

Exxon Valdez Oil Spill
Restoration Project Annual Report

Common Murre Population Monitoring at the Barren Islands, Alaska, 1996

Restoration Project 96144
Annual Report

This annual report was submitted for peer review as part of the *Exxon Valdez* Oil Spill Trustee Council restoration program for the purpose of assessing project progress. Peer review comments have been addressed in this report.

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Study History: *Exxon Valdez* Oil Spill Trustee Council-sponsored common murre damage assessment studies were initiated at the Barren Islands in 1989 as part of Department of Interior - Fish and Wildlife Service (DOI-FWS) Bird Study No. 3 (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 in numbers and reproduction of murre). During the damage assessment work, three progress reports were written (Nysewander and Dipple 1990, 1991; Dipple and Nysewander 1992), and a final report of the 1989-1991 results was completed in 1993 (see Nysewander *et al.* 1993, Effects of the *T/V Exxon Valdez* oil spill on murre: A perspective from observations at breeding colonies). In 1992, murre restoration monitoring work was initiated at the Barren Islands as part of Restoration Project No. 11 (see Dragoo *et al.* 1995, Effects of the *T/V Exxon Valdez* oil spill on murre: A perspective from observations at breeding colonies four years after the spill), and two more restoration monitoring projects were conducted there in 1993 and 1994 (Restoration Projects 93049 and 94039, respectively: see Roseneau *et al.* 1995, Common murre restoration monitoring in the Barren Islands, Alaska, 1993; and Roseneau *et al.* 1996a, Common murre restoration monitoring in the Barren Islands, Alaska, 1994). In 1996, Project 96144 was implemented to recensus the Barren Islands murre colonies and reassess the recovery status of these injured birds in the spill area (see the DOI-FWS FY 96 common murre population monitoring detailed project description).

Abstract: Murre were censused at the East Amatuli Island - Light Rock and Nord Island - Northwest Islet Barren Islands colonies using methods employed during the 1993-1994 restoration projects. Data were analyzed for differences among years and trends after they were pooled and averaged with corresponding information from 1989-1994 U.S. Fish and Wildlife Service, 1990-1992 University of Washington, and 1991 Dames & Moore postspill studies. No convincing evidence was found that indicated murre populations had changed at the colonies over the 8-year postspill period. Although an increase was evident on one small set of plots counted at East Amatuli Island - Light Rock since 1989, another small East Amatuli Island - Light Rock plot set that had shown an increase during 1990-1994 no longer exhibited a trend when 1996 data were included in the analysis. Trends were also not present at Nord Island - Northwest Islet, or on the larger sections of East Amatuli Island - Light Rock over the 1989-1996 interval. Furthermore, all data obtained since 1993, when Barren Islands sampling efforts were increased, suggested that murre populations have been relatively stable at this northern Gulf of Alaska nesting location over the past four years.

Key Words: Barren Islands, common murre, East Amatuli Island, East Amatuli Light Rock, *Exxon Valdez*, Gulf of Alaska, Nord Island, oil spill, population monitoring, Prince William Sound, restoration monitoring, thick-billed murre, *Uria aalge*, *Uria lomvia*.

Project Data: (To be addressed in the final report).

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EXECUTIVE SUMMARY

Introduction

The Barren Islands, in the northwestern Gulf of Alaska, supported one of the largest breeding concentrations of common murres (*Uria aalge*) in the path of the *Exxon Valdez* oil spill. When winds and currents swept oil through the region during April-May 1989, many of these seabirds were killed: they comprised 74% of 30,000 bird carcasses recovered by 1 August. Based on this information and a computer modeling study, estimates of total bird mortality suggested that 74,000 to 314,000 murres died after contacting floating oil. Because mortality of murres appeared to be high and large populations of these birds nested in the Barren Islands, the U.S. Fish and Wildlife Service (FWS) conducted *Exxon Valdez* Oil Spill Trustee Council-sponsored murre damage assessment and restoration studies there during 1989-1991 and 1992-1994, respectively. In 1996, murre populations were recensused at the Barren Islands. No convincing evidence was found that indicated numbers had changed at the colonies over the 8-year postspill period. Although an increase was evident on one small set of plots counted at East Amatuli Island - Light Rock since 1989, another small East Amatuli Island - Light Rock plot set that had shown an increase during 1990-1994 no longer exhibited a trend when 1996 data were included in the analysis. Trends were also not present at Nord Island - Northwest Islet, or on the larger sections of East Amatuli Island - Light Rock over the 1989-1996 interval. Furthermore, all data obtained since 1993, when Barren Islands sampling efforts were increased, suggested that murre populations have been relatively stable at this northern Gulf of Alaska nesting location over the past four years.

Objectives

The objective was to test the null hypothesis that murre populations have not increased at the Barren Islands colonies since 1989, the year of the spill.

Methods

Two different types of counts were made at the East Amatuli Island - Light Rock and Nord Island - Northwest Islet murre colonies: complete censuses of the colonies, and counts on sets of multicount plots (the multicount plot sets provide the best indices for detecting changes in numbers, because they are counted at least five separate times on different days during the census period). The counts were made from boats using the same methods employed during the 1993-1994 restoration studies (e.g., counts were made by two observers using of standard protocols that took into account daily and seasonal attendance patterns of adults). Data were pooled and averaged with corresponding information from 1989-1994 U.S. Fish and Wildlife Service (FWS), 1990-1992 University of Washington (UW), and 1991 Dames & Moore (D&M) postspill studies. Data sets were checked for differences among years with one-way analysis of variance (ANOVA) and Tukey HSD multiple pairwise comparison tests, and trends were tested with linear regressions.

Results

East Amatuli Island - Light Rock: At East Amatuli Island - Light Rock, the 1996 BMP1-8 multicount plot estimate of 5,648 birds was similar to the respective 1993, 1994, and 1995 counts of 5,808, 5,599, and 5,225 individuals (these estimates were not tested for trends because only four data points were available; however, given the strong similarities in counts, the presence of a trend seemed unlikely). An increase was present on the smaller BMP3-4 plot set first counted in 1989. Although the 1996 estimate of 1,392 murres on these plots was similar to the respective 1993, 1994, and 1995 counts of 1,375, 1,245, and 1,130 birds, all four of these scores were significantly higher than the 1990 and 1992 estimates of 575 and 745 individuals. In contrast, the UW OSTR plots did not exhibit a trend. The 1996 OSTR estimate of 785 birds was similar to the 1994 and 1995 counts of 866 and 724 individuals, but lower than the 1993 estimate of 1,003 birds

(combined 1990-1996 data were not tested for differences among years because individual scores were not reported for 1990-1992). Trends were also not evident in the 1989-1996 Light Rock and 1991-1996 East Amatuli Island - Light Rock whole-colony counts. Although the 1996 Light Rock estimate of 8,615 birds was significantly higher than the 1990 score of 5,865 individuals, it was similar to the respective 1989, 1992, 1993, and 1994 counts of 6,912, 7,808, 8,454, and 7,750 individuals (whole-colony estimates were not compared by ANOVA because only single counts were made in two of the five years).

Nord Island - Northwest Islet: At Nord Island - Northwest Islet, trends were not present in the BMP1-11 multicount plot or whole colony counts over the 8-year postspill period. Although the 1996 BMP1-11 estimate of 2,825 murres was significantly lower than the 1990 and 1993 counts of 4,383 and 4,003 birds, it was similar to the respective 1989, 1991, 1992, and 1994 scores of 2,431, 3,558, 2,971, and 2,893 individuals. No differences were found among the respective 1989, 1990, 1991, 1993, 1994, and 1996 whole colony estimates of 11,838, 12,227, 14,419, 13,422, 11,797, and 11,688 birds.

Discussion

No convincing evidence was found that indicated murre populations changed at the Barren Islands colonies over the 8-year postspill period. Of the three sets of plots that provided information on numbers of birds at the East Amatuli Island - Light Rock and Nord Island - Northwest Islet colonies since 1989-1990, one small set (BMP3-4 at East Amatuli Island - Light Rock) suggested that populations increased over the 1989-1996 interval. However, the other two (the small UW OSTR set at East Amatuli Island - Light Rock and BMP1-11 at Nord Island - Northwest Islet) indicated that numbers did not change significantly over the same period. Less frequent counts at Light Rock and Nord Island - Northwest Islet in 1989-1996 supported these latter findings. Furthermore, all counts made since 1993, when sampling efforts were increased at the Barren Islands, suggested that murre populations have been relatively stable at this northern Gulf of Alaska nesting location over the past four years.

Conclusions

No convincing evidence was found that indicated murre populations changed at the Barren Islands colonies over the 1989-1996 postspill interval.

INTRODUCTION

The Barren Islands, in the northwestern Gulf of Alaska, supported one of the largest breeding concentrations of common murres (*Uria aalge*) in the path of the T/V *Exxon Valdez* oil spill (e.g., Sowls *et al.* 1978, Piatt *et al.* 1990, FWS 1994). When winds and currents swept oil through the region during April-May 1989, many of these seabirds were killed: they comprised 74% of 30,000 bird carcasses recovered by 1 August (see Piatt *et al.* 1990).¹ Based on this information and a computer modeling study, estimates of total bird mortality suggested that 74,000-315,000 murres died after contacting floating oil (see Piatt *et al.* 1990, ECI 1991).

Because the impact of the spill on common murres appeared to be severe, and large numbers of these birds nested in the Barren Islands, the U.S. Fish and Wildlife Service (FWS) made population counts at this breeding location during the 1989-1991 *Exxon Valdez* Oil Spill Trustee Council-sponsored damage assessment studies (e.g., Nysewander and Dipple 1990, 1991; Dipple and Nysewander 1992; Nysewander *et al.* 1993). FWS biologists also counted murres at the Barren Islands in 1992, as part of the first Trustee Council restoration project designed to assess the recovery status of this species in the spill area (see Dragoo *et al.* 1995).

Other research groups also made population counts at the Barren Islands murre colonies during the early 1990's. University of Washington (UW) investigators counted birds at East Amatuli Island - Light Rock in 1990-1992, during Exxon- and Minerals Management Service-supported studies (see Boersma *et al.* 1995), and Dames & Moore biologists censused this nesting complex and the Nord Island - Northwest Islet colony for Exxon in 1991 (see Erikson 1995).

In 1993, we began a restoration project to monitor murre numbers and productivity at the East Amatuli Island - Light Rock and Nord Island - Northwest Islet colonies (Project 93049, see Roseneau *et al.* 1995). During the study, no trends were found in FWS counts over the 1989-1993 postspill period.

We recensused the Barren Islands murre colonies in 1994 and compared our counts with data from earlier FWS, UW, and D&M postspill studies (Project 94039, see Roseneau *et al.* 1996a). No trends were found at Nord Island - Northwest Islet, or on the larger sections of East Amatuli Island - Light Rock over the 1989-1994 interval. However, increases were present on two small East Amatuli Island - Light Rock plot sets counted in 1989-1994 and 1990-1994.

Murre restoration monitoring work was not funded at the Barren Islands in 1995. However, we counted birds on three sets of East Amatuli Island - Light Rock plots during our Alaska Predator Ecosystem Experiment (APEX) studies (Project 95163J, see Roseneau *et al.* 1996b).

In 1996, we censused the Barren Islands murre colonies again (this study, Project 96144). No convincing evidence was found that indicated population numbers had changed over the 8-year postspill period. Although an increase was evident on one small set of East Amatuli Island - Light Rock plots counted since 1989, another small East Amatuli Island - Light Rock plot set that had shown an increase between 1990 and 1994 no longer exhibited a trend when 1996 data were included in the analysis. Trends were also not present at Nord Island - Northwest Islet, or on the larger sections of East Amatuli Island - Light Rock over the 1989-1996 interval. Furthermore, all data obtained since 1993, when Barren Islands sampling efforts were increased, suggested that murre populations have been relatively stable at this northern Gulf of Alaska nesting location over the past four years.

¹ Seventy percent of the murre carcasses were common murres (Piatt *et al.* 1990; J.F. Piatt, pers. comm.).

OBJECTIVES

The project was designed to test the null hypothesis that murre populations have not changed at the Barren Islands colonies since 1989, the year of the spill. Specific objectives were to:

1. Make counts of murres at the East Amatuli Island - Light Rock and Nord Island - Northwest Islet colonies for comparison with data collected during previous 1989-1995 FWS, 1990-1992 UW, and 1991 D&M studies; and
2. Use the results to evaluate and resolve differences between the 1990-1992 FWS and UW counts (this objective is not addressed in this report, because it has already been met—see Roseneau *et al.* 1996a).

METHODS

The Barren Islands are located at about 58° 55' N, 152° 10' W, between the Kodiak archipelago and the Kenai Peninsula (Fig. 1). The study area consisted of East Amatuli and Nord islands and two nearby islets, East Amatuli Light Rock (Light Rock) and Northwest Islet (Figs. 2 and 3). These sites, which comprise the East Amatuli Island - Light Rock and Nord Island - Northwest Islet colonies, contain all of the breeding murres in the Barren Islands group (see Roseneau *et al.* 1995, 1996a).

We used the M/V *Curllew*, a 21-m-long FWS research vessel, and the Amatuli Cove camp to support the population counts (Fig. 2). Up to three people were based on the vessel during 18 July - 13 August. The vessel-based census team was intermittently assisted by two APEX seabird studies investigators stationed at Amatuli Cove camp (Project 96163J). APEX team members also continued to count some of the East Amatuli Island - Light Rock monitoring plots after the vessel-based team left the study area.

Population census data were collected and analyzed by the same basic methods employed during the 1993-1994 restoration monitoring projects (see Roseneau *et al.* 1995, 1996a). These methods and new procedures and tests used during the 1996 study are summarized below.

To compare numbers of murres at the nesting colonies with information obtained during previous studies, we made two types of counts. We censused East Amatuli Island, Light Rock, Nord Island, and Northwest Islet completely to obtain whole-colony estimates and numbers of birds on major subdivisions of the colonies (e.g., East Amatuli Island, Light Rock). We also counted smaller, previously established plot sets (“multicount plots”—see Roseneau *et al.* 1995, 1996a) several times at both colonies to obtain data for statistical analyses of among-year differences and trends in population size. The multicount plot sets, which provide the best indices for detecting changes in numbers, contained about 10-15% of the murres on the cliffs at each nesting complex.

To make the two types of counts at East Amatuli Island - Light Rock, we used the 64 population census plots (BCP1-64) and eight multicount plots (BMP1-8) set up in 1993 (Fig. 3a; also see Roseneau *et al.* 1995, 1996a). The multicount plots included both plots used during the 1989-1991 and 1992 FWS damage assessment and restoration projects (one on East Amatuli Island and one on Light Rock; see Nysewander *et al.* 1993, Dragoo *et al.* 1995). Subsections of some plots were also equivalent to the four plots used during the 1990-1992 University of Washington (UW) studies (Oval, Swatch, Triangle Rock S, and Triangle Rock NW; see Boersma *et al.* 1995). The multicount plots sampled both central and peripheral nesting areas in general proportion to the number of birds using these habitats (see Roseneau *et al.* 1995, 1996a). Plot boundaries were located using photographs in Alaska Maritime National Wildlife Refuge (AMNWR) files.

To census birds at Nord Island - Northwest Islet, we used the 28 population census plots (BCP1-28) and 11 multicount plots (BMP1-11) set up during the 1993-1994 restoration studies (Fig. 2b; also see Roseneau *et al.* 1995, 1996a). Twenty-six of the plots (BCP1-10 and 12-27) were established during the 1989-1991 FWS damage assessment studies (e.g., Nysewander *et al.* 1993, Dragoo *et al.* 1995; population census plots BCP1-10 and 24 are equivalent to multicount plots BMP1-10 and 11, respectively—see Fig. 3b), and two (BCP11 and 28) were set up in 1993 to cover areas containing small numbers of murrens not reported earlier (see Roseneau *et al.* 1995, 1996a). Alaska Maritime National Wildlife Refuge (AMNWR) photographs were used to locate plot boundaries.

Four of the six personnel who counted the population census and multicount plots had previous experience counting murrens at the Barren Islands and other Alaskan seabird colonies. Two of the people had counted several sets of East Amatuli Island - Light Rock plots on numerous occasions during 1990-1995, another had censused the Nord Island - Northwest Islet and East Amatuli Island - Light Rock colonies several times during 1993-1994, and the fourth person had counted the multicount plots at East Amatuli Island - Light Rock in 1995.

Census team members counted the plots from outboard-powered, 4.8-m-long, ridged-hulled inflatable boats and inflatable rafts with the aid of 7 x 42 binoculars and hand-held tally meters (see Roseneau *et al.* 1995, 1996a). Distances between observers and birds varied, depending on the height and configuration of cliffs and other factors (e.g., presence of offshore rocks). These variables were kept as consistent as possible between all plot set counts, including those made during 1993-1995. Boats were either tied to bull kelp (*Nereocystis spp.*) 30-90 m in front of the plots or were allowed to drift slowly past them at similar distances.

Counts of birds were made during the part of the nesting season when attendance was most stable. The census period was defined as the interval between the peak of laying and first sea-going of chicks (e.g., Hatch and Hatch 1989; Byrd 1989; Roseneau *et al.* 1995, 1996a). We used a combination of census guidelines, sun-time, and information on attendance patterns from previous Barren Islands studies to determine the best times of day for counting birds (e.g., Boersma *et al.* 1995; Dragoo *et al.*, unpubl. data). All counts were made during 1100-2000 hrs Alaska Daylight Time (ADT).

Plots were counted by two observers. During the counts, one person recorded the scores without revealing his or her own count to the other team member. The recorder compared the scores to see if they were within 15% of each other (i.e., within 7.5% of their average). If they were not and if time allowed, the plot was recounted until the scores fell within this range.

Birds were estimated by 10's; however, observers often counted the last group of individuals on a plot by 1's if the remaining birds consisted of less than 10 individuals (Roseneau *et al.* 1996a). The only exceptions were three small East Amatuli Island multicount plots that were counted by 1's to match UW methods (see Boersma *et al.* 1995), and the top of Light Rock, where in some cases, birds were counted by 50's.

We censused East Amatuli Island - Light Rock once, counted Light Rock three additional times, and censused multicount plots BMP1-8 (see Fig. 2a) seven times. Nord Island - Northwest Islet was counted completely three times, and the 11 multicount plots (BMP1-11; see Fig. 2b) were censused on three additional dates.

To analyze the data, we treated plots as sample units and calculated one-day totals for East Amatuli Island, Light Rock, East Amatuli Island - Light Rock multicount plots BMP1-8 and 3-4, Nord Island - Northwest Islet, and Nord Island - Northwest Islet multicount plots BMP1-11. We also calculated one-day totals for parts of multicount plots BMP1, 5, and 8 at East Amatuli Island - Light Rock, because sections of these plots were equivalent to the UW OSTR plots. To obtain

single values for the UW Light Rock, East Amatuli Island (“Mainland”), and East Amatuli Island - Light Rock (“E. Amatuli Island Total”) counts reported by Boersma *et al.* (1995), we averaged the numbers listed as ranges in Table 1 of their publication.¹ Results were pooled with corresponding data from previous FWS, UW, and D&M postspill studies (i.e., Nysewander and Dipple 1990, 1991; Dipple and Nysewander 1992; Nysewander *et al.* 1993, Dragoo *et al.* 1995; Roseneau *et al.* 1995, 1996a; Boersma *et al.* 1995; Erikson 1995). UW and D&M estimates were treated as additional counts and averaged with FWS data (e.g., the respective 1992 UW and FWS Light Rock counts of 9,655 and 5,960 birds were averaged to obtain a new estimate of 7,808 individuals for that area that year).² Data sets were checked for differences among years with one-way analysis of variance (ANOVA) and Tukey HSD multiple pairwise comparison tests, and tested for trends with linear regressions. The 0.1 significance level was used to increase the power of the tests and reduce Type II error (the 0.9 confidence interval was adequate for our purposes).³

RESULTS

East Amatuli Island - Light Rock

At East Amatuli Island - Light Rock, we censused Light Rock (Appendices 1-4), East Amatuli Island (Appendix 5), and the eight multicount plots that we set up at the colony in 1993 (Appendices 6, 7, and 8—1995 data were obtained during APEX Barren Islands seabird studies Project 95163J). The multicount plot counts also provided data on the small 1989-1992 FWS and 1990-1992 UW plot sets (see Dragoo *et al.* 1995 and Boersma *et al.* 1995, respectively).

Beginning in 1997, multicount plots BMP1-8 will become the primary set of plots for monitoring post-1992 trends at the East Amatuli Island - Light Rock colony. This plot set, counted four to eight times each year since it was set up in 1993, contains more plots, birds, and nesting habitat than the other sets of plots that have longer count histories (e.g., BMP3-4, UW OSTR plots).

Our 1996 BMP1-8 estimate of 5,648 birds was similar to the 1993, 1994, and 1995 counts of 5,808, 5,599, and 5,225 individuals, respectively (ANOVA; also see Table 1 and Fig. 4). We deferred testing these estimates for trends because only four data points were available. However, given the strong similarities in counts, the presence of a trend seemed unlikely.

An increase was found on the smaller BMP3-4 multicount plot set first counted in 1989 (Regression Analysis, $P < 0.02$; see Table 2 and Fig. 5a). Checking these data for among-year differences revealed that our 1996 estimate of 1,392 birds was similar to the respective 1993, 1994, and 1995 counts of 1,375, 1,245, and 1,130 individuals; however, all four of these scores were significantly higher than the 1990 and 1992 estimates of 575 and 745 birds (Tukey HSD, $P =$ or < 0.01 in all cases).

In contrast, the UW OSTR plots did not exhibit a trend (Regression Analysis; see Table 2 and Fig. 5b). When the 1993-1996 counts were checked for among-year differences, we found that our 1996 estimate of 785 birds was similar to the respective 1994 and 1995 scores of 866 and 724

¹ Numbers listed as ranges in Table 1 of Boersma *et al.* (1995) were the individual scores of two observers making the counts (A.B. Kettle, pers. comm.).

² In our last report (Roseneau *et al.* 1996a), we combined the single 1991 UW East Amatuli Island - Light Rock count of 35,757 birds with the average 1991 D&M estimate of 30,294 individuals to make a simple comparison between the FWS counts and estimates made by other groups of investigators (i.e., $n = 2$, mean = 33,026 birds). However, for this study we treated the three D&M counts of 28,660, 25,213, and 37,010 birds and the UW score as four different counts made on separate days (i.e., $n = 4$, mean = 31,660 birds).

³ Bonferroni multiple pairwise comparison tests were run in conjunction with the Tukey HSD tests (see Wilkinson *et al.* 1992, page 244). The Tukey test proved to be more sensitive in detecting differences among data sets.

individuals, but lower than the 1993 estimate of 1,003 birds (Tukey HSD; $P < 0.01$). We did not test our 1993-1996 counts in combination with the respective 1990-1992 UW estimates of 648, 811, 818 birds, because individual counts were not available for those years (only average values were reported for 1990-1992, see Boersma *et al.* 1995;).¹

Trends were also not evident in the 1989-1996 Light Rock and 1991-1996 East Amatuli Island - Light Rock whole-colony counts (Regression Analysis; see Table 3 and Figs. 6a and 6b, respectively). Although our 1996 Light Rock estimate of 8,615 birds was significantly higher than the 1990 score of 5,865 individuals (Tukey HSD, $P < 0.09$), it was similar to the respective 1989, 1992, 1993, and 1994 counts of 6,912, 7,808, 8,454, and 7,750 individuals.² The whole-colony estimates were not compared by ANOVA, because only single counts were made in two of the five years (1992 and 1996; see Table 3).³

Nord Island - Northwest Islet

At Nord Island - Northwest Islet, we censused the colony (Appendices 9-11) and the 11 multicount plots set up there in 1989 (Appendices 8 and 12). No trends were evident in the BMP1-11 multicount plot or whole colony counts over the 8-year postspill period (Regression Analysis; see Table 1 and 3, and Figs. 7a and 7b, respectively). Although our 1996 BMP1-11 estimate of 2,825 murre was significantly lower than the 1990 and 1993 counts of 4,383 and 4,003 birds (Tukey HSD, $P < 0.01$ in both cases), it was similar to the respective 1989, 1991, 1992, and 1994 scores of 2,431, 3,558, 2,971, and 2,893 individuals. No differences were found among the respective 1989, 1990, 1991, 1993, 1994, and 1996 whole colony estimates of 11,838, 12,227, 14,419, 13,422, 11,797, and 11,688 individuals (Tukey HSD, Table 3).⁴

DISCUSSION

We did not find convincing evidence that murre populations changed at the Barren Islands colonies over the 8-year postspill period. Of the three sets of plots that provided information on numbers of birds at the East Amatuli Island - Light Rock and Nord Island - Northwest Islet colonies since 1989-1990, one small set (BMP3-4 at East Amatuli Island - Light Rock) suggested that populations increased over the 1989-1996 interval (see Fig. 5a). However, the other two (the small UW OSTR set at East Amatuli Island - Light Rock and BMP1-11 at Nord Island - Northwest Islet) indicated that numbers did not change significantly over the same period (see Figs. 5b and 7a, respectively). Less frequent counts at Light Rock and Nord Island - Northwest Islet in 1989-1996 supported these latter findings (see Figs 6a and 7b, respectively). Furthermore, all counts made since 1993, when sampling efforts were increased at the Barren Islands, suggested that murre populations have been relatively stable at this northern Gulf of Alaska nesting location over the past four years (see Tables 1-3, Figs. 4-7).

¹ In our last report (Roseneau *et al.* 1996a), we inadvertently used the 1990-1992 UW OSTR estimates of 550, 667, and 700 birds that were listed in a 1993 draft manuscript of Boersma *et al.* (1995). These estimates did not include the counts made at Triangle Rock NW (the fourth OSTR plot). However, analyzing the revised 1990-1992 UW estimates in combination with our 1993-1994 counts did not alter our conclusion—a positive trend was present on the plots over the 1990-1994 interval (Kendall's Tau Rank Correlation Test, $P = 0.08$; also see Roseneau *et al.* 1996a, page 8).

² The 1991 UW count of 9,256 birds was not included in the Tukey HSD analysis because $n = 1$.

³ The 1994 East Amatuli Island - Light Rock whole-colony estimate of 33,011 birds reported by Roseneau *et al.* (1996a; Table 1) was incorrect; the revised total of 32,871 individuals is listed here.

⁴ The 1992 FWS count of 11,212 birds was not included in the Tukey HSD analysis because $n = 1$ (see Roseneau *et al.* 1996a).

CONCLUSIONS

No convincing evidence was found that indicated murre populations changed at the Barren Islands colonies over the 1989-1996 postspill interval.

RECOMMENDATIONS

1. We recommend censusing the East Amatuli - Light Rock and Nord Island - Northwest Islet murre colonies again in 1997, when birds belonging to the strong 1993 and 1994 cohorts will begin returning to their natal areas to interact with adults and prospect for nesting sites (see Roseneau *et al.* 1996a). *If evidence of population growth is not found in 1997, these colonies should be recensused at three-year intervals. Note: In the case of common murres (and many other alcid species having delayed maturity), subadult birds begin returning to their natal colonies several years before first attempting to breed (e.g., Hudson 1985; also see Birkhead and Hudson 1977). Three-year-old birds begin visiting the nesting cliffs during the early incubation period and four-year-olds are often present before laying begins (early enough to be detected during population counts). The percentages of subadults belonging to these age-classes that return to their colonies average about 14% and 19%, respectively; this may be an underestimate, because it is based on banded birds and murres often lose bands at sea.*
2. We also recommend censusing the Chiswell Islands murre colonies in 1998. These islands have not been visited since 1992, and four years of census data are available from 1989-1992 for comparison with counts made during 1998 (see Dragoo *et al.* 1995). Censusing birds at the Chiswell Islands in 1998 will provide data that, in conjunction with the 1989-1997 Barren Islands population monitoring results, will help assess the overall recovery status of this injured species within the spill area.

ACKNOWLEDGMENTS

We would like to thank Margaret A. Blanding, B. Leslie Slater, Stephanie Zuniga, and Catherine Berg for helping to make the 1996 Barrens Islands murre population monitoring project a success. Their boating skills and willingness to spend long hours at sea counting plots made our job much easier. Special thanks go to Nevin Holmberg and Captain Ted Estrada, Ecological Services, Juneau. Nevin arranged for our use of the M/V *Curlew* during the study, and Ted gave us constant, cheerful assistance, both in Homer and while sailing under his expert command. Ted's maritime expertise and willingness to help contributed significantly to the safety and success of the project. John Lindell (Ecological Services, Juneau) and Willy Dunn and Carmen Fields (AMNWR Visitor Center) helped ferry the vessel between Juneau and Homer. Trina Fellows and Carol Hagglund, AMNWR headquarters, monitored our daily radio calls and were always there to help us with our logistical needs.

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Table 1. Average FWS counts of murres on multicount plots at the Barren Islands, Alaska nesting colonies during 1989-1996 (numbers of counts are shown in parentheses; ND = no data).

Year	East Amatuli Island - Light Rock (EAILR) Multicount Plots BMP1-8		Nord Island - Northwest Islet (NINI) Multicount Plots BMP1-11	
	Numbers of Birds	CV(%) ^a	Numbers of Birds	CV(%)
1989 ^b	ND		2,431 (2)	5.1
1990 ^b	ND		4,383 (3)	12.9
1991 ^b	ND		3,558 (2)	4.0
1992 ^c	ND		2,971 (5)	10.6
1993 ^d	5,807 (4)	6.9	4,003 (5)	12.9
1994 ^e	5,599 (8)	4.9	2,890 (5)	22.1
1995 ^f	5,225 (5)	11.2	ND	
1996 ^g	5,648 (7)	7.0	2,825 (6)	6.3

Tukey HSD Multiple Comparisons Test (Significance Level = 0.1)

EAILR Multicount Plots BMP1-8

NINI Multicount Plots BMP1-11

No significant differences among years (n = 4)

1989 1992 1994 1996 1991 1990 1993

Regression Analysis: Count vs. Year (Significance Level = 0.1)

EAILR Multicount Plots BMP1-8

NINI Multicount Plots BMP1-11

Analysis deferred (n = 4)

No significant correlation (n = 7)

^a CV = coefficient of variation (standard deviation divided by the mean and multiplied by 100).

^b Data are from Nysewander and Dipple (1990, 1991); Dipple and Nysewander (1992); and Nysewander *et al.* (1993). Counts on Nord Island - Northwest Islet plots BMP1-11 were 2,519 and 2,343 in 1989; 4,991, 3,869, and 4,288 in 1990; and 3,659 and 3,457 in 1991.

^c Data are from Dragoo *et al.* (1995). Counts on Nord Island - Northwest Islet plots BMP1-11 were 3,008, 2,637, 2,744, 3,449, and 3,016 in 1992.

^d Data are from Roseneau *et al.* (1995). Counts were 6,148, 5,835, 6,002, and 5,242 on East Amatuli Island - Light Rock plots BMP1-8, and 4,589, 4,513, 3,813, 3,479, and 3,623 on Nord Island - Northwest Islet plots BMP1-11 in 1993.

^e Data are from Roseneau *et al.* (1996a). Counts were 5,423, 5,215, 5,530, 6,145, 5,635, 5,741, 5,674, and 5,430 on East Amatuli Island - Light Rock plots BMP1-8, and 1,970, 2,685, 3,031, 3,046, and 3,718 on Nord Island - Northwest Islet plots BMP1-11 in 1994.

^f Data are from Roseneau *et al.*, unpubl. data. Counts were 4,791, 5,074, 5,937, 4,597, and 5,727 on East Amatuli Island - Light Rock plots BMP1-8 in 1995.

^g Data are from this study (see Appendices 6 and 12).

Table 2. Average counts of murres on FWS multicount plots BMP3-4 and the four UW OSTR plots at the Barren Islands, Alaska nesting colonies during 1989-1996 (numbers of counts are shown in parentheses; ND = no data).

Year	East Amatuli Island - Light Rock			
	FWS Multicount Plots BMP3-4		UW OSTR Plots	
	Numbers of Birds	CV(%) ^a	Numbers of Birds	CV(%)
1989	852 (2) ^b	14.8	ND	
1990	575 (2) ^b	32.8	648 (2-5) ^c	
1991	860 (2) ^b	27.2	811 (5-6) ^c	
1992	745 (5) ^d	32.6	818 (6-10) ^c	
1993	1,375 (8) ^e	12.6	1,003 (5) ^e	9.1
1994	1,246 (8) ^f	8.1	866 (8) ^f	5.4
1995	1,130 (5) ^g	14.7	724 (5) ^g	11.3
1996	1,392 (7) ^h	7.8	785 (7) ^h	8.2

Tukey HSD Multiple Comparisons Test (Significance Level = 0.1)

Multicount Plots BMP3-4				UW OSTR Plots			
1990	1992	1989	1991	1995	1993	1994	1996

Regression Analysis: Count vs. Year (Significance Level = 0.1)

Multicount Plots BMP3-4	UW OSTR Plots
$r^2 = 0.63$, H_0 : Slope = 0, $P < 0.02$ (n = 8)	No significant correlation (n = 7)

^a CV = coefficient of variation (standard deviation divided by the mean and multiplied by 100).

^b Data are from Nysewander and Dipple (1990, 1991); Dipple and Nysewander (1992); and Nysewander *et al.* (1993). Counts on BMP3-4 were 763 and 941 in 1989; 708 and 441 in 1990; and 1,025 and 694 in 1991.

^c Data are from Boersma *et al.* (1995). Only the averages of the counts were reported for 1990, 1991, and 1992. Numbers of counts were listed as ranges because they apparently varied among the four plots each year (e.g., in 1990, at least one plot was only counted two times and at least one was counted five times).

^d Data are from Dragoo *et al.* (1995). Counts were 467, 948, 926, 893, and 493 on BMP3-4 in 1992.

^e Data are from Roseneau *et al.* (1995). Counts were 1,580, 1,259, 1,540, 1,492, 1,505, 1,254, 1,263, and 1,110 on BMP3-4, and 1,091, 1,086, 1,022, 889, and 928 on the OSTR plots in 1993.

^f Data are from Roseneau *et al.* (1996a). Counts were 1,110, 1,153, 1,270, 1,439, 1,258, 1,301, 1,188, and 1,245 on BMP3-4, and 871, 788, 850, 949, 842, 899, 873, and 855 on the OSTR plots in 1994.

Table 2 (Continued).

^g Data are from Roseneau *et al.*, unpubl. data. Counts were 1,040, 1,148, 1,323, 900, and 1,238 on BMP3-4. and 652, 697, 793, 652, and 828 on the OSTR plots in 1995.

^h Data are from this study. Counts were 1,443, 1,408, 1,421, 1,326, 1,240, 1,580, and 1,329 on BMP3-4 (see Appendix 8), and 778, 709, 899, 823, 720, 788, and 775 on the OSTR plots in 1996.

Table 3. Average counts of murres at the Barren Islands, Alaska nesting colonies during 1989-1996 (numbers of counts are shown in parentheses).

Year	East Amatuli Island - Light Rock						Nord Island - Northwest Islet	
	East Amatuli Light Rock		East Amatuli Island		Entire Colony		Entire Colony	
	Number of Birds	CV(%) ^a	Number of Birds	CV(%)	Number of Birds	CV(%)	Number of Birds	CV(%)
1989	6,912 (2) ^b	10.2	ND ^c		ND		11,838 (2) ^b	6.5
1990	5,865 (2) ^b	10.5	ND		ND		12,278 (2) ^b	6.5
1991	9,256 (1) ^d		26,501 (1) ^e		31,660 (4) ^f	17.9	14,419 (3) ^g	13.1
1992	7,808 (2) ^h	33.5	25,129 (1) ⁱ		34,784 (1) ^j		11,212 (1) ^k	
1993 ^l	8,454 (4)	8.4	24,775 (2)	6.5	32,722 (2)	5.7	13,422 (4)	15.5
1994 ^m	7,750 (5)	7.5	25,054 (2)	3.2	32,871 (2)	0.7	11,797 (4)	11.0
1996 ⁿ	8,620 (4)	13.0	19,722 (1)		27,550 (1)		11,688 (3)	5.3

Tukey HSD Multiple Comparisons Test (Significance Level = 0.1)^o

East Amatuli Light Rock ^p						Nord Island - Northwest Islet ^q	
1990	1989	1992	1993	1994	1996	No significant differences among years (n = 6)	

Regression Analysis: Count vs. Year (Significance Level = 0.1)

East Amatuli Light Rock		Nord Island - Northwest Islet	
No significant correlation (n = 7)		No significant correlation (n = 7)	
East Amatuli Island - Light Rock			
No significant correlation (n = 5)			

^a CV = coefficient of variation (standard deviation divided by the mean and multiplied by 100).

^b Data are from Nysewander and Dipple (1990, 1991), Dipple and Nysewander (1992), Nysewander *et al.* (1993). Counts at Light Rock were 7,410 and 6,413 in 1989, and 5,430 and 6,300 in 1990, and counts at Nord Island - Northwest Islet were 12,381 and 11,294 in 1989, and 11,713 and 12,842 in 1990.

^c ND = no data.

^d Data are from Boersma *et al.* (1995). The number listed here is the average of the two values reported in Table 1 of their publication (8,918 and 9,594; in all cases, numbers that appear to be ranges in their table are the individual scores of two observers). The previously reported single 1991 FWS count of 5,529 murres was not used, because it included 3,429 birds on the cliffs and 2,100 individuals on nearby waters (see Nysewander and Dippel 1991).

Table 3 (Continued).

- ^e Data are from Boersma *et al.* (1995). The number listed here is the average of the two values (25,468 and 27,534) reported in Table 1 of their publication.
- ^f Data are from Boersma *et al.* (1995; Table 1) and Erikson (1995; Table 2). The number listed here was derived by averaging the two values (34,386 and 37,128) reported by Boersma *et al.*, and then averaging this number with the counts made by Erikson (28,660, 25,213, and 37,010).
- ^g Data are from Dipple and Nyswander (1992), Nyswander *et al.* (1993), and Erikson (1995). The number listed here is the average of the counts reported by Dipple and Nyswander and Nyswander *et al.* (13,404 and 13,262) and the count made by Erikson (16,592).
- ^h Data are from Dragoo *et al.* (1995) and Boersma *et al.* (1995; Table 1). The number listed here was derived by averaging the two values (9,573 and 9,736) reported by Boersma *et al.*, and then averaging this number with the count made by Dragoo *et al.* (5,960).
- ⁱ Data are from Boersma *et al.* (1995; Table 1). The number listed here is the average of the two values reported in their publication (24,814 and 25,444).
- ^j Data are from Boersma *et al.* (1995; Table 1). The number listed here is the average of the two values reported in their publication (34,387 and 35,180).
- ^k Data are from Dragoo *et al.* (1995).
- ^l Data are from Roseneau *et al.* (1995). Counts were 9,414, 8,134, 7,760, and 8,507 at Light Rock; 23,632 and 25,917 at East Amatuli Island; 31,392 and 34,051 at East Amatuli Island - Light Rock; and 12,474, 16,484, 12,817, and 11,913 at Nord Island - Northwest Islet in 1993.
- ^m Data are from Roseneau *et al.* (1996a). Counts were 6,749, 7,412, 8,450, 7,916, and 8,223 at Light Rock; 25,615 and 24,492 at East Amatuli Island; 33,027 and 32,715 at East Amatuli Island - Light Rock; and 11,071, 10,461, 12,296, and 13,361 at Nord Island - Northwest Islet in 1994 (the average East Amatuli Island and East Amatuli Island - Light Rock counts of 25,195 and 33,011 listed in Table 1 of Roseneau *et al.* 1996a were incorrect; the corrected values of 24,054 and 32,871 are reported here).
- ⁿ Data are from this study (see Appendices 1-5 and 9-11).
- ^o The East Amatuli Island - Light Rock whole colony counts were not included in the Tukey HSD analysis because only one count was available in two of the five years (i.e., $n = 1$ in 1992 and 1996).
- ^p The 1991 data were not included in the Tukey HSD analysis because only one count was available (i.e., $n = 1$).
- ^q The 1992 data were not included in the Tukey HSD analysis because only one count was available (i.e., $n = 1$).

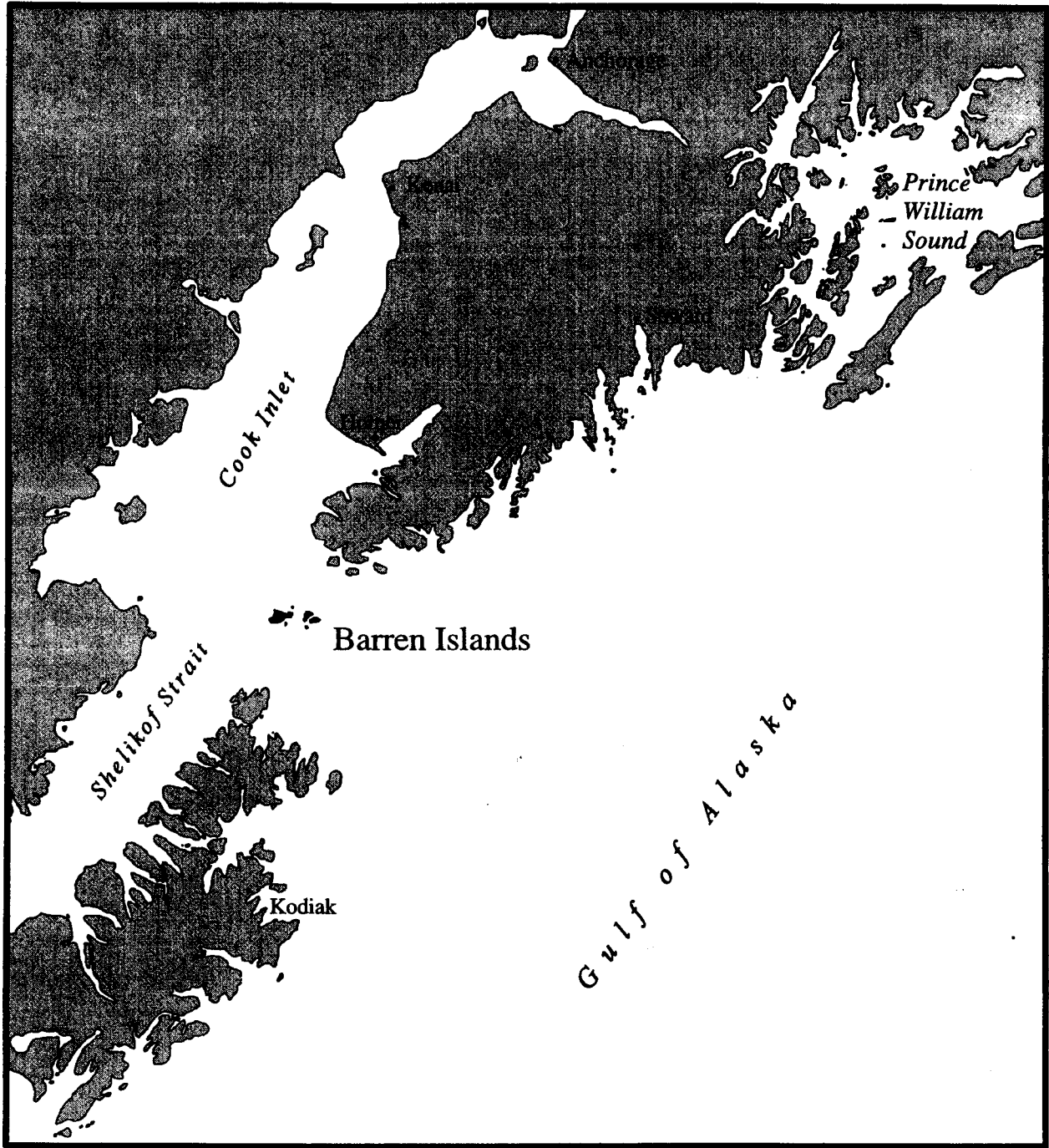


Figure 1. Location of the Barren Islands, Alaska.

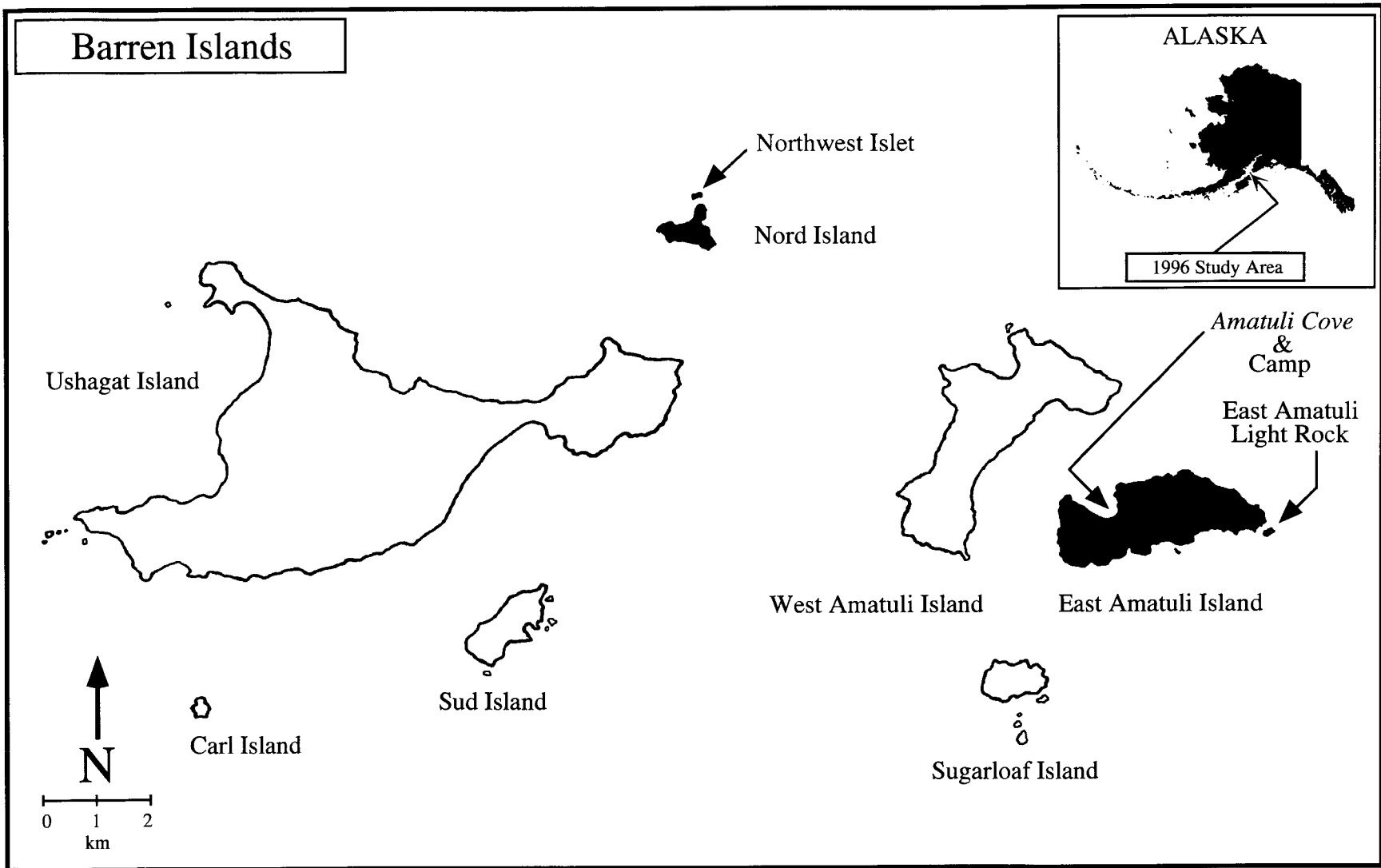


Figure 2. The East Amatuli Island - Light Rock and Nord Island - Northwest Islet study areas (in black), Barren Islands, Alaska (the study areas contain all known murre nesting habitat in the island group).

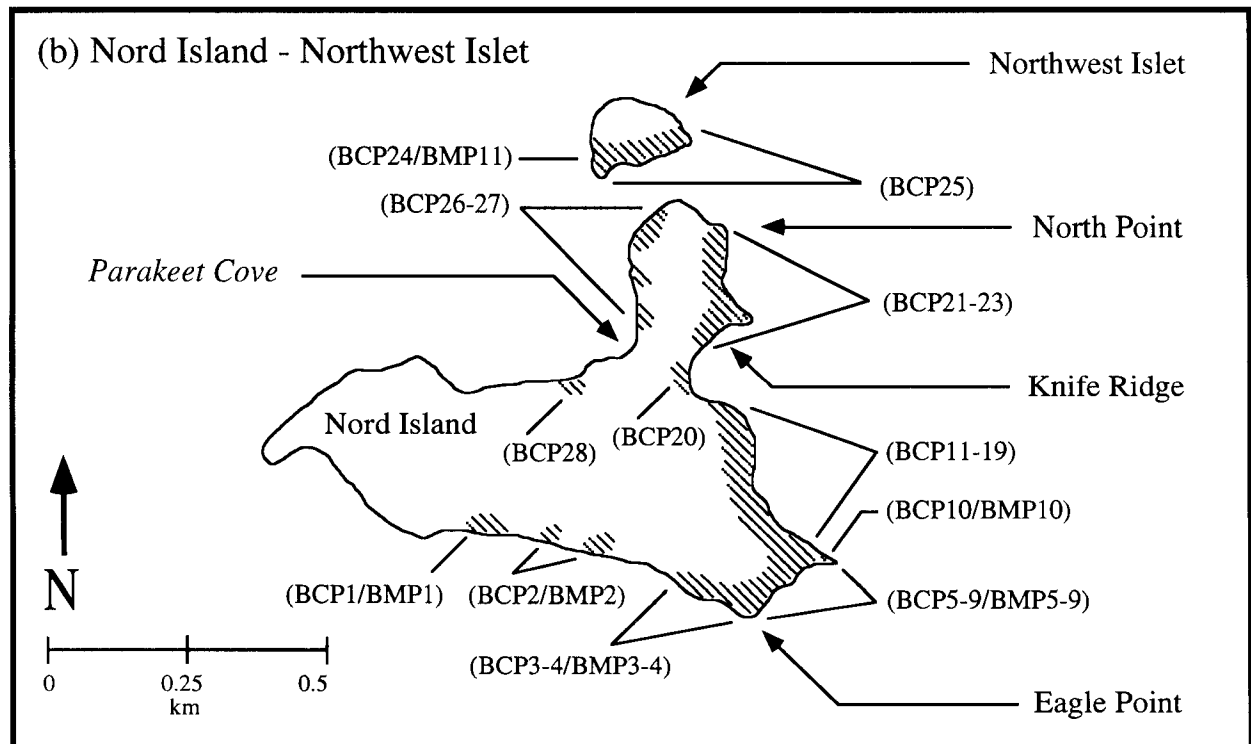
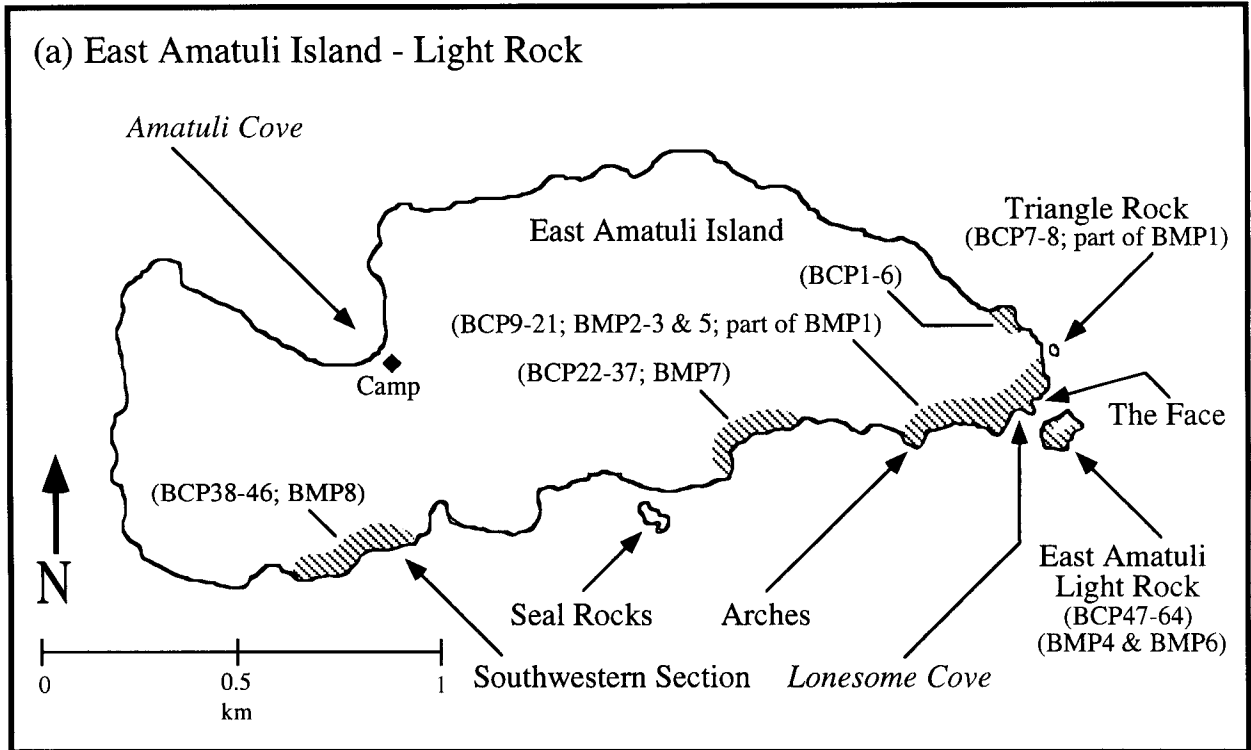


Figure 3. Murre nesting habitat (shaded areas), population census plots (BCP) and multicount plots (BMP) at the (a) East Amatuli Island - Light Rock and (b) Nord Island - Northwest Islet murre colonies, Barren Islands, Alaska.

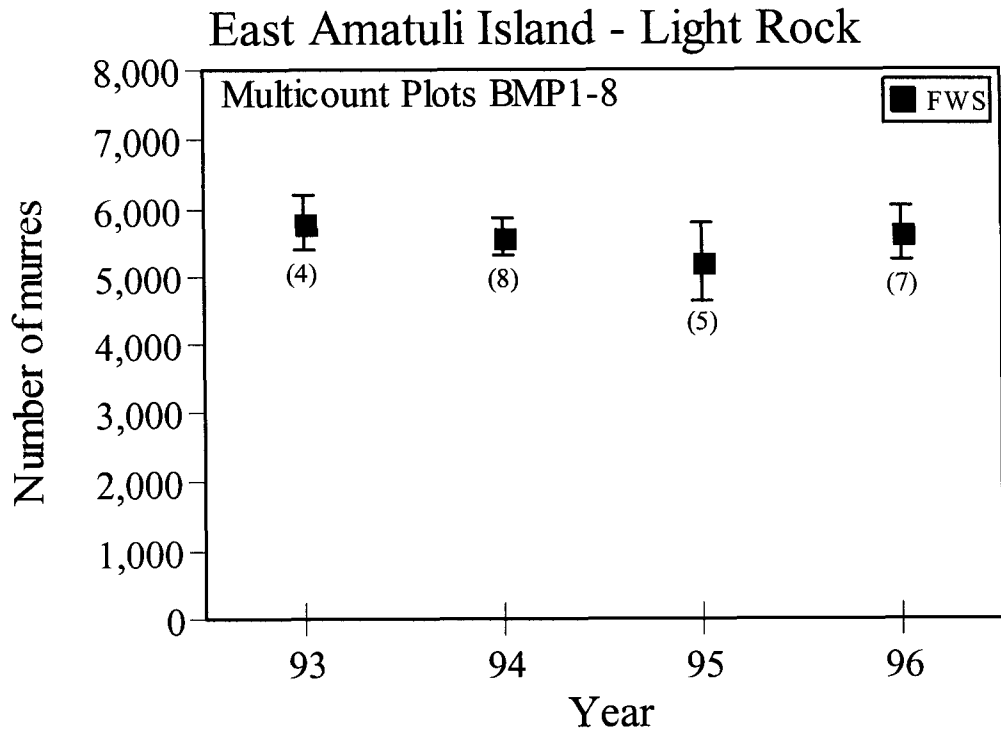


Figure 4. Average counts of murre on multcount plots BMP1-8 at East Amatuli Island - Light Rock, Barren Islands, Alaska, 1993-1996. Counts were made by the U.S. Fish and Wildlife Service (FWS). Number of counts shown in parentheses; error bars = standard deviation.

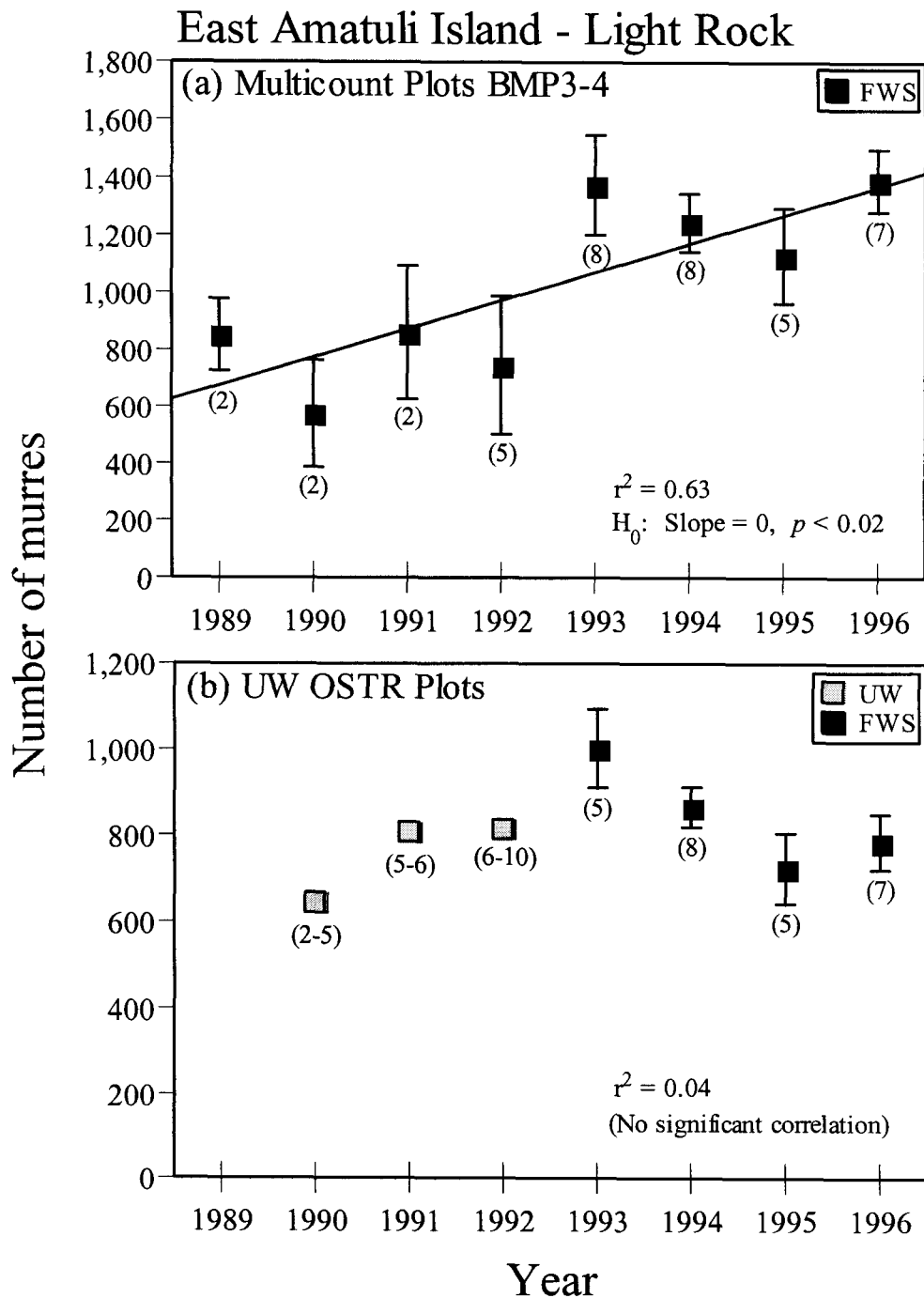


Figure 5. Average counts of murre on two small sets of plots at East Amatuli Island - Light Rock, Barren Islands, Alaska, 1989-1996. (a) Multicount plots BMP3-4 and (b) the University of Washington (UW) Oval, Swatch, and Triangle Rock (OSTR) plots (see text and Boersma et al. 1995). Counts were made by the U.S. Fish and Wildlife Service (FWS) and UW. Number of counts shown in parentheses; error bars = standard deviation (no error bars are shown for the UW counts because only averages were available).

East Amatuli Island - Light Rock

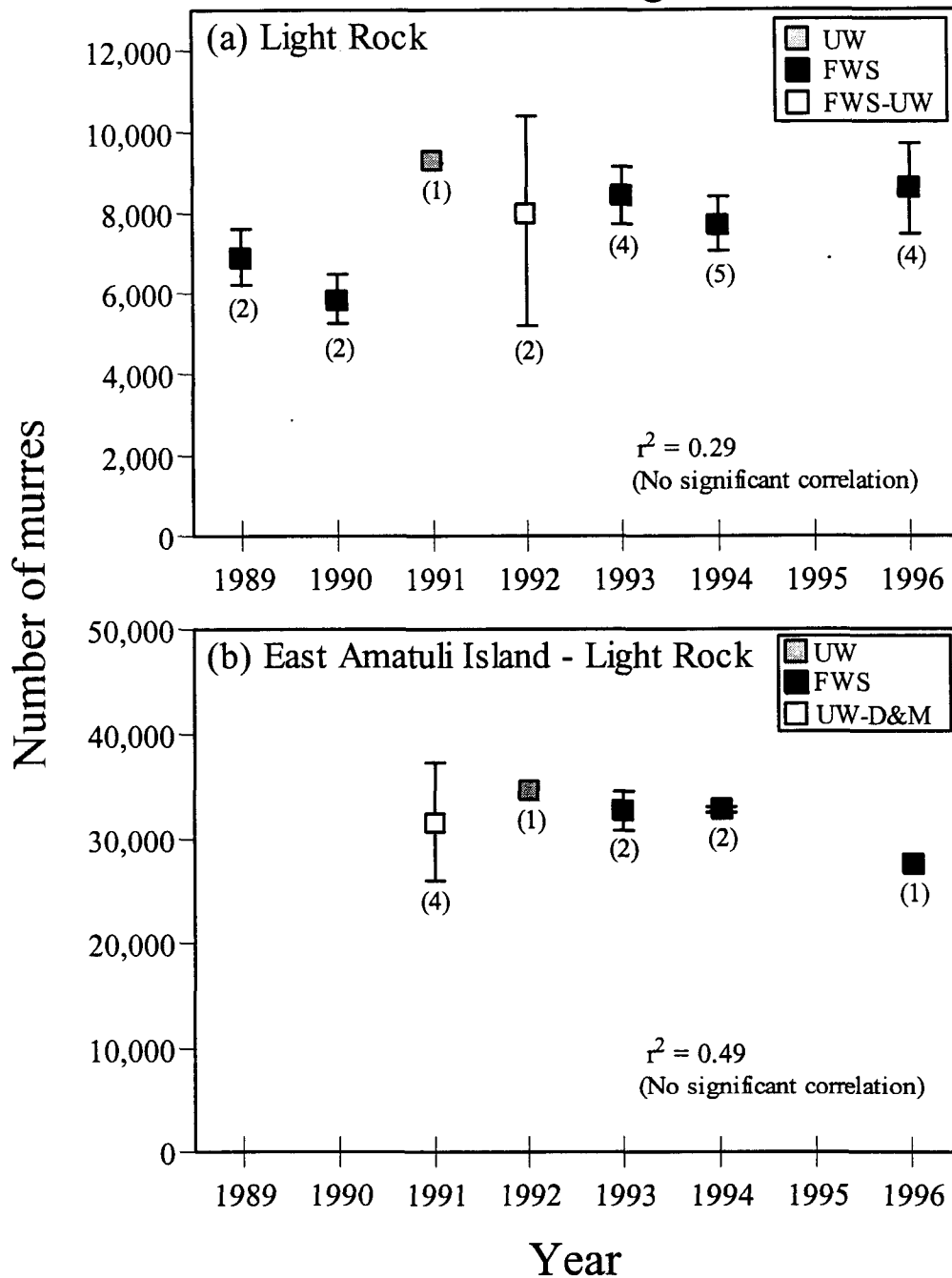


Figure 6. Average counts of murre on (a) East Amatuli Light Rock and (b) the East Amatuli Island - Light Rock complex, Barren Islands, Alaska, 1989-1996. Counts were made by U.S. Fish and Wildlife Service (FWS), the University of Washington (UW; see text and Boersma et al. 1995), and Dames & Moore (D&M; see text and Erikson 1995). Number of counts shown in parentheses; error bars = standard deviation.

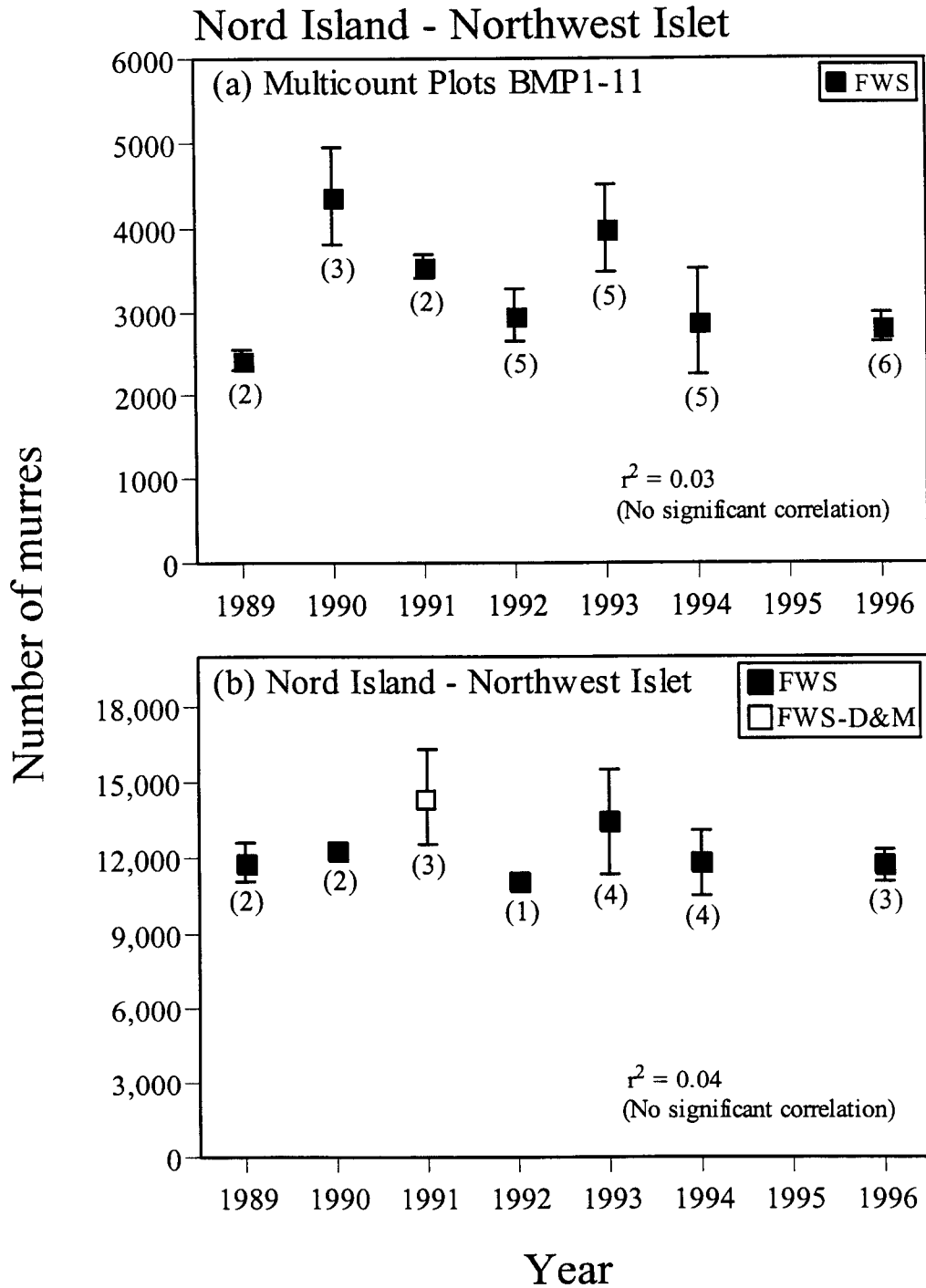


Figure 7. Average counts of mures on (a) Nord Island - Northwest Islet multicount plots BMP1-11 and (b) the Nord Island - Northwest Islet complex, Barren Islands, Alaska, 1989-1996. Counts were made by the U.S. Fish and Wildlife Service (FWS) and Dames & Moore (D&M; see text and Erikson 1995). Number of counts in parentheses; error bars = standard deviation.

Appendix 1. Counts of murre at East Amatuli Light Rock, 21 July 1996.

Note: All counts were made by 10's from small boats; times are Alaska Daylight Time; FWS = U.S. Fish & Wildlife Service; BCP numbers indicate the plots are boat plots counted from water, not land; DGR = David G. Roseneau and MAB = Margaret A. Blanding.

FWS Plot Number	Time	Observer 1 (DGR)				Observer 2 (MAB)				Observer 1 & 2	
		Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	Average	
BCP47	1300	220			220	200			200	210	
BCP48	1312	780			780	680			680	730	
BCP49	1304	230			230	250			250	240	
BCP50	1253	65			65	62			62	64	
BCP51	1208	760	790		775	810	810	830	817	796	
BCP52	1348	270	280		275	260			260	268	
BCP53	1315	480	450		465	480			480	473	
BCP54	1326	840			840	890	835		863	852	
BCP55	1356	225			225	220			220	223	
BCP56	1339	440	480		460	500	440		470	465	
BCP57	[Included in BCP61]										
BCP58	1824	280	300		290	310			310	300	
BCP59	1834	580			580	610			610	595	
BCP60	1812	150			150	150			150	150	
BCP61+57	1845	1,950	2,250	2,050	2,083	2,150	1,850	2,050	2,017	2,050	
BCP62	1837	130			130	130			130	130	
BCP63	1841	80	90		85	90	85		88	87	
BCP64	1242	190	200		195	195			195	195	
TOTAL (Whole Rock)		7,670				7,848	7,987			7,802	7,828

Appendix 2. Counts of murrelets at East Amatuli Light Rock, 12 August 1996.

Note: All counts were made by 10's from small boats; times are Alaska Daylight Time; FWS = U.S. Fish & Wildlife Service; BCP numbers indicate the plots are boat plots counted from water, not land; DGR = David G. Roseneau and BLS = Barbara L. Slater.

FWS Plot Number	Time	Observer 1 (DGR)				Observer 2 (BLS)				Observer 1 & 2 Average
		Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP47	1336	150	150		150	150	160		155	153
BCP48	1350	640			640	710			710	675
BCP49	1342	170	170		170	150	170		160	165
BCP50	1340	60	60		60	60	60		60	60
BCP51	1356	900			900	870			870	885
BCP52	1424	350	330	330	337	340			340	339
BCP53	1401	520			520	540			540	530
BCP54	1406	1,080			1,080	1,110			1,110	1,095
BCP55	1434	200			200	180			180	190
BCP56	1415	340	360		350	330			330	340
BCP57	[Included in BCP61]									
BCP58	1530	320	320		320	360	360	360	360	340
BCP59	1535	480	520		500	480	490		485	493
BCP60	1521	155	155		155	155	165		160	158
BCP61+57	1545	2,320	2,500		2,410	2,600	2,230		2,415	2,413
BCP62	1515	120	120		120	130	130		130	125
BCP63	1447	80			80	80			80	87
BCP64	1500	210	190		200	200	210		205	203
TOTAL (Whole Rock)		8,095			8,192	8,445			8,290	8,244

Appendix 3. Counts of murrelets at East Amatuli Light Rock, 13 August 1996.

Note: All counts were made by 10's from small boats; times are Alaska Daylight Time; FWS = U.S. Fish & Wildlife Service; BCP numbers indicate the plots are boat plots counted from water, not land; DGR = David G. Roseneau and BLS = Barbara L. Slater.

FWS Plot Number	Time	Observer 1 (DGR)				Observer 2 (BLS)				Observer 1 & 2
		Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	Average
BCP47	1524	180	190		185	190	190		190	188
BCP48	1535	920			920	920			920	920
BCP49	1529	190	200		195	190	170	180	180	188
BCP50	1528	80	80		80	80	90		85	83
BCP51	1538	1,030	1,130		1,080	1,210	1,070		1,140	1,110
BCP52	1609	450			450	460	450		455	453
BCP53	1548	600	580		590	630	550		590	590
BCP54	1554	1,480	1,510		1,495	1,610	1,410		1,510	1,503
BCP55	1613	170	170		170	150	180		165	168
BCP56	1605	630			630	600			600	615
BCP57	[Included in BCP61]									
BCP58	1635	420	400		410	410			410	410
BCP59	1639	710	730		720	770	710		740	730
BCP60	1628	160	160		160	140	140		140	150
BCP61+57	1653	2,570	2,840		2,705	2,715			2,715	2,710
BCP62	1631	130	130		130	140	130		135	133
BCP63	1649	100	110		105	100	110		105	105
BCP64	1623	220	220		220	220			220	220
TOTAL (Whole Rock)		10,040			10,245	10,535			10,300	10,273

Appendix 4. Counts of murrelets at East Amatuli Light Rock, 17 August 1996.

Note: All counts were made by 10's from small boats; times are Alaska Daylight Time; FWS = U.S. Fish & Wildlife Service; BCP numbers indicate the plots are boat plots counted from water, not land; ABK = Arthur B. Kettle and SZ = Stephanie Zuniga.

FWS Plot Number	Time	Observer 1 (ABK)				Observer 2 (SZ)				Observer 1 & 2
		Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	Average
BCP47	1615	170			170	160			160	165
BCP48	1637	930			930	960			960	945
BCP49	1642	240			240	220			220	230
BCP50	1642	80			80	80			80	80
BCP51	1702	1,050			1,050	1,040			1,040	1,045
BCP52	1736	290			290	320			320	305
BCP53	1654	520			520	510			510	515
BCP54	1716	1,080			1,080	1,150			1,150	1,115
BCP55	1858	180			180	190			190	185
BCP56	1734	440			440	430			430	435
BCP57	[Included in BCP61]									
BCP58	1748	260			260	250			250	255
BCP59	1753	450			450	440			440	445
BCP60	1755	160			160	175			175	168
BCP61+57	1830	1,784			1,784	2,016			2,016	1,900
BCP62	1758	80			80	80			80	80
BCP63	1900	90			90	100			100	95
BCP64	1613	170			170	170			170	170
TOTAL (Whole Rock)		7,974			7,974	8,291			8,291	8,133

Appendix 5. Counts of murrelets at East Amatuli Island, 21 July 1996.

Note: All counts were made by 10's from small boats; times are Alaska Daylight Time; FWS = U.S. Fish & Wildlife Service; BCP numbers indicate the plots are population census plots counted from boats, not land; DGR = David G. Roseneau; MAB = Margaret A. Blanding; ABK = Arthur B. Kettle; SZ = Stephanie Zuniga.

FWS Plot Number	Time	Observer 1 (DGR)				Observer 2 (MAB)				Observer 1 & 2 Average
		Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP1	1411	26	27		27	28			28	28
BCP2	1409	15			15	12			12	14
BCP3	1413	18			18	20			20	19
BCP4	1418	0			0	0			0	0
BCP5	1423	19	20		20	18			18	19
BCP6	1435	48			48	49			49	49
BCP6.1	1435	21			21	22			22	22
BCP7	1444	130	130		130	125			125	128
BCP8	1449	260	270		265	250			250	258
BCP9	1458	290	280		285	305			305	295
BCP10	1501	100	100		100	80	80		80	90
BCP11	1532	220	230	230	227	240	230		235	231
BCP12	1530	370	380		375	370			370	373
BCP13	1653	770			770	810			810	790
BCP14	1557	1,110	1,150	1,080	1,113	980			980	1,047
BCP15	1545	290	290		290	270			270	280
BCP16	1659	2,310			2,310	2,360			2,360	2,335
BCP17	1610	2,890			2,890	2,770			2,770	2,830
BCP18	1245	380			380	380			380	380
BCP19	1249	195			195	200			200	198

Appendix 5 (Continued).

FWS Plot Number	Time	Observer 1 (ABK)				Observer 2 (SZ)				Observer 1 & 2 Average
		Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP20	1936	2,220			2,220	2,185			2,185	2,203
BCP21	1640	1,020			1,020	880			880	950
		Observer 1 (DGR)				Observer 2 (MAB)				
BCP22	1655	710			710	740			740	725
		Observer 1 (ABK)				Observer 2 (SZ)				
BCP23	1639	870			870	890			890	880
BCP24	1600	540			540	510			510	525
BCP25	1537	570			570	607			607	589
BCP26	1551	130			130	130			130	130
BCP27	1530	0			0	0			0	0
BCP28	1527	340			340	345			345	343
BCP29	1514	160			160	170			170	165
BCP30	1507	510			510	480			480	495
BCP31	1504	530			530	520			520	525
BCP32	1453	33			33	35			35	34
BCP33	1417	490			490	435			435	463
BCP34	1432	175			175	184			184	180
BCP35	1447	460			460	430			430	445
BCP36	1355	95			95	100			100	98
BCP37	1358	200			200	185			185	193
BCP38	1343	109			109	104			104	107
BCP39	1339	61			61	54			54	58

Appendix 5 (Continued).

FWS Plot Number	Time	Observer 1 (ABK)				Observer 2 (SZ)				Observer 1 & 2
		Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	Average
BCP40	1336	58			58	58			58	58
BCP41	1335	61			61	57			57	59
BCP42	1325	270			270	272			272	271
BCP43	1325	70			70	60			60	65
BCP44	1320	490			490	520			520	505
BCP45	1310	160			160	160			160	160
BCP46	1300	120			120	104			104	112
TOTAL (Whole Island)		19,914		19,930		19,504		19,499		19,722

Appendix 6. Counts of murre on multicount plots at East Amatuli Island - Light Rock, 1996.

Note: Counts were made by 1's and 10's from small boats; times are Alaska Daylight Time; FWS = U.S. Fish & Wildlife Service; BCP numbers indicate that the plots are population census plots counted from boats, not land; BMP numbers indicate that the plots are also multicount plots that are counted from boats at least five separate times on different days to help track population trends; ABK = Arthur B. Kettle; MAB = Margaret A. Blanding; DGR = David G. Roseneau; SZ = Stephanie Zuniga.

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (DGR)					Observer 2 (MAB)					Observer 1 & 2 Average
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	
BMP1	BCP7-9	19 Jul	1826	598				598	593				593	596
BMP2	BCP11-12	19 Jul	1700	670				670	640				640	655
BMP3	BCP18-19	19 Jul	1801	625				625	610				610	618
BMP4	Part of BCP47-49	19 Jul	1756	820				820	830				830	825
<i>Subtotal</i>	<i>4 Plots: BMP1-4</i>			2,713				2,713	2,673				2,673	2,694
BMP5	Part of BCP20-21	19 Jul	1859	971				971	975				975	973
<i>Subtotal</i>	<i>5 Plots: BMP1-5</i>			3,684				3,684	3,648				3,648	3,667
BMP6	BCP51	19 Jul	1743	970				970	960				960	965
BMP7	BCP22	19 Jul	1830	780				780	840				840	810
BMP8	BCP38-42	19 Jul	1740	720				720	692				692	706
<i>Subtotal</i>	<i>7 Plots: BMP1-5 & 7-8</i>			5,184				5,184	5,180				5,180	5,183
TOTAL	8 Plots: BMP1-8	19 Jul		6,154				6,154	6,140				6,140	6,148

Appendix 6 (Continued).

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (DGR)					Observer 2 (MAB)					Observer 1 & 2 Average
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	
BMP1	BCP7-9	20 Jul	1452	572				572	562				562	567
BMP2	BCP11-12	20 Jul	1911	540				540	580				580	560
BMP3	BCP18-19	20 Jul	1845	570				570	550				550	560
BMP4	Part of BCP47-49	20 Jul	1835	900	890			895	800	800			800	848
<i>Subtotal</i>	<i>4 Plots: BMP1-4</i>			2,582				2,577	2,492				2,492	2,535
BMP5	Part of BCP20-21	20 Jul	1526	795				795	820				820	808
<i>Subtotal</i>	<i>5 Plots: BMP1-5</i>			3,377				3,372	3,312				3,312	3,343
BMP6	BCP51	20 Jul	1830	870				870	850				850	860
BMP7	BCP22	20 Jul	1435	750	750			750	800	790			795	773
BMP8	BCP38-42	20 Jul	1353	527				527	529				529	528
<i>Subtotal</i>	<i>7 Plots: BMP1-5 & 7-8</i>			4,654				4,649	4,641				4,636	4,644
TOTAL	8 Plots: BMP1-8	20 Jul		5,524				5,519	5,491				5,486	5,504
BMP1	BCP7-9	21 Jul	1444	680	680			680	680				680	680
BMP2	BCP11-12	21 Jul	1530	602				602	605				605	604
BMP3	BCP18-19	21 Jul	1245	575				575	580				580	578
BMP4	Part of BCP47-49	21 Jul	1220	860	830			845	840				840	843
<i>Subtotal</i>	<i>4 Plots: BMP1-4</i>			2,717				2,702	2,705				2,705	2,705

Appendix 6 (Continued).

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (ABK)					Observer 2 (SZ)					Observer 1 & 2 Average
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	
BMP5	Part of BCP20-21	21 Jul	1720	747				747	750				750	749
<i>Subtotal</i>	<i>5 Plots: BMP1-5</i>			3,464				3,449	3,455				3,455	3,454
				Observer 1 (DGR)					Observer 2 (MAB)					
BMP6	BCP51	21 Jul	1208	760	790			775	810	810	830		817	796
				Observer 1 (ABK)					Observer 2 (SZ)					
BMP7	BCP22	21 Jul	1655	710				710	740				740	725
BMP8	BCP38-42	21 Jul	1325	559				559	545				545	552
<i>Subtotal</i>	<i>7 Plots: BMP1-5 & 7-8</i>			4,733				4,718	4,740				4,740	4,731
TOTAL	8 Plots: BMP1-8	21 Jul		5,493				5,493	5,550				5,557	5,527
BMP1	BCP7-9	22 Jul	1300	543				543	536				536	540
BMP2	BCP11-12	22 Jul	1247	627				627	580				580	604
BMP3	BCP18-19	22 Jul	1230	603				603	569				569	586
BMP4	Part of BCP47-49	22 Jul	1220	770				770	710				710	740
<i>Subtotal</i>	<i>4 Plots: BMP1-4</i>			2,543				2,543	2,395				2,395	2,470

Appendix 6 (Continued).

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (ABK)					Observer 2 (SZ)					Observer 1 & 2 Average
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	
BMP5	Part of BCP20-21	22 Jul	1438	670				670	590				590	630
<i>Subtotal</i>	<i>5 Plots: BMP1-5</i>			<i>3,213</i>				<i>3,213</i>	<i>2,985</i>				<i>2,985</i>	<i>3,100</i>
BMP6	BCP51	22 Jul	1155	800				800	750				750	775
BMP7	BCP22	22 Jul	1355	575				575	640				640	608
BMP8	BCP38-42	22 Jul	1424	625				625	606				606	616
<i>Subtotal</i>	<i>7 Plots: BMP1-5 & 7-8</i>			<i>4,413</i>				<i>4,413</i>	<i>4,231</i>				<i>4,231</i>	<i>4,324</i>
TOTAL	8 Plots: BMP1-8	22 Jul		5,213				5,213	4,981				4,981	5,099
				Observer 1 (DGR)					Observer 2 (MAB)					
BMP1	BCP7-9	12 Aug	1558	484				484	452				452	468
				Observer 1 (ABK)					Observer 2 (SZ)					
BMP2	BCP11-12	12 Aug	1637	550				550	550				550	550
BMP3	BCP18-19	12 Aug	1646	485				485	474				474	480
BMP4	Part of BCP47-49	12 Aug	1432	770				770	750				750	760
<i>Subtotal</i>	<i>4 Plots: BMP1-4</i>			<i>2,289</i>				<i>2,289</i>	<i>2,226</i>				<i>2,226</i>	<i>2,258</i>

Appendix 6 (Continued).

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (ABK)					Observer 2 (SZ)					Observer 1 & 2 Average
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	
BMP5	Part of BCP20-21	12 Aug	1656	785				785	820				820	803
<i>Subtotal</i>	<i>5 Plots: BMP1-5</i>			<u>3,074</u>				<u>3,074</u>	<u>3,046</u>				<u>3,046</u>	<u>3,061</u>
				<u>Observer 1 (DGR)</u>					<u>Observer 2 (MAB)</u>					
BMP6	BCP51	12 Aug	1356	900				900	870				870	885
				<u>Observer 1 (ABK)</u>					<u>Observer 2 (SZ)</u>					
BMP7	BCP22	12 Aug	1628	850				850	840				840	845
BMP8	BCP38-42	12 Aug	1354	639				639	617				617	628
<i>Subtotal</i>	<i>7 Plots: BMP1-5 & 7-8</i>			<u>4,563</u>				<u>4,563</u>	<u>4,503</u>				<u>4,503</u>	<u>4,534</u>
TOTAL	8 Plots: BMP1-8	12 Aug		<u>5,463</u>				<u>5,463</u>	<u>5,373</u>				<u>5,373</u>	<u>5,419</u>
				<u>Observer 1 (DGR)</u>					<u>Observer 2 (MAB)</u>					
BMP1	BCP7-9	13 Aug	1700	574				574	543				543	559
				<u>Observer 1 (ABK)</u>					<u>Observer 2 (SZ)</u>					
BMP2	BCP11-12	13 Aug	1754	590				590	580				580	585
BMP3	BCP18-19	13 Aug	1716	590				590	580				580	585

Appendix 6 (Continued).

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (ABK)					Observer 2 (SZ)					Observer 1 & 2 Average	
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average		
BMP4	Part of BCP47-49	13 Aug	1702	1,050					940					995	
<i>Subtotal</i>	<i>4 Plots: BMP1-4</i>			2,804					2,643					2,724	
BMP5	Part of BCP20-21	13 Aug	1739	815					820					818	
<i>Subtotal</i>	<i>5 Plots: BMP1-5</i>			3,619					3,463					3,542	
				Observer 1 (DGR)					Observer 2 (MAB)						
BMP6	BCP51	13 Aug	1538	1,030	1,130			1,080	1,210	1070			1,140	1,110	
				Observer 1 (ABK)					Observer 2 (SZ)						
BMP7	BCP22	13 Aug	1639	900					970					935	
BMP8	BCP38-42	13 Aug	1608	604					617					611	
<i>Subtotal</i>	<i>7 Plots: BMP1-5 & 7-8</i>			5,123					5,050					5,088	
TOTAL	8 Plots: BMP1-8	13 Aug		6,153					6,260					6,190	6,198
				Observer 1 (ABK)					Observer 2 (SZ)						
BMP1	BCP7-9	14 Aug	1830	522					523					523	
BMP2	BCP11-12	14 Aug	1815	605					580					593	

Appendix 6 (Continued).

New FWS Multicount Plot Number	New FWS Boat Plot Number & Former FWS Number/Name	Date	Time	Observer 1 (ABK)					Observer 2 (SZ)					Observer 1 & 2
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	Average
BMP3	BCP18-19	14 Aug	1804	460				460	468				468	464
BMP4	Part of BCP47-49	14 Aug	1758	870				870	860				860	865
<i>Subtotal</i>	<i>4 Plots: BMP1-4</i>			<u>2,457</u>				<u>2,457</u>	<u>2,431</u>				<u>2,431</u>	<u>2,445</u>
BMP5	Part of BCP20-21	14 Aug	1849	990				990	960				960	975
<i>Subtotal</i>	<i>5 Plots: BMP1-5</i>			<u>3,447</u>				<u>3,447</u>	<u>3,391</u>				<u>3,391</u>	<u>3,420</u>
BMP6	BCP51	14 Aug	1733	915				915	885				885	900
BMP7	BCP22	14 Aug	1715	680				680	630				630	655
BMP8	BCP38-42	14 Aug	1641	660				660	666				666	663
<i>Subtotal</i>	<i>7 Plots: BMP1-5 & 7-8</i>			<u>4,787</u>				<u>4,787</u>	<u>4,687</u>				<u>4,687</u>	<u>4,738</u>
TOTAL	8 Plots: BMP1-8	14 Aug		<u>5,702</u>				<u>5,702</u>	<u>5,572</u>				<u>5,572</u>	<u>5,638</u>

Mean of 7 counts on 4 plots (BMP1-4)

Range = 2,258 - 2,724

SD = 172

2,547

Mean of 7 counts on 5 plots (BMP1-5)

Range = 3,061 - 3,667

SD = 222

3,370

Mean of 7 counts on 7 plots (BMP1-5 & 7-8)

Range = 4,324 - 5,183

SD = 300

4,749

MEAN OF 7 COUNTS ON 8 PLOTS (BMP1-8)

Range = 5,099 - 6,198

SD = 396

5,648

Appendix 7. Counts of murre on multicount plots at East Amatuli Island - Light Rock, 1995 (data are from Roseneau *et al.*, unpubl. data).

Note: Counts were made by 1's and 10's from small boats; times are Alaska Daylight Time; FWS = U.S. Fish & Wildlife Service; BCP numbers indicate that the plots are population census plots counted from boats, not land; BMP numbers indicate that the plots are also multicount plots that are counted from boats at least five separate times on different days to help track population trends; ABK = Arthur B. Kettle; MAB = Margaret A. Blanding.

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (ABK)					Observer 2 (MAB)					Observer 1 & 2
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	Average
BMP1	BCP7-9	27 Jul	1657	515				515	515				515	515
BMP2	BCP11-12	27 Jul	1636	410				410	430				430	420
BMP3	BCP18-19	27 Jul	1801	400				400	450				450	425
BMP4	Part of BCP47-49	27 Jul	1605	590				590	640				640	615
<i>Subtotal</i>	<i>4 Plots: BMP1-4</i>			<i>1,915</i>				<i>1,915</i>	<i>2,035</i>				<i>2,035</i>	<i>2,694</i>
BMP5	Part of BCP20-21	27 Jul	1724	820				820	784				784	802
<i>Subtotal</i>	<i>5 Plots: BMP1-5</i>			<i>2,735</i>				<i>2,735</i>	<i>2,819</i>				<i>2,819</i>	<i>3,667</i>
BMP6	BCP51	27 Jul	1545	710				710	740				740	725
BMP7	BCP22	27 Jul	1533	710				710	670				670	690
BMP8	BCP38-42	27 Jul	1418	596				596	602				602	599
<i>Subtotal</i>	<i>7 Plots: BMP1-5 & 7-8</i>			<i>4,041</i>				<i>4,041</i>	<i>4,091</i>				<i>4,091</i>	<i>4,066</i>
TOTAL	8 Plots: BMP1-8	27 Jul		4,751				4,751	4,831				4,831	4,791
BMP1	BCP7-9	31 Jul	1108	610				610	597				597	604
BMP2	BCP11-12	31 Jul	1210	485				485	505				505	495
BMP3	BCP18-19	31 Jul	1206	515				515	500				500	508

Appendix 7 (Continued).

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (ABK)					Observer 2 (MAB)					Observer 1 & 2 Average
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	
BMP4	Part of BCP47-49	31 Jul	1157	670				670	610				610	640
<i>Subtotal</i>	<i>4 Plots: BMP1-4</i>			<i>2,280</i>				<i>2,280</i>	<i>2,212</i>				<i>2,212</i>	<i>2,247</i>
BMP5	Part of BCP20-21	31 Jul	1724	820				820	784				784	802
<i>Subtotal</i>	<i>5 Plots: BMP1-5</i>			<i>3,100</i>				<i>3,100</i>	<i>2,996</i>				<i>2,996</i>	<i>3,049</i>
BMP6	BCP51	31 Jul	1150	795				795	810				810	803
BMP7	BCP22	31 Jul	1141	840				840	800				800	820
BMP8	BCP38-42	31 Jul	1120	380				380	370				370	375
<i>Subtotal</i>	<i>7 Plots: BMP1-5 & 7-8</i>			<i>4,320</i>				<i>4,320</i>	<i>4,166</i>				<i>4,166</i>	<i>4,244</i>
TOTAL	8 Plots: BMP1-8	31 Jul		5,115				5,115	4,976				4,976	5,074
BMP1	BCP7-9	6 Aug	1936	585				585	604				604	595
BMP2	BCP11-12	6 Aug	1910	570				570	550				550	560
BMP3	BCP18-19	6 Aug	1900	535				535	530				530	533
BMP4	Part of BCP47-49	6 Aug	1855	770				770	810				810	790
<i>Subtotal</i>	<i>4 Plots: BMP1-4</i>			<i>2,460</i>				<i>2,460</i>	<i>2,494</i>				<i>2,494</i>	<i>2,478</i>
BMP5	Part of BCP20-21	6 Aug	1920	891				891	922				922	907
<i>Subtotal</i>	<i>5 Plots: BMP1-5</i>			<i>3,351</i>				<i>3,351</i>	<i>3,416</i>				<i>3,416</i>	<i>3,454</i>

Appendix 7 (Continued).

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (ABK)					Observer 2 (MAB)					Observer 1 & 2 Average
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	
BMP6	BCP51	6 Aug	1849	1,020				1,020	970				970	995
BMP7	BCP22	6 Aug	1841	750				750	840				840	795
BMP8	BCP38-42	6 Aug	1817	756				756	767				767	762
<i>Subtotal</i>	<i>7 Plots: BMP1-5 & 7-8</i>			<i>4,857</i>				<i>4,857</i>	<i>5,023</i>				<i>5,023</i>	<i>4,942</i>
TOTAL	8 Plots: BMP1-8	6 Aug		5,877				5,877	5,993				5,993	5,937
BMP1	BCP7-9	8 Aug	1552	497				497	503				503	500
BMP2	BCP11-12	8 Aug	1538	415				415	440				440	428
BMP3	BCP18-19	8 Aug	1438	370				370	380				380	375
BMP4	Part of BCP47-49	8 Aug	1433	540				540	510				510	525
<i>Subtotal</i>	<i>4 Plots: BMP1-4</i>			<i>1,822</i>				<i>1,822</i>	<i>1,833</i>				<i>1,833</i>	<i>1,828</i>
BMP5	Part of BCP20-21	8 Aug	1610	718				718	764				764	741
<i>Subtotal</i>	<i>5 Plots: BMP1-5</i>			<i>2,540</i>				<i>2,540</i>	<i>2,597</i>				<i>2,597</i>	<i>2,569</i>
BMP6	BCP51	8 Aug	1410	720				720	810				810	765
BMP7	BCP22	8 Aug	1422	700				700	740				740	720
BMP8	BCP38-42	8 Aug	1455	539				539	546				546	543
<i>Subtotal</i>	<i>7 Plots: BMP1-5 & 7-8</i>			<i>3,779</i>				<i>3,779</i>	<i>3,883</i>				<i>3,883</i>	<i>3,832</i>
TOTAL	8 Plots: BMP1-8	8 Aug		4,499				4,499	4,693				4,693	4,597

Appendix 7 (Continued).

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (ABK)					Observer 2 (MAB)					Observer 1 & 2 Average
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	
BMP1	BCP7-9	21 Aug	1936	529				529	520				520	525
BMP2	BCP11-12	21 Aug	1912	510				510	490				490	500
BMP3	BCP18-19	21 Aug	1904	490				490	470				470	480
BMP4	Part of BCP47-49	21 Aug	1850	775				775	740				740	758
<i>Subtotal</i>	<i>4 Plots: BMP1-4</i>			<i>2,304</i>				<i>2,304</i>	<i>2,220</i>				<i>2,220</i>	<i>2,263</i>
BMP5	Part of BCP20-21	21 Aug	1922	881				881	800				800	841
<i>Subtotal</i>	<i>5 Plots: BMP1-5</i>			<i>3,185</i>				<i>3,185</i>	<i>3,020</i>				<i>3,020</i>	<i>3,104</i>
BMP6	BCP51	21 Aug	1825	820				820	890				890	855
BMP7	BCP22	21 Aug	1727	950				950	1,090				1,090	1,020
BMP8	BCP38-42	21 Aug	1640	749				749	747				747	748
<i>Subtotal</i>	<i>7 Plots: BMP1-5 & 7-8</i>			<i>4,884</i>				<i>4,884</i>	<i>4,857</i>				<i>4,857</i>	<i>4,872</i>
TOTAL	8 Plots: BMP1-8	21 Aug		5,704				5,704	5,747				5,747	5,727

<i>Mean of 5 counts on 4 plots (BMP1-4)</i>	<i>Range = 1,828 - 2,694</i>	<i>SD = 322</i>	<i>2,302</i>
<i>Mean of 5 counts on 5 plots (BMP1-5)</i>	<i>Range = 2,569 - 3,667</i>	<i>SD = 421</i>	<i>3,169</i>
<i>Mean of 5 counts on 7 plots (BMP1-5 & 7-8)</i>	<i>Range = 3,832 - 4,942</i>	<i>SD = 494</i>	<i>4,391</i>
MEAN OF 5 COUNTS ON 8 PLOTS (BMP1-8)	Range = 4,597 - 5,937	SD = 584	5,225

Appendix 8. Counts of murres on multicount plots at the Nord Island - Northwest Islet and East Amatuli Island - Light Rock colonies, Barren Islands, Alaska, 1989-1996 (1989-1992 data are from Dragoo *et al.* 1995 and Nysewander *et al.* 1993; 1993-1994 data are from Roseneau *et al.* 1996a; 1995 data are from Roseneau *et al.* unpubl. data).¹

Nord Island - Northwest Islet														East Amatuli Island - Light Rock				
Date	BMP1	BMP2	BMP3	BMP4	BMP5	BMP6	BMP7	BMP8	BMP9	BMP10	BMP11	Total	(SD) ²	Date	BMP3	BMP4	Total	(SD) ²
<u>1989</u>														<u>1989</u>				
27 Jul	154	127	7	139	460	531	74	274	375	159	219	2,519		27 Jul	339	424	763	
13 Aug	147	125	10	115	203	480	81	542	250	159	231	2,343		13 Aug	406	535	941	
Mean	151	126	9	127	332	506	78	408	313	159	225	2,431	(124.5)	Mean	373	480	852	(125.9)
<u>1990</u>														<u>1990</u>				
19 Jul	136	436	13	249	1,240	726	110	1,460	252	127	242	4,991		ND ³	ND	ND	ND	
14 Aug	134	310	13	231	875	468	155	898	380	144	261	3,869		15 Aug	292	416	708	
18 Aug	34	377	14	102	1,016	780	168	978	460	133	226	4,288		19 Aug	233	208	441	
Mean	101	374	13	194	1,044	658	144	1,112	364	135	243	4,383	(567.0)	Mean	263	312	575	(188.8)
<u>1991</u>														<u>1991</u>				
17 Aug	139	291	14	153	833	711	147	595	407	165	204	3,659		19 Aug	529	496	1,025	
22 Aug	140	220	12	126	830	514	103	825	358	129	200	3,457		1 Sep	375	319	694	
Mean	140	256	13	140	832	613	125	710	383	147	202	3,558	(142.8)	Mean	452	408	860	(234.1)

Appendix 8 (Continued).

Nord Island - Northwest Islet													East Amatuli Island - Light Rock					
Date	BMP1	BMP2	BMP3	BMP4	BMP5	BMP6	BMP7	BMP8	BMP9	BMP10	BMP11	Total	(SD)	Date	BMP3	BMP4	Total	(SD)
<u>1992</u>													<u>1992</u>					
6 & 9 Aug	95	181	9	143	688	473	71	873	285	84	106	3,008		7 Aug	232	235	467	
10 Aug	63	195	0	65	618	493	76	610	242	117	158	2,637		9 Aug	440	508	948	
18 Aug	85	169	10	178	682	380	114	523	301	168	134	2,744		10 Aug	388	538	926	
24 Aug	70	321	0	163	780	541	150	760	311	165	188	3,449		18 Aug	392	501	893	
26 Aug	42	151	7	113	730	488	101	855	251	142	136	3,016		26 Aug	199	294	493	
Mean	71	203	5	132	700	475	102	724	278	135	144	2,971	(314.2)	Mean	330	415	745	(243.2)
<u>1993</u>													<u>1993</u>					
19 Jul	90	210	10	140	1,130	960	120	1,360	240	120	209	4,589		22 Jul	813	767	1,580	
3 Aug	60	175	10	141	1,090	903	90	1,208	480	103	253	4,513		26 Jul	570	689	1,259	
4 Aug	55	153	9	85	1,100	585	95	965	415	143	208	3,813		31 Jul	815	725	1,540	
9 Aug	48	150	1	113	910	443	101	1,108	370	85	150	3,479		2 Aug	735	757	1,492	
17 Aug	123	254	0	115	710	530	140	1,000	380	136	235	3,623		11 Aug	733	772	1,505	
Mean	75	188	6	119	988	684	109	1,128	377	117	211	4,003	(514.4)	16 Aug	594	660	1,254	
														17 Aug	566	697	1,263	
														2 Sep	500	610	1,110	
														Mean	666	710	1,375	(173.5)
<u>1994</u>													<u>1994</u>					
27 Jul	39	153	0	57	490	435	75	135	260	87	239	1,970		27 Jul	550	560	1,110	
28 Jul	54	111	9	50	513	513	120	579	418	96	222	2,685		28 Jul	588	565	1,153	

Appendix 8 (Continued).

Nord Island - Northwest Islet													East Amatuli Island - Light Rock					
Date	BMP1	BMP2	BMP3	BMP4	BMP5	BMP6	BMP7	BMP8	BMP9	BMP10	BMP11	Total	(SD)	Date	BMP3	BMP4	Total	(SD)
<u>1994</u>													<u>1994</u>					
14 Aug	40	155	9	90	648	630	103	605	393	90	268	3,031		30 Jul	545	725	1,270	
15 Aug	69	205	11	105	685	565	138	568	405	102	193	3,046		31 Jul	584	855	1,439	
16 Aug	78	280	9	130	797	655	124	895	439	92	219	3,718		5 Aug	528	730	1,258	
Mean	56	181	8	86	627	560	112	556	383	93	228	2,890	(636.0)	6 Aug	546	755	1,301	
														14 Aug	548	640	1,188	
														15 Aug	495	750	1,245	
														Mean	548	698	1,246	(101.1)
<u>1995</u>													<u>1995</u>					
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		27 Jul	425	615	1,040	
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		31 Jul	508	640	1,148	
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		6 Aug	533	790	1,323	
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		8 Aug	375	525	900	
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		21 Aug	480	758	1,238	
														Mean	464	666	1,130	(166.0)
<u>1996</u>													<u>1996</u>					
22 Jul	88	252	5	64	603	548	94	735	305	105	236	3,035		19 Jul	618	825	1,443	
24 Jul	74	244	5	81	505	520	118	633	355	87	245	2,867		20 Jul	560	848	1,408	
25 Jul	64	233	10	89	463	533	112	568	293	93	201	2,659		21 Jul	578	843	1,421	
26 Jul	65	175	6	80	500	545	85	563	293	85	259	2,656		22 Jul	586	740	1,326	
27 Jul	73	291	5	87	448	465	93	264	693	85	200	2,704		12 Aug	480	760	1,240	

Appendix 8 (Continued).

Nord Island - Northwest Islet													East Amatuli Island - Light Rock					
Date	BMP1	BMP2	BMP3	BMP4	BMP5	BMP6	BMP7	BMP8	BMP9	BMP10	BMP11	Total	(SD)	Date	BMP3	BMP4	Total	(SD)
1996													1996					
9 Aug	79	242	4	81	588	618	112	660	315	100	229	3,028		13 Aug	585	995	1,580	
Mean	74	240	6	80	518	538	102	571	376	93	228	2,825	(177.7)	14 Aug	464	865	1,329	
														Mean	553	839	1,392	(108.4)

¹ This table contains some values that are slightly different from previously published figures (e.g., Dragoo *et al.* 1995). These revisions were made after reviewing the 1989-1992 field notes. In 1989, count dates were 27 July and 13 August, not 26 July and 12 August. Also, mean plot values have been recalculated in several cases (e.g., Nord Island, 1990), and the number 318 reported for plot BMP4 at East Amatuli Light Rock on 1 September 1991 was changed to 319. Correct dates for East Amatuli Island and Light Rock counts are also reported here. Nord Island plots BMP1-11 are equivalent to previously reported plots A1, A2, B, C, D, E, G, H1, H2, I, and NW Islet, respectively. East Amatuli Island and Light Rock plots BMP3 and BMP4 are equivalent to the "Mainland" and "Lt. Rock" plots, respectively. The 13 August 1989 total for plot BMP10 is an estimated value (Dragoo *et al.* 1995).

² SD = standard deviation.

³ ND = no data.

Appendix 9. Counts of murres at Nord Island - Northwest Islet, 24 July 1996.

Note: All counts were made by 10's from small boats; times are Alaska Daylight Time; FWS = U.S. Fish & Wildlife Service; BCP numbers indicate the plots are population census plots counted from boats, not land; DGR = David G. Roseneau and MAB = Margaret A. Blanding.

New FWS Plot Number	Previous FWS Plot Numbers & Names	Time	Observer 1 (DGR)				Observer 2 (MAB)				Observer 1 & 2 Average
			Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP1	A1	1306	72			72	75			75	74
BCP2	A2	1321	246	256		251	237			237	244
BCP3	B	1335	5			5	5			5	5
BCP4	C	1336	78	79		79	82			82	81
BCP5	D	1346	510			510	500			500	505
BCP6	E	1352	540			540	500			500	520
BCP7	G	1402	120	120	120	120	115			115	118
BCP8	H1	1423	620	650		635	630			630	633
BCP9	H2	1435	340			340	370			370	355
BCP10	I	1642	87	89		88	85			85	87
BCP11	(None) ¹	1643	2			2	2			2	2
BCP12	J	1645	2			2	2			2	2
BCP13	P	1449	150			150	120	130	140	130	140
BCP14	Q + R ²	1502	1,342			1,342	1,295			1,295	1,319
BCP15	S [also "S-1" or "R-S"] ³	1515	435			435	425	455		440	438
BCP16	W [also "S-2"] ⁴	1647	130			130	140			140	135
BCP17	T (right)	1753	300	280		290	290			290	290
BCP18	T (left)	1736	370	335	350	352	340	340	360	347	350
BCP19	U	1755	130	125		128	140			140	134
BCP20	V ["V-1"+V-X"] ⁵	1740	68			68	60			60	64
BCP21	X	1650	2,360	2,420		2,390	2,430			2,430	2,410
BCP22	Y	1605	1070	1120		1,095	1210			1,210	1,153
BCP23	Z	1623	890	950		920	970			970	945

Appendix 9 (Continued).

New FWS Plot Number	Previous FWS Plot Numbers & Names	Time	Observer 1 (DGR)				Observer 2 (MAB)				Observer 1 & 2 Average
			Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP24	NW Islet Plot	1258	240			240	250			250	245
BCP25	Remainder NW Islet ⁶	1635	1,203			1,203	1,218			1,218	1,211
BCP26	("Smaller NW Islet") [Subislet-2] ⁷	1630	490	500		495	510			510	503
BCP27	Parakeet Cove	1815	412	422	422	419	417	407		412	416
BCP28	(None) [West Parakeet] ⁸	1839	12			12	13			13	13
TOTAL (Whole Island)			12,224			12,313	12,431			12,458	12,392

¹ Consists of the area between BCP10 and BCP12 that was apparently not counted in previous years (i.e., 1989-1992).

² Plots Q and R were combined to form BCP14 because of a boundary problem that occurred during the 19 July and 3 August 1993 counts.

³ Plot S (BCP15) is equivalent to Plot "S-1" and it is also equivalent to Plot "R-S".

⁴ Plot W (BCP16) is equivalent to Plot "S-2".

⁵ Plot V was counted as "V-1" (1740 hrs: DGR = 25 birds, MAB = 25 birds) + "V-X" (1734 hrs: DGR = 43 birds, MAB = 35 birds).

⁶ Includes a small islet immediately adjacent to Northwest Islet that was counted as part of "Remainder NW Islet" in 1992. In 1993, this small islet was designated "Subislet-1" and the 24 July 1996 counts were: (1641 hrs) DGR = 138 birds; MAB = 138 birds.

⁷ Consists of a small islet immediately adjacent to Nord Island that was designated "Smaller NW Islet" in 1992 and redesignated "Subislet-2" in 1993.

⁸ Consists of a small group of birds found on a high cliff west of Parakeet Cove that was apparently not counted prior to 1993.

Appendix 10. Counts of murres at Nord Island - Northwest Islet, 25 July 1996.

Note: All counts were made by 10's from small boats; times are Alaska Daylight Time; FWS = U.S. Fish & Wildlife Service; BCP numbers indicate the plots are population census plots counted from boats, not land; DGR = David G. Roseneau, MAB = Margaret A. Blanding, ABK = Arthur B. Kettle, and SZ = Stephanie Zuniga.

New FWS Plot Number	Previous FWS Plot Numbers & Names	Time	Observer 1 (DGR)				Observer 2 (MAB)				Observer 1 & 2 Average
			Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP1	A1	1332	66			66	62			62	64
BCP2	A2	1349	232			232	234			234	233
BCP3	B	1359	10			10	10			10	10
BCP4	C	1402	88	92		90	87			87	89
BCP5	D	1405	460	470		465	460			460	463
BCP6	E	1417	540	530		535	530			530	533
BCP7	G	1427	115	120	120	118	105			105	112
BCP8	H1	1405	550	560		555	580			580	568
BCP9	H2	1444	290	290		290	295			295	293
BCP10	I	1452	90	94		92	94			94	93
BCP11	(None) ¹	1451	3			3	3			3	3
BCP12	J	1455	1			1	1			1	1
BCP13	P	1457	140	155		148	150			150	149
BCP14	Q + R ²	1504	1,345			1,345	1,340			1,340	1,343
BCP15	S [also "S-1" or "R-S"] ³	1536	505	525		515	495			495	505
			Observer 1 (ABK)				Observer 1 (SZ)				
			Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP16	W [also "S-2"] ⁴	1423	163			163	145			145	154
BCP17	T (right)	1644	280	290	270	280	290			290	285
BCP18	T (left)	1633	315	345	355	338	290			290	314
BCP19	U	1406	147	145		146	130	125		128	137

Appendix 10 (Continued).

New FWS Plot Number	Previous FWS Plot Numbers & Names	Time	Observer 1 (ABK)				Observer 2 (SZ)				Observer 1 & 2 Average
			Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP20	V ["V-1"+V-X"] ⁵	1408	52			52	51			51	52
			Observer 1 (DGR)				Observer 1 (MAB)				
			Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP21	X	1614	2,180	2,255		2,218	1,895			1,895	2,057
			Observer 1 (ABK)				Observer 1 (SZ)				
			Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP22	Y	1542	1,050	890		970	880	900		890	930
BCP23	Z	1602	800	730		765	770			770	768
			Observer 1 (DGR)				Observer 1 (MAB)				
			Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP24	NW Islet Plot	1305	199			199	203			203	201
BCP25	Remainder NW Islet ⁶	1630	1,135			1,135	1,084			1,084	1,110
			Observer 1 (ABK)				Observer 1 (SZ)				
			Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP26	("Smaller NW Islet") [Subislet-2] ⁷	1715	337			337	347			347	342

Appendix 10 (Continued).

New FWS Plot Number	Previous FWS Plot Numbers & Names	Time	Observer 1 (DGR)				Observer 2 (MAB)				Observer 1 & 2 Average
			Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP27	Parakeet Cove	1650	374			374	377			377	376
BCP28	(None) [West Parakeet] ⁸	1720	14			14	14			14	14
TOTAL (Whole Island)			11,481			11,456	10,922			10,930	11,199

¹ Consists of the area between BCP10 and BCP12 that was apparently not counted in previous years (i.e., 1989-1992).

² Plots Q and R were combined to form BCP14 because of a boundary problem that occurred during the 19 July and 3 August 1993 counts.

³ Plot S (BCP15) is equivalent to Plot "S-1" and it is also equivalent to Plot "R-S".

⁴ Plot W (BCP16) is equivalent to Plot "S-2".

⁵ Plot V was counted as "V-1" (1408 hrs: ABK = 24 birds, SZ = 21 birds) + "V-X" (1412 hrs: ABK = 28 birds, SZ = 30 birds).

⁶ Includes a small islet immediately adjacent to Northwest Islet that was counted as part of "Remainder NW Islet" in 1992. In 1993, this small islet was designated "Subislet-1" and the 25 July 1996 counts were: (1720 hrs) ABK = 123 birds; SZ = 127 birds.

⁷ Consists of a small islet immediately adjacent to Nord Island that was designated "Smaller NW Islet" in 1992 and redesignated "Subislet-2" in 1993.

⁸ Consists of a small group of birds found on a high cliff west of Parakeet Cove that was apparently not counted prior to 1993.

Appendix 11. Counts of murres at Nord Island - Northwest Islet, 26 July 1996.

Note: All counts were made by 10's from small boats; times are Alaska Daylight Time; FWS = U.S. Fish & Wildlife Service; BCP numbers indicate the plots are population census plots counted from boats, not land; DGR = David G. Roseneau and MAB = Margaret A. Blanding.

New FWS Plot Number	Previous FWS Plot Numbers & Names	Time	Observer 1 (DGR)				Observer 2 (MAB)				Observer 1 & 2 Average
			Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP1	A1	1303	59	61		60	69		69	65	
BCP2	A2	1315	171	172		172	181	175	178	175	
BCP3	B	1331	6			6	6		6	6	
BCP4	C	1335	78	79	79	79	80		80	80	
BCP5	D	1354	500			500	500		500	500	
BCP6	E	1340	530	550		540	550		550	545	
BCP7	G	1357	90	90	80	87	80	85	83	85	
BCP8	H1	1410	580	570		575	550		550	563	
BCP9	H2	1414	300	310		305	270	290	280	293	
BCP10	I	1431	81	86		84	90	79	85	85	
BCP11	(None) ¹	1434	3			3	3		3	3	
BCP12	J	1435	0			0	0		0	0	
BCP13	P	1438	140	150		145	140		140	143	
BCP14	Q + R ²	1442	1,533			1,533	1,620		1,620	1,577	
BCP15	S [also "S-1" or "R-S"] ³	1503	505	505		505	575		575	540	
BCP16	W [also "S-2"] ⁴	1544	130	120	130	127	122		122	125	
BCP17	T (right)	1559	330	330		330	340	320	330	330	
BCP18	T (left)	1554	360	370		365	375		375	370	
BCP19	U	1609	120	120	120	120	115		115	118	
BCP20	V ["V-1" + V-X"] ⁵	1615	50			50	50		50	50	
BCP21	X	1621	1,825	1,950		1,888	1,930		1,930	1,909	
BCP22	Y	1656	890	910	900	900	945		945	923	
BCP23	Z	1715	770	810		790	830		830	810	

Appendix 11 (Continued).

New FWS Plot Number	Previous FWS Plot Numbers & Names	Time	Observer 1 (DGR)				Observer 2 (MAB)				Observer 1 & 2 Average
			Count 1	Count 2	Count 3	Average	Count 1	Count 2	Count 3	Average	
BCP24	NW Islet Plot	1820	268			268	249			249	259
BCP25	Remainder NW Islet ⁶	1735	1,138			1,138	1,145			1,145	1,142
BCP26	("Smaller NW Islet") [Subislet-2] ⁷	1726	347			347	363			363	355
BCP27	Parakeet Cove	1802	407			407	416			416	412
BCP28	(None) [West Parakeet] ⁸	1827	11			11	11			11	11
TOTAL (Whole Island)			11,222			11,335	11,605			11,600	11,474

¹ Consists of the area between BCP10 and BCP12 that was apparently not counted in previous years (i.e., 1989-1992).

² Plots Q and R were combined to form BCP14 because of a boundary problem that occurred during the 19 July and 3 August 1993 counts.

³ Plot S (BCP15) is equivalent to Plot "S-1" and it is also equivalent to Plot "R-S".

⁴ Plot W (BCP16) is equivalent to Plot "S-2".

⁵ Plot V was counted as "V-1" (1615 hrs: DGR = 20 birds, MAB = 20 birds) + "V-X" (1616 hrs: DGR = 30 birds, MAB = 30 birds).

⁶ Includes a small islet immediately adjacent to Northwest Islet that was counted as part of "Remainder NW Islet" in 1992. In 1993, this small islet was designated "Subislet-1" and the 26 July 1996 counts were: (1748 hrs) DGR = 128 birds; MAB = 120 birds.

⁷ Consists of a small islet immediately adjacent to Nord Island that was designated "Smaller NW Islet" in 1992 and redesignated "Subislet-2" in 1993.

⁸ Consists of a small group of birds found on a high cliff west of Parakeet Cove that was apparently not counted prior to 1993.

Appendix 12. Counts of murre on multicount plots at Nord Island - Northwest Islet, 1996.

Note: All counts were made by 10's from small boats; times are Alaska Daylight Time; FWS = U.S. Fish and Wildlife Service; BCP numbers indicate the plots are population census plots counted from boats, not land; BMP numbers indicate the plots are also multicount plots that are counted from boats at least 5 separate times on different days to help track population trends; DGR = David G. Roseneau, MAB = Margaret A. Blanding, and BLS = Barbara L. Slater.

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (DGR)					Observer 2 (MAB)					Observer 1 & 2 Average
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	
BMP1	BCP1 (A1)	22 Jul	1235	89				89	87				87	88
BMP2	BCP2 (A2)	22 Jul	1258	243	256			250	252	255			254	252
BMP3	BCP3 (B)	22 Jul	1305	5				5	5				5	5
BMP4	BCP4 (C)	22 Jul	1325	67	68			68	58	61			60	64
BMP5	BCP5 (D)	22 Jul	1342	585	595			590	615				615	603
BMP6	BCP6 (E)	22 Jul	1353	505	535			520	545	605			575	548
BMP7	BCP7 (G)	22 Jul	1338	98				98	90				90	94
BMP8	BCP8 (H1)	22 Jul	1409	750				750	720				720	735
BMP9	BCP9 (H2)	22 Jul	1416	300				300	310				310	305
BMP10	BCP10 (I)	22 Jul	1423	100				100	110				110	105
BMP11	BCP11 (NW Islet Plot)	22 Jul	1446	246	233			240	232	231			232	236
<i>Subtotal</i>	<i>6 Plots: BMP1-4, BMP10, BMP11</i>			<i>750</i>				<i>752</i>	<i>744</i>				<i>748</i>	<i>750</i>
<i>Subtotal</i>	<i>8 Plots: BMP1-6, BMP10, BMP11</i>			<i>1,840</i>				<i>1,862</i>	<i>1,904</i>				<i>1,938</i>	<i>1,901</i>
TOTAL	11 Plots: BMP1-11			2,988				3,010	3,024				3,058	3,035
BMP1	BCP1 (A1)	24 Jul	1306	72				72	75				75	74
BMP2	BCP2 (A2)	24 Jul	1321	246	256			251	237				237	244
BMP3	BCP3 (B)	24 Jul	1335	5				5	5				5	5

Appendix 12 (Continued).

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (DGR)					Observer 2 (MAB)					Observer 1 & 2
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	Average
BMP4	BCP4 (C)	24 Jul	1336	79	78			79	82				82	81
BMP5	BCP5 (D)	24 Jul	1346	510				510	500				500	505
BMP6	BCP6 (E)	24 Jul	1352	540				540	500				500	520
BMP7	BCP7 (G)	24 Jul	1402	120	120	120		120	115				115	118
BMP8	BCP8 (H1)	24 Jul	1423	620	650			635	630				630	633
BMP9	BCP9 (H2)	24 Jul	1435	340				340	370				370	355
BMP10	BCP10 (I)	24 Jul	1642	87	89			88	85				85	87
BMP11	BCP11 (NW Islet Plot)	24 Jul	1258	240				240	250				250	245
<i>Subtotal</i>	<i>6 Plots: BMP1-4, BMP10, BMP11</i>			<i>729</i>				<i>735</i>	<i>734</i>				<i>734</i>	<i>736</i>
<i>Subtotal</i>	<i>8 Plots: BMP1-6, BMP10, BMP11</i>			<i>1,779</i>				<i>1,785</i>	<i>1,734</i>				<i>1,734</i>	<i>1,761</i>
TOTAL	11 Plots: BMP1-11			2,859				2,880	2,849				2,849	2,867
BMP1	BCP1 (A1)	25 Jul	1332	66				66	62				62	64
BMP2	BCP2 (A2)	25 Jul	1349	232				232	234				234	233
BMP3	BCP3 (B)	25 Jul	1359	10				10	10				10	10
BMP4	BCP4 (C)	25 Jul	1402	88	92			90	87				87	89
BMP5	BCP5 (D)	25 Jul	1405	460	470			465	460				460	463
BMP6	BCP6 (E)	25 Jul	1417	540	530			535	530				530	533
BMP7	BCP7 (G)	25 Jul	1427	115	120	120		118	105				105	112
BMP8	BCP8 (H1)	25 Jul	1434	550	560			555	580				580	568
BMP9	BCP9 (H2)	25 Jul	1444	290	290			290	295				295	293
BMP10	BCP10 (I)	25 Jul	1452	90	94			92	94				94	93

Appendix 12 (Continued).

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (DGR)					Observer 2 (MAB)					Observer 1 & 2 Average
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	
BMP11	BCP11 (NW Islet Plot)	25 Jul	1305	199				199		203			203	201
<i>Subtotal</i>	<i>6 Plots: BMP1-4, BMP10, BMP11</i>			685				689		690			690	690
<i>Subtotal</i>	<i>8 Plots: BMP1-6, BMP10, BMP11</i>			2,730				2,744		2,754			2,754	2,752
TOTAL	11 Plots: BMP1-11			2,640				2,652		2,660			2,660	2,659
BMP1	BCP1 (A1)	26 Jul	1303	59	61			60		69			69	65
BMP2	BCP2 (A2)	26 Jul	1315	171	172			172		181	175		178	175
BMP3	BCP3 (B)	26 Jul	1331	6				6		6			6	6
BMP4	BCP4 (C)	26 Jul	1335	78	79	79		79		80			80	80
BMP5	BCP5 (D)	26 Jul	1354	500				500		500			500	500
BMP6	BCP6 (E)	26 Jul	1340	530	550			540		550			550	545
BMP7	BCP7 (G)	26 Jul	1357	90	90	80		87		80	85		83	85
BMP8	BCP8 (H1)	26 Jul	1410	580	570			575		550			550	563
BMP9	BCP9 (H2)	26 Jul	1414	300	310			305		270	290		280	293
BMP10	BCP10 (I)	26 Jul	1431	81	86			84		90	79		85	85
BMP11	BCP11 (NW Islet Plot)	26 Jul	1820	268				268		249			249	259
<i>Subtotal</i>	<i>6 Plots: BMP1-4, BMP10, BMP11</i>			663				669		675			667	670
<i>Subtotal</i>	<i>8 Plots: BMP1-6, BMP10, BMP11</i>			1,693				1,709		1,725			1,717	1,715
TOTAL	11 Plots: BMP1-11			2,663				2,676		2,625			2,630	2,656

Appendix 12 (Continued).

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (DGR)					Observer 2 (MAB)					Observer 1 & 2
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	Average
BMP1	BCP1 (A1)	27 Jul	1455	75				75	71				71	73
BMP2	BCP2 (A2)	27 Jul	1509	293				293	289				289	291
BMP3	BCP3 (B)	27 Jul	1434	5				5	5				5	5
BMP4	BCP4 (C)	27 Jul	1430	90				90	84				84	87
BMP5	BCP5 (D)	27 Jul	1423	440	450			445	450				450	448
BMP6	BCP6 (E)	27 Jul	1425	450	470			460	470				470	465
BMP7	BCP7 (G)	27 Jul	1438	90	100			95	90				90	93
BMP8	BCP8 (H1)	27 Jul	1520	275	275			275	240	265			253	264
BMP9	BCP9 (H2)	27 Jul	1552	670	680			675	710				710	693
BMP10	BCP10 (I)	27 Jul	1610	81	86			84	90	79			85	85
BMP11	BCP11 (NW Islet Plot)	27 Jul	1320	202				202	198				198	200
<i>Subtotal</i>	<i>6 Plots: BMP1-4, BMP10, BMP11</i>			<i>746</i>				<i>749</i>	<i>737</i>				<i>732</i>	<i>741</i>
<i>Subtotal</i>	<i>8 Plots: BMP1-6, BMP10, BMP11</i>			<i>1,636</i>				<i>1,654</i>	<i>1,657</i>				<i>1,652</i>	<i>1,654</i>
TOTAL	11 Plots: BMP1-11			2,671				2,699	2,697				2,705	2,704
				Observer 1 (DGR)					Observer 2 (BLS)					
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	Average
BMP1	BCP1 (A1)	9 Aug	1550	80	84			82	75	76			76	79
BMP2	BCP2 (A2)	9 Aug	1610	231				231	253				253	242
BMP3	BCP3 (B)	9 Aug	1625	4				4	4				4	4
BMP4	BCP4 (C)	9 Aug	1630	87	90			89	72				72	81
BMP5	BCP5 (D)	9 Aug	1740	600	570			585	590				590	588

Appendix 12 (Continued).

New FWS Multicount Plot Number	New FWS Boat Plot Number & Previous Plot Number/Name	Date	Time	Observer 1 (DGR)					Observer 2 (BLS)					Observer 1 & 2 Average
				Count 1	Count 2	Count 3	Count 4	Average	Count 1	Count 2	Count 3	Count 4	Average	
BMP6	BCP6 (E)	9 Aug	1750	600	620			610	680	570			625	618
BMP7	BCP7 (G)	9 Aug	1700	110	120	130		120	103				103	112
BMP8	BCP8 (H1)	9 Aug	1710	650				650	670				670	660
BMP9	BCP9 (H2)	9 Aug	1720	320				320	310				310	315
BMP10	BCP10 (I)	9 Aug	1730	100				100	99				99	100
BMP11	BCP11 (NW Islet Plot)	9 Aug	1515	226	230			228	229				229	229
<i>Subtotal</i>	<i>6 Plots: BMP1-4, BMP10, BMP11</i>			<i>728</i>				<i>734</i>	<i>732</i>				<i>733</i>	<i>735</i>
<i>Subtotal</i>	<i>8 Plots: BMP1-6, BMP10, BMP11</i>			<i>1,928</i>				<i>1,929</i>	<i>2,002</i>				<i>1,948</i>	<i>1,941</i>
TOTAL	11 Plots: BMP1-11			3,008				3,019	3,085				3,031	3,028

Mean of 6 counts on 6 plots (BMP1-4, BMP10, AND BMP11)

Range = 670 - 750

SD = 32

720

Mean of 6 counts on 8 plots (BMP1-6, BMP10, AND BMP11)

Range = 1,654 - 2,752

SD = 406

1,954

MEAN OF 6 COUNTS ON 11 PLOTS (BMP1-11)

Range = 2,056 - 3,035

SD = 178

2,825



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Alaska Maritime National Wildlife Refuge
2355 Kachemak Bay Drive, Suite 101
Homer, Alaska 99603-8021

IN REPLY REFER TO:

14 November 1997

To: Dr. Robert B. Spies Chief Scientist, *Exxon Valdez* Oil Spill Trustee Council, Applied Marine Sciences, 2155 Las Positas Court (Suite S), Livermore, California 94550

From: David G. Roseneau, Wildlife Biologist, Alaska Maritime NWR, 2355 Kachemak Bay Drive (Suite 101), Homer, Alaska 99603-8021

Subject: Submission of Final Common Murre Population Monitoring Annual Report (Project 96144)

Dear Bob:

Two copies (as per EVOSTC guidelines) of the final revised common murre population monitoring annual report entitled "Common Murre Population Monitoring in the Barren Islands, Alaska, 1996" are enclosed. We appreciate the peer review comments on the earlier draft; they were helpful and have been addressed (see below). Also, the report is formatted as per EVOSTC guidelines. A brief summary of the reviewer's comments and our responses to them are listed below.

Comment 1: "The Dragoo et al. 1995 reference was not listed in the Literature Cited; or is the reference listed as Dipple et al. 1995 actually Dragoo et al. 1995?" *Response: Yes, Dragoo et al. 1995 was inadvertently listed as Dipple et al. 1995; this error has been corrected.*

Comment 2: "Could find no place in text, table, or appendices where Roseneau et al. 1996b (in the Literature Cited, p. 8) was actually used." *Response: The Roseneau et al. 1996b reference was used at the end of the last sentence of the second to last paragraph in the Introduction.*

Comment 3: "In Figures 6 and 7, possibly use "trend" instead of "correlation" in the graphic." *Response: We believe that "correlation" is the appropriate word; the term "No significant correlation" was used on Figures 5, 6, and 7 to indicate that the correlation coefficient between year and count was not significant at the 0.1 significance level, and therefore it was not appropriate to proceed and test for trends with a simple linear regression.*

Comment 4: "In appendix 8 and subsequently: is there any technical reason why letters are used in tables for subscripts, but numbers are used in some of the appendices?" *Response: Yes, there is a technical reason why superscripted letters were used for footnotes in the tables and superscripted numbers were used for footnotes in Appendices 8, 9, 10, and 11. Superscripted lower case letters were used in the tables to avoid any confusion that might result from using numbers within fields or lists of numbers (i.e., lower case letters stand out and are easier to see in a table of numbers, and more importantly, they cannot be misconstrued as numerical data or scientific notations that might indicate squaring, cubing, etc.). Superscripted numbers (instead of lower case letters) were used in Appendices 8, 9, 10, and 11 for the same basic reason (however, in these cases, all of the places that required footnotes are limited to fields where letters are the dominant feature; therefore numbers are easier to see and cannot be misconstrued as part of the plot names listed in the column). In general, when following this convention, the overall content of each table or appendix and the general placement of superscripts within each of them dictates whether numbers or letters are used for footnoting. Also note that when this convention is followed, numbers are used for footnotes that may*

occur within larger bodies of text (e.g., see page 1 of the report). Ratti and Ratti (Manuscript Guidelines for the Journal of Wildlife Management, 1988) suggest using only lower case letters for all footnotes, regardless of their being used within bodies of written text (where they can be difficult to find and see) or in conjunction with fields of letters or numbers in tables and appendices. In contrast, the convention we followed in this and past reports makes superscripts easier to find and see, and helps avoid potential misinterpretations by readers. However, if required, we can change the superscripted footnote numbers in the body of the report and Appendices 8-11 to superscripted lower case letters as per the Ratti and Ratti (1988) convention and reprint these pages.

Sincerely,

A handwritten signature in black ink, appearing to read "David G. Roseneau". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

David G. Roseneau
Wildlife Biologist

cc: Catherine Berg, FWS Environmental Contaminants

DRoseneau

REVIEW COMMENTS FOR EXXON VALDEZ OILSPILL TRUSTEE COUNCIL
"Common Murre Population Monitoring at the Barren Islands, Alaska, 1996": Annual
Report for Restoration Project #96144
by D. G. Roseneau et al.

The trajectory of populations damaged by the EVOS, and time lines required to once again attain pre-spill conditions, are at the heart of the entire monitoring/research/recovery program sponsored by the EVOS Trustee Council. This report summarizes the latest results on population trends of murre (*Uria* spp.) at the Barren Island colonies outside Prince William Sound. As of the 1996 breeding season, no evidence has been found that murre populations have changed over the 8-year postspill period.

Authors make a number of recommendations: 1) recensusing during 1997 to check whether the strong 1993/94 cohorts begin to return to (and increase numbers at) the colonies, 2) recensusing at 3-year intervals if no evidence of population growth is found in 1997, and 3) recensusing the Chiswell Islands in 1998. All of these are appropriate tasks and should be supported by the EVOSTC.

This report is very concise. Typical of Roseneau et al.'s work, rich detail is provided in the methods section. As a result, matching counting areas and techniques will facilitate replication in the future. The figures are very good, and the tables and appendices provide a wealth of data. Methodologies are sound and based on previous work of similar nature.

As far as the product itself, the report is exceptionally well-prepared and remarkably free of typographical errors. Numbered comments below correspond to specific locations numbered throughout the text, tables, or figures. A few additional suggestions have been penned in red ink directly onto the text.

- 1) The Dragoo et al. 1995 reference was not listed in the Literature Cited; or, is the reference listed as Dipple et al. 1995 actually Dragoo et al. 1995?
- 2) Could find no place in text, table, or appendices where Roseneau et al. 1996b (in the Literature Cited, p. 8) was actually used.
- 3) In figures 6 and 7, possibly use "trend" instead of "correlation" in the graphic. (also Fig 5!)
- 4) In appendix 8 and subsequently: is there any technical reason why letters are used in tables for subscripts, but numbers are used in some of the appendices?