. 1985. Copepod-based food webs: auklets and oceanography in the Bering Sea. *Marine Ecol. Prog. Ser.* 21: 229-237.
- Murphy, E.C., D.G. Roseneau, and P.J. Bente. 1984. An inland nest record for the Kittlitz's murrelet. *Condor* 86: 218.
- Springer, A.M., D.G. Roseneau, E.C. Murphy, and M.I. Springer. 1984. Environmental controls of marine food webs: food habits of seabirds in the eastern Chukchi Sea. *Can. J. Fish Aquat. Sci.* 41: 1202-1215.

#### OTHER KEY PERSONNEL

1. G. Vernon Byrd (Project Manager)

Vernon Byrd received a B.S. degree in wildlife management from the University of Georgia in 1968, did post-graduate studies in wildlife biology at the University of Alaska-Fairbanks in 1975, and completed a M.S. degree in wildlife resources management at the University of Idaho in 1989. His thesis, entitled "Seabirds in the Pribilof Islands, Alaska: Trends and monitoring methods", explored statistical procedures for analyzing kittiwake (*Rissa spp.*) and murre (*Uria spp.*) population data. Mr. Byrd has worked for the U.S. Fish and Wildlife Service for over 20 years, focusing on studies of marine birds in Alaska and Hawaii. His major interests center around monitoring long-term trends in seabird populations, including numbers of birds and reproductive performance, and he has worked at murre colonies in the Aleutian Islands, the Bering and Chukchi seas, and western Gulf of Alaska. Mr. Byrd was a co-author of the final T/V *Exxon Valdez* oil spill damage assessment report for murre. Also, he was project manager of the 1993-1994 Barren Islands common murre restoration monitoring projects (Projects 93049 and 94039), the 1995-1999 APEX Barren Islands seabird and large fish as samplers studies (Projects 95163J, 95163K, 96163J, 97163J, 97163K, 98163J, 98163K, 99163J, and 99163K), the 1996-1997 and 1999 Barren Islands and 1998 Chiswell Islands common murre population monitoring projects (Project 96144, 97144, and 98144), and EVOS-sponsored work designed to remove predators from seabird nesting habitats (Projects 94041 and 95041). Currently, Mr. Byrd is project manager of the 2000 APEX Barren Islands seabird and large fish as samplers studies (Projects 00163J and 00163K) and the 2000 Barren Islands common murre population monitoring project (Project 00144). He has authored and co-authored over 50 scientific papers and 70 U.S. Fish and Wildlife Service reports on field studies, and has made about 35 presentations on seabirds at scientific conferences and meetings. Mr. Byrd is the supervisory wildlife biologist at the Alaska Maritime National Wildlife Refuge, the premier seabird nesting area in the national public land system.

#### Selected Seabird Publications

- Byrd, G.V., E.C. Murphy, G.W. Kaiser, A.J. Kondratyev, and Y.V. Shibaev. (In press). Status and ecology of offshore fish-feeding alcids (murre and puffins) in the North Pacific Ocean. Proceedings of "Symposium on the Status, Ecology, and Conservation of Marine Birds of the Temperate North Pacific". Canadian Wildlife Service, Ottawa.
- Byrd, G.V., and J.C. Williams. Whiskered Auklet. 1993. A chapter describing the biology of the species *in* The birds of North America, No. 76 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia PA, and the American Ornithologists' Union, Washington, D.C. 12 pp.
- Byrd, G.V., and J.C. Williams. Red-legged Kittiwake. 1993. A chapter describing the biology of the species *in* The birds of North America No. 60 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia PA, and the American Ornithologists' Union, Washington, D.C. 12 pp.
- Springer, A.M. and G.V. Byrd. 1989. Seabird dependence on walleye pollock in the southeastern Bering Sea. Pages 667-677 *in* Proceedings of the International Symposium on the Biology and Management of Walleye Pollock. Alaska Sea Grant Rep. No. 89-1, Univ. of Alaska-Fairbanks.

## 2. Arthur B. Kettle (Biological Technician)

Arthur Kettle received his B.A. degree in Human Ecology from the College of the Atlantic in 1984. Since that time, he has participated in several large-scale seabird research projects at remote locations. He joined the U.S. Fish and Wildlife Service in May 1993, and is currently the field team leader for the upcoming 2000 APEX Barren Islands seabird studies (Project 00163J)

and the 2000 Barren Islands common murre population monitoring project (Project 00144). He served as field team leader during the 1995-1999 APEX Barren Islands seabird studies (Projects 95163J, 96163J, 97163J, 98163J, and 99163J), and participated in the 1996-1997 and 1999 Barren Islands and 1998 Chiswell Islands common murre population monitoring projects (Projects 96144, 97144, 98144, and 99144). He was also in charge of field work at East Amatuli Island during the 1993-1994 Barren Islands common murre restoration monitoring projects (Projects 93049 and 94039). Mr. Kettle also censused murrelets at the East Amatuli Island - Light Rock colony during Exxon-sponsored University of Washington studies in 1990-1992, and in addition to this work, he participated in large-scale University of Washington studies of magellanic penguins (*Spheniscus magellanicus*) in Argentina during 1987-1991, and tufted puffins (*Fratercula cirrhata*) and fork-tailed storm-petrels (*Oceanodroma furcata*) at the Barren Islands in 1990-1992. Mr. Kettle has over 20 years experience safely operating small boats in the north Atlantic and Pacific oceans (e.g., Maine and Alaska), including 10 consecutive field seasons running outboard-powered craft at the Barren Islands.

#### Selected Seabird Publications

Boersma, P.D., J.K. Parrish, and A.B. Kettle. 1995. Common murre abundance, phenology, and productivity on the Barren Islands, Alaska: The *Exxon Valdez* oil spill and long-term environmental change. *Exxon Valdez Oil Spill: Fate and effects in Alaskan waters*, ASTM STP 1219, P.G. Wells, J.N. Butler, and J.S. Hughes (eds.), Amer. Soc. for Testing and Materials, Philadelphia, PA.

#### LITERATURE CITED

Byrd, G.V. 1989. Seabirds in the Pribilof Islands, Alaska: Trends and monitoring methods. M.S. thesis. Univ. of Idaho.

Dipple, C. and D. Nysewander. 1992. Marine bird and mammal censuses in the Barren Islands, 1989 and 1990, with specific emphasis on species potentially impacted by the 1989 *Exxon Valdez*, including supplemental appendices for 1991 murre data. Unpubl. rept., U. S. Fish Wildl. Serv., Homer, Alaska.

Dragoo, D.E., G.V. Byrd, D.G. Roseneau, D.A. Dewhurst, J.A. Cooper, and J.H. McCarthy. 1995. Effects of the *TV Exxon Valdez* oil spill on murrelets: A perspective from observations at breeding colonies four years after the spill. Final rept., Restoration Proj. No. 11, U.S. Fish Wildl. Serv., Homer, Alaska.

Erikson, D.E. 1995. Surveys of murre colony attendance in the northern Gulf of Alaska following the *Exxon Valdez* oil spill. Pp. 780-819 *in Exxon Valdez oil spill: Fate and effects in Alaskan waters*, ASTM STP 1219, P.G. Wells, J.N. Butler, and J.S. Hughes (eds.), Amer. Soc. for Testing and Materials, Philadelphia, Pennsylvania.

Gerrodette, T. 1987. A power analysis for detecting trends. *Ecology* 68:1,364-1,372.

Hatch, S.A. and M.A. Hatch. 1989. Attendance patterns of common and thick-billed murrelets at breeding sites: Implications for monitoring. *J. Wildl. Manage.* 53:483-493.

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- \_\_\_\_\_ and \_\_\_\_\_. 1991. Population surveys of seabird nesting colonies in Prince William Sound, the outside coast of the Kenai Peninsula, Barren Islands, and other nearby colonies, with emphasis on changes of numbers and reproduction of murre. Bird Study No. 3. Unpubl. prog. rept., U. S. Fish Wildl. Serv., Homer, Alaska.
- \_\_\_\_\_, C.H. Dipple, G.V. Byrd, and E.P. Knudtson. 1993. Effects of the *T/V Exxon Valdez* oil spill on murre: A perspective from observations at breeding colonies. Bird Study No. 3. Final rept., U.S. Fish Wildl. Serv., Homer, Alaska.
- Roseneau, D.G., A.B. Kettle, and G.V. Byrd. 1995. Common murre restoration monitoring in the Barren Islands, Alaska, 1993. Unpubl. final rept. by the Alaska Maritime National Wildlife Refuge, Homer, Alaska for the *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska (Restoration Project 93049).
- \_\_\_\_\_. 1996. Common murre restoration monitoring in the Barren Islands, Alaska, 1994. Unpubl. final rept. by the Alaska Maritime National Wildlife Refuge, Homer, Alaska for the *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska (Restoration Project 94039).
- \_\_\_\_\_. 1997. Common murre restoration monitoring in the Barren Islands, Alaska, 1996. Unpubl. final rept. by the Alaska Maritime National Wildlife Refuge, Homer, Alaska for the *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska (Restoration Project 96144).
- \_\_\_\_\_. 1998. Common murre restoration monitoring in the Barren Islands, Alaska, 1997. Unpubl. final rept. by the Alaska Maritime National Wildlife Refuge, Homer, Alaska for the *Exxon Valdez* Oil Spill Trustee Council, Anchorage, Alaska (Restoration Project 97144).
- \_\_\_\_\_. 1999. Common murre restoration monitoring in the Chiswell Islands, Alaska, 1998. Unpubl. annual rept. by the Alaska Maritime National Wildlife Refuge, Homer, Alaska for the *Exxon Valdez* Oil Spill Trustee Council, Anchorage, AK (Restoration Project 98144).
- \_\_\_\_\_. 2000. Common murre restoration monitoring in the Barren Islands, Alaska, 1999. Unpubl. annual rept. by the Alaska Maritime National Wildlife Refuge, Homer, Alaska for the *Exxon Valdez* Oil Spill Trustee Council, Anchorage, AK (Restoration Project 99144).

## Appendix 1. Power analysis of common murre counts in the Barren Islands, Alaska.\*

We know from prior work that a total of about 5-7 counts made on separate days are needed in each year to detect among-year differences of 20% at the  $P = 0.1$  level with 90% power (see Byrd 1989, Hatch and Hatch 1989). Using a computer program called "TRENDIO" written by T. Gerrodette (i.e., Gerrodette 1987), we ran a series of simulations to predict the number of surveys needed and the number of years required at different survey intervals to detect a significant positive trend in murre populations with the following assumptions:

1. **Rate of Change:** 2 levels (8% yr<sup>-1</sup> and 13% yr<sup>-1</sup>) — these levels were chosen because they represent the normal range of values reported in the literature for common murres.
2. **Coefficient of Variation CV:** 15% was used because that is the average value recorded for counts made in the Barren Islands during 1992-1994.
3. **Alpha ( ) and Beta ( ) Levels:** We were more concerned about Type II errors than Type I errors; therefore we relaxed Alpha to 0.1 and set the power at 0.9.
4. **Model Selection:** Murre populations are expected to grow exponentially rather than in a linear fashion.

Table 1. Summary of power analysis simulation for detecting a significant positive trend (1-tailed) in murre populations in the Barren Islands.

Rate of Change (year <sup>-1</sup> )	Years Between Surveys	CV			Number of Surveys Required <sup>a</sup>	Number of Years Required to Detect Trends
0.8	1	0.15	0.1	0.9	7	7
	2	0.15	0.1	0.9	5	10
	3	0.15	0.1	0.9	4	12
	4	0.15	0.1	0.9	4	16
	5	0.15	0.1	0.9	4	20
0.13	1	0.15	0.1	0.9	5	5
	2	0.15	0.1	0.9	4	8
	3	0.15	0.1	0.9	4	12
	4	0.15	0.1	0.9	3	12
	5	0.15	0.1	0.9	3	15

<sup>a</sup> Each survey would include 5 replicate counts. Increasing the number of replicate counts to 10 would reduce the CV to 0.1 and generally reduce the number of surveys needed by 1 in each category.

**Conclusions:** If murre populations in the T/V *Exxon Valdez* oil spill area are increasing at 8% yr<sup>-1</sup>, it would require 7 years of annual surveys (at 5 replicate counts yr<sup>-1</sup>) to detect a significant trend at the 0.1 level with 90% power. However, if the number of replicates yr<sup>-1</sup> were increased to 10, it would take only 6 years of annual surveys to detect a significant trend at the same level. If populations were increasing at 13% yr<sup>-1</sup>, the same comparisons listed above would require 4 and 5 years, respectively. If surveys were conducted every 3 years (5 replicate counts yr<sup>-1</sup>), it would take 12 years, whether the rate of increase was 8% or 13% (rounding in the reason the values are the same), but increasing the number of replicates yr<sup>-1</sup> to 10 would reduce the time required to detect a trend to 9 years. Surveys conducted at 5-year intervals would take 15 to 20 years (at 5 replicate counts yr<sup>-1</sup>) to detect a significant trend in population size.

\* Information in this power analysis is applicable to the Chiswell Islands murre colonies; copies of the analysis can be obtained from the Alaska Maritime NWR upon request. Contact D.G. Roseneau or G.V. Byrd at (907) 235-6546.

**2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 2000 - September 30, 2001

<b>Budget Category:</b>	Authorized FFY 2000	Proposed FFY 2001					
Personnel	\$11.0	\$14.6					
Travel	\$2.3	\$1.2					
Contractual	\$0.0	\$24.0					
Commodities	\$0.4	\$1.8					
Equipment	\$0.0	\$1.0	LONG RANGE FUNDING REQUIREMENTS				
Subtotal	\$13.7	\$42.6	Estimated FFY 2002	Estimated FFY 2003	Estimated FFY 2004	Estimated FFY 2005	Estimated FFY 2006
General Administration	\$1.7	\$3.9					
Project Total	\$15.4	\$46.5	\$14.0				
Full-time Equivalent (FTE)	0.3	0.4					
Dollar amounts are shown in thousands of dollars.							
Other Resources							
<p>Comments: This project is designed to monitor the recovery of murre ( <i>Uria</i> spp.) at colonies in the Gulf of Alaska affected by the T/V <i>Exxon Valdez</i> oil spill. It is based on a recommendation made at the conclusion of Project 98144 to recount the Chiswell Islands murre colonies in 2000 or 2001 (see Roseneau <i>et al.</i> 1999).</p> <p>Travel costs to attend the 2002 EVOS workshop in Anchorage and the 2002 Alaska Bird Conference are included in the estimated FFY 2002 budget.</p> <p>The FWS is donating up to 1 month of the project manager's time at no extra cost to the project.</p>							

**2001**

Prepared: 03/31/00

Project Number: 01144  
 Project Title: Common Murre Population Monitoring  
 Agency: DOI-FWS

**2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 2000 - September 30, 2001

<b>Personnel Costs:</b>		GS/Range/ Step	Months Budgeted	Monthly Costs	Overtime
Name	Position Description				
David G. Roseneau	Project Leader (Principal Investigator)	GS11/6	2.0	5.4	0.0
Arthur B. Kettle	Biological Science Tech. (Wildlife)	GS7/1	1.0	3.5	0.3
G. Vernon Byrd	Project Manager	GS13/1	1.0	0.0	0.0
C. Berg	Program Manager	GS12	0.5	0.0	0.0
Subtotal			4.5	8.9	0.3
<b>Personnel Total</b>					
<b>Travel Costs:</b>		Ticket Price	Round Trips	Total Days	Daily Per Diem
Description					
Travel to Seward to conduct surveys (personnel may need to overnight in Seward because of bad weather (2 people for 3 days @ \$200.00/day)				6	0.2
<b>Travel Total</b>					

**2001**

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**2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 2000 - September 30, 2001

<b>Contractual Costs:</b>	
Description	
12 vessel days @ \$2.0K/day = \$24.0K (a large vessel is needed to support the counts & transport census teams to the study area)	
When a non-trustee organization is used, the form 4A is required.	<b>Contractual Total</b>
<b>Commodities Costs:</b>	
Description	
Fuel (outboard gas & oil; estimated @ \$0.15K)	
Other field supplies (maps, notebooks, film =\$ 0.1K; boating supplies, including rope, paddles, spark-plugs, emergency flares & other survival gear = \$0.6K; replacement of rain gear, rubber boots, waterproof bags = \$0.3K)	
Costs of producing & printing 2 large format posters for public display of project results	
[Note: FWS will furnish office materials and additional boating supplies.]	
	<b>Commodities Total</b>

**2001**

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**2001 EXXON VALDEZ TRUSTEE COUNCIL PROJECT BUDGET**

October 1, 2000 - September 30, 2001

<b>New Equipment Purchases:</b>		Number of Units	Unit Price
Description			
Equipment cleaning/repair/service (includes checking, cleaning, repairing & servicing binoculars, cameras, rafts, radios, outboard motors, survival suits, emergency locator beacons)			
Those purchases associated with replacement equipment should be indicated by placement of an R.		<b>New Equipment Total</b>	
<b>Existing Equipment Usage:</b>		Number of Units	
Description			
Inflatable raft		1	
Outboard motors		2	
Hand-held VHF radios		2	
Camera		2	
Computer		1	
Binoculars		4	
[Note: FWS will also supply other items: 4 survival suits, 4 Mustang suits, & emergency gear.]			

**2001**

Prepared: 03/31/00

Project Number: 01144  
 Project Title: Common Murre Population Monitoring  
 Agency: DOI-FWS