Recommendations for Monitoring Distribution, Abundance, and Trends for North American Sea Ducks

Sea Duck Joint Venture

December 20, 2007

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Recommended Citation: Sea Duck Joint Venture. 2007. Recommendations for Monitoring Distribution, Abundance, and Trends for North American Sea Ducks. December 2007. Available at http://seaduckjv.org or U.S. Fish and Wildlife Service, Anchorage, Alaska or Canadian Wildlife Service, Sackville, New Brunswick.

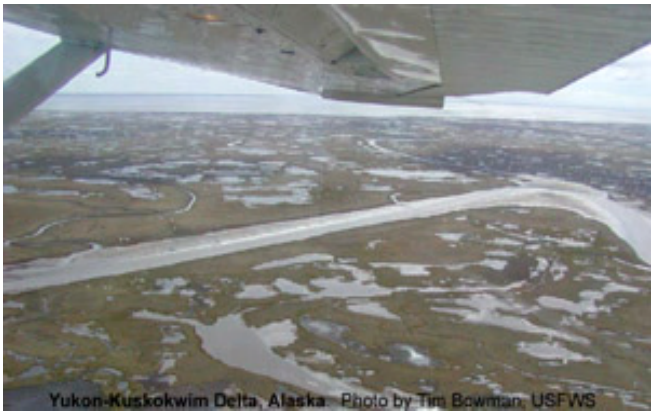
Cover Photo courtesy of Molly Kirk; taken in Baynes Sound, British Columbia

PREFACE

The Sea Duck Monitoring Working Group, an ad hoc group formed under the auspices of the Sea Duck Joint Venture (SDJV), met March 9-11, 2005 at Patuxent Wildlife Research Center, Laurel, Maryland to develop recommendations for monitoring sea duck populations in North America. Working Group members included Daniel Bordage (CWS), Tim Bowman (USFWS), Sean Boyd (CWS), Andre Breault (CWS), Lynne Dickson (CWS), Doug Forsell (USFWS), Scott Gilliland (CWS), Jack Hodges (USFWS), Mark Koneff (USFWS), Bill Larned (USFWS), Dave Nysewander (Washington Dept Fish and Wildlife), Matt Perry (USGS), Andy Royle (USGS), and Jim Wortham (USFWS).

EXECUTIVE SUMMARY

The Sea Duck Monitoring Working Group was formed at the request of the SDJV Management Board to identify and prioritize monitoring needs for North American sea ducks. The working group met in March 2005 and produced a list of high, medium, and low priority monitoring needs. The process involved four steps: 1) identify populations or stocks that are appropriate as management units; 2) determine relative conservation priorities among stocks; 3) identify appropriate monitoring tasks for those stocks; and 4) prioritize among surveys or tasks. In addition, the working group identified activities that should be accomplished to design, evaluate the feasibility, or enable interpretation of specific surveys. A prioritized list of monitoring needs is presented to help guide decisions about how to allocate current and future funds. The working group also recognized that nearly every sea duck species is currently inadequately monitored, and that opportunities to monitor populations or conduct sea duck surveys should be encouraged and pursued when appropriate and cost effective. Further prioritization will undoubtedly be needed as new information becomes available and alternative survey techniques are tested.



INTRODUCTION

The SDJV was formed in 1999 under the auspices of the North American Waterfowl Management Plan (NAWMP) due to concern about declining populations of sea ducks. Its mission is to promote the conservation of North American sea ducks through partnerships by providing greater knowledge and understanding for effective management. One of the information needs identified in the SDJV strategic plan (SDJV Continental Technical Team 2001) as high priority for most sea duck species was determination of population size and trends.

However, relatively few additional resources have been put toward assessing population sizes and trends.

Most sea ducks are poorly monitored by traditional waterfowl surveys, and information on population size and trend for most species is unreliable. Sea ducks inhabit vast, remote breeding areas, and molting and wintering birds often gather on large lakes and coastal waters that are difficult to survey. The Waterfowl Breeding Population and Habitat Survey (WBPHS), flown in spring and used as a basis for setting population goals for many North American waterfowl, does not cover the core breeding ranges of about half the sea duck species and is not optimally timed to capture peak counts of breeding sea ducks, which generally nest later than dabbling ducks. Additionally, some groups of sea ducks have not been differentiated to species in the past during this survey (e.g., scoters, goldeneyes, mergansers). Consequently, for most populations of sea ducks, we cannot accurately estimate how many there are, relative densities, or the trajectories of their population trends. There is an urgent need for more intensive, precise surveys that will provide an index of population size for long term monitoring and robust detection of trends for all sea ducks. In addition, unlike most goose populations and some duck populations that have been defined as management units, sea ducks are not well delineated from historical surveys and banding to identify particular stocks that are oriented to the arctic, Great Lakes, or Pacific and Atlantic coasts.

Recognizing the deficiencies in monitoring programs for sea ducks, the SDJV Management Board decided to earmark annually a portion of congressionally appropriated SDJV funds toward monitoring, and directed the SDJV Continental Technical Team (CTT) to form a sea duck monitoring working group to identify and prioritize monitoring needs for North American sea ducks.

The Board also asked the CTT to consider other activities such as exploratory distributional surveys or development of survey methods that would provide information to design more robust surveys. The working group's task was to develop a prioritized list of sea duck monitoring needs to help guide decisions about how to allocate current and future funds.

The Board's primary interest was in abundance monitoring at a population level or large geographic scale to provide the primary means of tracking changes in abundance and develop abundance objectives. In addition to determining distribution, abundance, and trends, most surveys could also gather geo-referenced attributes (habitat characteristics, fishing activity, oil slicks, etc) that may be used to better interpret survey results.

Many factors suggest that it is an opportune time to undertake a comprehensive assessment of monitoring needs for North American sea ducks. The 2004 NAWMP calls for increased waterfowl monitoring and assessment capabilities. However, federal funding for traditional migratory bird management activities of federal agencies has failed to keep pace with uncontrollable program cost increases, making it necessary to restrict some traditional monitoring activities. Additional federal agency support will be necessary to meet the NAWMP recommendation. It is important that wildlife agencies in the U.S. and Canada be able to justify requests for annual resource increases based on clearly articulated assessments of resource needs for waterfowl monitoring.

Steller's Eiders, Alaska Peninsula. Photo by Tim Bowman, USFWS

How will this report and the working group's recommendations be used?

An earlier draft of this report was posted on the SDJV web site, ***seaduckjv.org,*** in September 2005. Flyway biologists, USFWS and CWS migratory bird coordinators, state, and provincial waterfowl biologists, Joint Venture coordinators, Ducks Unlimited, Flyway Councils, NGOs, and other bird conservation groups (e.g., waterbirds, habitat joint ventures) were notified about the availability of the report by email and encouraged to comment, as they may be interested in forming partnerships on surveys of joint interest. Public comments have now been incorporated into this document. This report will be posted on the SDJV web site, ***seaduckjv.org.***

This report is intended to help guide decisions about how to allocate current and future funds and resources. The SDJV emphasizes that this report represents the state of science now, and includes some survey plans for monitoring surveys based on unproven techniques or analyses. The report will likely be updated in the future as new information becomes available.

OBJECTIVES

1. Identify sea duck populations or "stocks" appropriate as management units
2. Determine relative conservation priorities among stocks
3. Identify and briefly describe appropriate monitoring surveys or tasks for those stocks
4. Prioritize among surveys or prerequisite tasks

METHODS

The working group's intent was to develop an objective process for identifying and prioritizing monitoring needs. This process involved four steps:

Identify sea duck populations or "stocks" appropriate as management units

For many species of sea ducks, there is biological justification for subdividing their North American population into subpopulations or what we will refer to as "stocks" - that are more appropriate for management purposes, including abundance monitoring. Such justification for subdivision may include recognition of distinct races (e.g., four races of common eider), complete allopatry of breeding populations (e.g., east and west populations of Barrow's goldeneye and harlequin duck), or emerging information about population delineation that may support separation of stocks on either breeding or wintering areas to facilitate management actions (e.g., east and west populations of all three scoter species, multiple stock definition for Pacific common eider). Some of these stock definitions will likely change as more information on population delineation becomes available. Future application of these conceptual monitoring or management units needs to be more broadly discussed by management agencies.

Thirty-eight stocks were identified (Table 1). In some cases, the working group identified mutually inclusive stocks recognizing that some species may be more effectively or appropriately monitored on either breeding or wintering grounds, or in some cases, molting and staging areas. In other words, the group wanted to evaluate all reasonable options for monitoring a stock on breeding, wintering, staging, or molting areas. For example, for surf and white-winged scoters, we identified the entire North America breeding population as well as separate Atlantic and Pacific wintering populations.

Table 1. Conceptual North American sea duck stocks identified by the sea duck monitoring working group. Some of these stock definitions will likely change as more information on population delineation becomes available.

Species and abbreviation used in this document	**Stock or subpopulation**
Common Eider – Pacific race (PCOEI)	
	northwest Canada and northern Alaska (breeding and wintering)
	western Alaska (breeding and wintering)
	Aleutian Islands (breeding and wintering)
Common Eider – northern race (NCOEI)	
	northeast Canada (breeding)
	eastern Canada (wintering)
	west coast Greenland (wintering)
Common Eider – Hudson Bay race (HCOEI)	
	Hudson Bay (breeding and wintering)
Common Eider – American race (ACOEI)	
	northern range (breeding)
	southern range (breeding)
	eastern North America (wintering)
King Eider (KIEI)	
	Pacific (breeding and wintering)
	Atlantic (breeding and wintering)
Steller's Eider (STEI)	
	North Slope Alaska (breeding)
	Bering Sea – Alaska and Russia (wintering)
Spectacled Eider (SPEI)	
	Yukon-Kuskokwim Delta (breeding)
	North Slope Alaska (breeding)
	Bering Sea (wintering)
Black Scoter (BLSC)	
	Atlantic (breeding and wintering)
	Pacific (breeding and wintering)
Surf Scoter (SUSC)	
	Atlantic (wintering)
	Pacific (wintering)
	North America (breeding)
White-winged Scoter (WWSC)	
	Atlantic (wintering)
	Pacific (wintering)
	North America (breeding)
Long-tailed Duck (LTDU)	
	Atlantic, Great Lakes, and Mississippi flyway (wintering)
	Pacific (wintering)
	North America (breeding)

Barrow's Goldeneye (BAGO)	
	eastern North America (breeding and wintering)
	western North America (breeding and wintering)
Common Goldeneye (COGO)	
	North America (breeding and wintering)
Bufflehead (BUFF)	
	North America (breeding and wintering)
Harlequin Duck (HARD)	
	eastern Canada and Greenland (breeding and wintering)
	eastern Canada and US (breeding and wintering)
	Pacific – Alaska (breeding and wintering)
	Pacific – Rocky Mtn / Northwest US (breeding and wintering)
Common Merganser (COME)	
	North America (breeding and wintering)
Red-breasted Merganser (RBME)	
	North America (breeding and wintering)
Hooded Merganser (HOME)	
	eastern North America (breeding and wintering)
	western North America (breeding and wintering)

Table 2. Relative conservation priorities of North American sea ducks. Shading represents degree of conservation priorities; the first group represents species that are federally listed in the U.S. or Canada whose assessments are largely guided by existing conservation or endangered species recovery plans. We acknowledge that there are many shortcomings and uncertainty related to estimation of trends and harvest, and that relative priorities may change substantially with new data and further analyses; this information should be used only as general guidance.

Species "Stock" or "Management Unit"	(A) Long Term 1970-2003 Population Trend [1]	(B) Short Term 1990-2003 Population Trend [1]	(C) "Harvest Index" (sport and Subsistence) [2]	(D) Known threats (other than hunting) or vulnerability [3]	Weighted Sum A-D	Relative Conservation Priority
Category Weight:	0.5	0.5	1	1		
STEI - North Slope Alaska (breeding)	4	3	2	4	**na**	**Threatened**
STEI - Bering Sea (AK and Russia - wintering)	4	4	1	3	**na**	**Threatened**
SPEI - Y-K Delta, Alaska (breeding)	5	1	2	3	**na**	**Threatened**
SPEI - Russia/North America (wintering)	3	3	2	3	**na**	**Threatened**
SPEI - North Slope Alaska (breeding)	4	2	1	3	**na**	**Threatened**
HARD - Eastern - USA-CAN (breeding&wintering)	3	1	2	3	**na**	**SSC[4]**
HARD - Eastern Canada and Greenland (breeding&wintering)	3	3	1	2	**na**	**SSC[4]**
BAGO – Eastern (breeding&wintering)	3	3	3	4	**na**	**SSC[4]**
BLSC – Atlantic (breeding&wintering)	4	4	4	3	**11**	**High**
NCOEI – eastern Canada (wintering)	3	3	4	4	**11**	**High**
PCOEI- NW Canada & No. AK (breeding&wintering)	5	2	4	3	**10.5**	**High**
NCOEI - West Coast Greenland (wintering)	4	4	4	2	**10**	**High**
BLSC - Pacific (breeding&wintering)	5	5	3	2	**10**	**High**
SUSC - North America (breeding)	5	5	2	3	**10**	**High**
WWSC - Atlantic (wintering)	4	4	4	2	**10**	**High**
ACOEI - southern range (breeding)	2	3	4	3	**9.5**	**High**
SUSC – Atlantic (wintering)	4	3	3	3	**9.5**	**High**
PCOEI- Western Alaska (breeding&wintering)	5	2	4	2	**9.5**	**High**
NCOEI - NE Canada (breeding)	5	2	4	2	**9.5**	**High**
KIEI - Pacific (breeding&wintering)	5	2	3	3	**9.5**	**High**
SUSC - Pacific (wintering)	5	4	2	3	**9.5**	**High**
ACOEI - northern range (breeding)	2	2	4	3	**9**	**High**
ACOEI – eastern NA (wintering)	2	2	4	3	**9**	**High**
WWSC - North America (breeding)	5	5	2	2	**9**	**High**
WWSC – Pacific (wintering)	5	4	2	2	**8.5**	**High**
LTDU - Pacific (wintering)	4	3	2	3	**8.5**	**High**
BAGO - Western (breeding&wintering)	3	3	2	3	**8**	**High**
KIEI - Atlantic (breeding&wintering)	3	3	3	2	**8**	**High**
HCOEI - Entire Population (breeding&wintering)	5	2	2	2	**7.5**	**High**
LTDU – Atlantic and Great Lakes (wintering)	4	3	2	2	**7.5**	**High**
LTDU - North America (breeding)	5	2	2	2	**7.5**	**High**
HARD – Pacific-Alaska (breeding&wintering)	3	2	2	3	**7.5**	**High**
HARD – Pacific-Rocky Mtn (breeding&wintering)	3	2	2	3	**7.5**	**High**
HOME – Eastern (breeding&wintering)	1	1	4	2	**7**	**Low**
HOME - Western (breeding&wintering)	1	3	3	2	**7**	**Low**
COGO - North America (breeding&wintering)	2	1	3	2	**6.5**	**Low**
BUFF - North America (breeding&wintering)	1	1	4	2	**7**	**Low**
PCOEI- Aleutians (breeding&wintering)	3	1	1	3	**6**	**Low**
RBME - North America (breeding&wintering)	1	1	3	1	**5**	**Low**
COME - North America (breeding&wintering)	1	1	2	2	**5**	**Low**

[1] Long- and short term population trend: 1 = increasing, 2 – stable, 3 = unknown, 4 = suspected decreasing, 5 = decreasing

[2] Proportion harvested: 1 = <1%, 2 = 1-5%, 3 = 6-10%, 4 = >10% (see Appendix A)

[3] Threats/Vulnerability: 1 = very low, 2 = low, 3 = medium, 4 = high (Sea Duck Joint Venture Management Board 2001)

[4] Species of Special Concern (Canada); State-listed as Threatened in Maine

Determine relative conservation priorities among stocks

Stocks were given a relative conservation priority based on three factors: population trend (or lack of trend information), proportion of population harvested (including sport and subsistence harvest), and known threats or vulnerabilities other than hunting (Table 2; see Appendix A for data used to generate harvest scores). Scores were entered into a matrix and a weighted sum was used to assign relative conservation priority for each stock. These criteria and methods were similar to the continental species prioritization done for the 2004 update to the NAWMP (North American Waterfowl Management Plan Committee 2005). The intent of this step was to identify stocks or populations where we should focus our efforts to further develop or identify new monitoring surveys (i.e., given the universe of all sea duck stocks in North America, which ones are higher priority than others?).

We decided that any species federally recognized as endangered, threatened, or as a species of concern in the U.S. or Canada would automatically be considered high priority regardless of their score in the matrix, and that monitoring activities addressing those species would be more thoroughly outlined in their respective recovery or conservation plans. While recognizing the importance of these species, the SDJV largely, but not exclusively, relies on dedicated recovery programs to fund endangered species activities in order to support a broadly diverse program of sea duck work on very limited appropriations.

Estimates of population trend were based on the best available information. For many stocks, the WBPHS provided the only long-term data set. Other survey data were used as appropriate, and in instances where data were lacking, we relied on expert opinion. We considered both long-term and short-term trend, with equal weight given to short- and long-term trends. Trends were categorized and scored as increasing (1), stable (2), unknown (3), suspected decreasing (4), or decreasing (5).

Estimates of population size were from several sources including Wetlands International Waterbird Population Estimates (Wetlands International 2005) and NAWMP, both of which include data provided by CTT members and other sea duck authorities, other survey data, and in some cases, expert opinion. Wherever possible, indices were adjusted upward to account for incomplete detection, incomplete coverage of the species range, and for nonbreeding birds that were not counted during surveys. These estimates were intended to reflect spring total population size.

U.S. sport harvest estimates for1992-2001were obtained from the Division of Migratory Bird Management's Harvest Information Branch, Laurel, MD. The Canadian Wildlife Service provided sport harvest data for Canada for the same years (http://www.cws-scf.ec.gc.ca/nwrc-cnrf/migb/nhs_e.cfm). Existing national surveys to estimate waterfowl harvest have important limitations for estimating harvest of sea ducks. The limitations relate to two key factors. First, because of the relatively small number of sea duck hunters and the geographically restricted harvest areas, the sampling process tends to produce estimates with low precision. Although the U.S. harvest survey system enables targeting of sea duck hunters and realizes fairly high response rates, Canadian sea duck hunters tend to be in areas of relatively low response rates and sea ducks are not sampled separately from the regular duck harvest, leading to under-sampling and low precision in estimates. Consequently, sea duck harvest estimates most likely are biased low.

A variety of surveys were used to estimate aboriginal subsistence harvest of various species in the U.S. (Paige and Wolfe 1999, also http://alaska.fws.gov/ambcc/harvest.htm), Canada (Fabijan et al. 1997), and Greenland (Wendt and Dickson 2001). However, with few exceptions, harvest of sea ducks by Aboriginal people is estimated only at rare intervals.

Although there are no reliable estimates of the magnitude of sea duck harvest in Russia, we made some rough (and probably conservative) estimates for a few species based on data of unknown quality from studies of limited geographic scope (Syroechkovski et al. 2003a, 2003b, Syroechkovski and Klokov 2004).

Using these estimates of population size and combined sport and subsistence harvest, we estimated the proportion of each species harvested. Given the limitations of the data, these estimates should be viewed as relative indices to hunting pressure rather than accurate harvest rates. We assigned these values to one of four categories: <1%, 1-5%, 6-10%, and >10% of total population harvested, with scores of 1 to 4, respectively.

Known threats or vulnerability were subjectively assigned to one of four categories using expert opinion. Categories were: very low (1), low (2), medium (3), or high (4). Examples of known threats or vulnerabilities included factors such as a history of large die-offs due to disease, large die-offs due to unfavorable ice conditions, a population that is concentrated in a small area for part of the year, threats due to impending offshore oil or wind power development, sand mining, forest harvest that reduces availability of nest cavities, or demonstrated vulnerability to oil spills (SDJV Continental Technical Team, 2001).

Scores for trends, harvest, and threats were summed for each stock and then sorted to provide a ranked list of stocks by conservation priority (Table 2). From this list, we identified a subset of stocks (those with scores 7.0 or below) that we decided did not warrant further discussion about monitoring surveys *given the limited resources available at this time and in the near future*.

Identify appropriate monitoring surveys or tasks for those stocks

We viewed the purpose of monitoring as providing data needed to inform management decisions (e.g., harvest, habitat protection) that are based upon resource status. Abundance surveys can improve management decisions and provide important insights into the mechanisms underlying changes in bird demographics when coordinated with monitoring of natural and management-induced environmental changes.

We used a step-wise decision process (Fig. 1) to identify monitoring tasks for each stock identified as high conservation priority. We relied on a review of survey and management considerations for each species (completed by the working group and other sea duck experts prior to the working group meeting) to identify one or more surveys that could provide the information necessary for the primary task of monitoring the status of each population. We also considered opportunities, where feasible, to address other management-oriented questions about a particular stock in the course of survey projects. In order to explore necessary cost and resource

efficiencies, we also identified surveys with the potential to monitor multiple species or stocks (e.g., broad scale surveys on wintering areas).

Figure 1. Process for determining priorities for management-oriented abundance monitoring

- Do we have reasonably reliable information about population trajectory?
  - **NO**: reliable estimates of N and trend are a priority
    - Do we know enough about population structure/distribution/movements to design abundance surveys?
      - NO: systematic/distributional surveys, explore survey timing
      - YES: can we formulate hypotheses about agents causing (or possibly causing, e.g., future offshore developments) population change?
        - » NO: design survey to estimate N and trend to meet precision objectives, consider sources of bias (e.g., detection)
          * Look for spatial/temporal pattern in the survey data in relation to other biological, physiographic, anthropogenic patterns that might assist in hypothesis development
        - » YES: Is abundance data useful in testing hypotheses?
          * NO: Design survey to estimate N and trend to meet precision objectives, consider sources of bias (e.g., detection)
          * YES: Do the above, but consider a design (timing/collection of auxiliary covariates) to test hypotheses
  - **YES**: Maintenance or improvement in estimates of N and trend (i.e., precision) are priority
    - Can we formulate hypotheses about agents causing (or possibly causing, e.g., future offshore developments) population change?
      - NO: Improve systematic/distributional surveys
        - » Look for spatial/temporal pattern in the survey data in relation to other ecological/physiographic/anthropogenic patterns that might assist in hypothesis development
      - YES: Is abundance data useful in testing hypotheses?
        - » NO: Determine what other monitoring data is needed
        - » YES: Design survey to estimate N and trend to meet precision objectives, consider sources of bias (e.g., detection) considering means (timing/collection of auxiliary covariates) to test hypotheses

---

We also identified activities that should be accomplished to facilitate design, evaluate the feasibility, or enable interpretation of specific surveys. For example, distributional surveys of sea ducks in previously unsurveyed areas on both the Atlantic and Pacific coasts are required to design broad scale winter surveys. Similarly, an evaluation of some of the assumptions about bird movements (timing, distance offshore or inland) is necessary to evaluate the usefulness of point counts at key migration areas, such as Point Barrow, Alaska or Avalon Beach, New Jersey.

For each survey, teams or individuals from the working group completed a brief summary for each survey, including a history of the survey (if applicable), the target stocks, survey objectives, a general description of survey design, survey prerequisites, outcomes, geographic coverage, survey platform, survey timing, survey frequency, primary survey strengths and limitations, potential partners, and rough estimates of cost for prerequisites and for an operational survey (Appendix B). The working group then discussed each survey to ensure a better understanding and more informed assessment of the relative priorities prior to the next step.

The working group identified many prerequisites – tasks that must be completed before a particular survey could be implemented or properly interpreted. For example, information on population distribution, size, and trend should be complemented by efforts to delineate populations using satellite telemetry, stable isotopes, banding, or genetic techniques. Until populations are delineated, interpretation and evaluation of population trends may be compromised. Other examples include reconnaissance surveys of currently unsurveyed regions, development of survey techniques, estimation of detection rates, or evaluation of assumptions regarding bird turnover rates or migration paths through survey areas.

Prioritize among surveys or tasks

The working group then scored surveys as high, medium or low (scores of 3, 2, or 1, respectively) based on feasibility, perceived cost effectiveness in meeting stated objectives, whether or not more than one stock/species would be covered, and the proportion of a population

covered by a survey. Average scores were used to develop final ranking. The team arbitrarily assigned the 11 surveys with the highest scores to the high priority category and the remaining 13 surveys to the medium priority category.

RESULTS AND DISCUSSION

Thirty-one stocks were identified, not including stocks for the four populations that are federally recognized as threatened in the U.S. or are on the Species of Concern list in Canada. When defining stocks, we assumed that site fidelity to wintering areas and philopatry to breeding areas is high. Most studies that have examined these behaviors support this assumption.

Seven of the 31 non-listed stocks were considered low in conservation priority (Table 2). For the remaining 24 stocks of higher priority, 23 surveys were identified for further consideration. The group found that for most stocks, the level of knowledge about population status, life history, ecology, and harvest was so poor that management-oriented questions could not yet be identified. Thus, the primary objective of most surveys at this time was to monitor distribution, abundance, and trends. Although this report deals primarily with distribution, abundance, and trend surveys, there are several other types of tools that can aid in waterfowl management, such as age ratio surveys, harvest surveys, banding programs, and brood surveys.

The final prioritized list of recommended sea duck monitoring surveys (Table 3) included surveys of four U.S. federally-listed threatened species or Canadian Species of Special Concern for which we simply deferred to recovery or conservation plans for surveys. We ranked 11 of the remaining 23 monitoring projects as high priority surveys and 12 as medium priority surveys (Table 3). Twelve of the 23 high or medium priority surveys address a single species and at least eleven could potentially adequately monitor more than one sea duck species.

The list of recommended surveys includes more than one survey for several species, indicating that there may be more than one way to monitor a stock. For example, there are three surveys listed that would primarily monitor the Atlantic population of black scoters. None of the three are proven techniques, and it's likely that only one of those surveys would be required to monitor the population. Thus, the working group did not advocate multiple surveys for specific stocks, but rather identified potential survey options that should be evaluated before a decision is made to advocate one over the others as a primary monitoring survey. The fact that one of those options (James Bay BLSC molting survey) was prioritized high versus medium for the other two (Breeding scoter survey, Atlantic Black Scoter spring staging survey) reflects the group's consensus that the former survey may be a more viable or cost efficient monitoring tool than the other options.

Table 3. Relative priorities of sea duck monitoring surveys as recommended by the Sea Duck Monitoring Working Group. Surveys are not listed in order of priority within the relative priority groups.

Relative Priority	Survey Name	Primary Sea Duck Species/Stocks Targeted	Estimated Cost of Prerequisites ($K US)	Rough Estimated Operational Cost/Yr ($K US) 2007/2008	Current (2007) Status of Survey[2]	Agency(s) or group most likely responsible for survey
Listed	Spectacled Eider – Surveys as Recommended in Recovery Plan	SPEI – Y-K Delta, N.Slope	Not estimated	Not estimated	Ongoing	USFWS
Listed	Steller's Eider - Surveys as Recommended in Recovery Plan	STEI – Alaska	Not estimated	Not estimated	Ongoing	USFWS
Listed	Eastern Barrow's Goldeneye - Surveys as Recommended in Conservation Plan	Eastern BAGO	Not estimated	Not estimated	Ongoing (in Canada only)	CWS
Listed	Eastern Harlequin Duck- Surveys as Recommended in Conservation Plan	HARD wintering in eastern U.S. and Canada	Not estimated	Not estimated	Ongoing	CWS, USFWS
High	Waterfowl Breeding Population and Habitat Survey (WBPHS)	Many	Not estimated	Not estimated	Operational	USFWS, CWS
High	Alaska North Slope Waterfowl and Waterbird Survey	PKIEI, SPEI, LTDU	0	25[1]	Operational	USFWS
High	James Bay Atlantic Black Scoter Molting Survey	ABLSC	20	14	Developmental	CWS
High	Pacific Flyway Winter Sea Duck Survey	PSUSC, PWWSC, PLTDU, PBAGO, PHARD	0	300[1]	Developmental	USFWS, CWS, states
High	Atlantic and Gulf Coasts Wintering Sea Duck Survey	AWWSC, ASUSC, ABLSC, ALTDU, ACOEI	67 for 3 yrs	91[1]	Developmental	USFWS
High	Pt. Barrow, Alaska Eider Spring Migration Counts	PCOEI, PKIEI	0	50-70 every 3 yrs	Operational	North Slope Borough, USFWS
High	Pacific Black Scoter Breeding Survey	PBLSC	0	41	Operational	USFWS
High	Yukon-Kuskokwim Delta Aerial and Nest Surveys	PCOEI, SPEI	0	65[1]	Operational	USFWS
High	Waterfowl Breeding Population Survey for Central and Western Arctic Canada	PKIEI, LTDU	0	120-160	Developmental	USFWS, CWS
High	Scoter Breeding Survey	WWSC, SUSC,	30-40 for 3 yrs	90-150[1]	New, Conceptual	USFWS, CWS

		ABLSC			in most of range	
High	Northern Common Eider Canada Winter Surveys	NCOEI wintering in NE CAN	10-20 every 5 yrs	25-35 every 5 yrs[1]	Operational	CWS
Medium	Northern Alaska Coastal Pacific Common Eider Breeding Survey	PCOEI	0	25	Operational	USFWS
Medium	Atlantic Surf Scoter Fall Staging Survey	ASUSC	5-10 for 3-5 yrs	16	New, Conceptual	CWS
Medium	Great Lakes Winter Survey	ALTDU	5-10 for 2-3 yrs	26	Developmental	USFWS, CWS, Bird Studies Canada, states and provinces
Medium	Northwest Alaska Common Eider Breeding Population Survey	PCOEI	0	21	Developmental	USFWS
Medium	Central Arctic Canada Pacific Common Eider Breeding Survey	PCOEI	0	100	Developmental	CWS
Medium	Atlantic Black Scoter Spring Staging Survey	ABLSC	40 for 2 yrs	19	Developmental	CWS
Medium	Avalon, NJ Seawatch	ASUSC, ABLSC	15 for 2 yrs	26	Operational	New Jersey Audubon
Medium	Point Lepreau, NB Spring Migration Count	ABLSC, ASUSC	15 for 2 yrs	8	Operational	St. John Naturalist Club
Medium	Hudson Bay Common Eider Colony Counts	HCOEI	0	80 plus 70 every 5 yrs[1]	Intermittent	CWS
Medium	Northern Common Eider Nest Counts	NCOEI	0	190 plus 130 every 5 yrs[1]	Intermittent	CWS
Medium	American Common Eider Breeding Survey	ACOEI	0	45 every 5 yrs[1]	Developmental	CWS, USFWS, states and provinces
Medium	Pacific Barrow's Goldeneye Breeding Survey	PBAGO	0	90-110[1]	Developmental	CWS, USFWS

[1] Salary/personnel costs not included

[2] Ongoing: surveys of listed species that are conducted based on species' respective conservation plans.
Operational: techniques are established; survey is, or could be, repeated given adequate resources.
Intermittent: techniques are established and survey has historically been completed at infrequent intervals.
Developmental: techniques, design, or assumptions are not yet fully developed but pilot surveys have been done.
New, Conceptual: techniques and/or survey design are largely hypothetical and untested.

The working group's task was to develop a prioritized list of sea duck monitoring needs to help guide decisions regarding allocation of current and future funds and/or to provide support for continuation of some existing surveys. The relative priorities are intended to help guide decisions among competing options. However, the working group also recognized that nearly every sea duck species is currently inadequately monitored, and that opportunities to monitor populations or conduct surveys listed as low priority should be pursued when appropriate and cost effective. Similarly, the working group acknowledges that there may be surveys not identified in this report that may prove to have merit as our knowledge of sea duck life histories and seasonal distribution improves.

Given the uncertainty about the definition of population units for several species, it seems prudent to design surveys focused at smaller scales to maintain adequate precision to detect trends of potential sub-populations. Examining spatial variation in population trends may help guide comparative research that would provide insights into mechanisms controlling local populations.

Although one of the charges to the working group was to develop priorities on how to spend SDJV funds for monitoring, we realized that current funding is a paltry amount in the context of even the high priority monitoring needs for sea ducks. Substantial new sources of funding will be needed to meet currently unmet monitoring needs for sea ducks.

The U.S. Fish and Wildlife Service and Canadian Wildlife Service should provide leadership to ensure adequacy and compatibility of survey designs to address monitoring needs of sea ducks continentally, but states, provinces, flyway councils, and other interested entities also must be deeply involved. Agencies, organizations, and industry can participate by: 1) providing funding or other assistance (aircraft, observers, fuel, housing) to support survey operations; 2) providing baseline information on sea duck distribution, abundance, or timing of migration or breeding for specific areas; 3) maintaining existing surveys that provide information on sea ducks in important breeding or wintering areas; 4) supporting research that will complement survey data, such as satellite telemetry to help identify geographically distinct populations; and 5) advancing the need for this work and garnering support in legislative arenas.

LITERATURE CITED

Fabijan, M., R. Brook, D. Kuptana, and J. E. Hines. 1997. The subsistence harvest of King and Common eiders in the Inuvialuit Settlement Region. 1988-1994. *In*. D. L. Dickson [Ed.] King and Common Eiders of the western Canadian Arctic. Occ. Pap. No. 94. Can. Wildl. Serv., Ottawa, Canada.

North American Waterfowl Management Plan, Plan Committee. 2004. North American Waterfowl Management Plan 2004. Strategic Guidance: Strengthening the Biological Foundation. Canadian Wildlife Service, U.S. Fish and Wildlife Service, Secretaria de Medio Ambiente y Recursos Naturales, 22 pp.

North American Waterfowl Management Plan, Plan Committee. 2005. North American Waterfowl Management Plan 2004. Implementation Framework: Strengthening the Biological Foundation. Canadian Wildlife Service, U.S. Fish and Wildlife Service, Secretaria de Medio Ambiente y Recursos Naturales, 117 pp.

Paige, A. W. and R. J. Wolfe. 1999. The subsistence harvest of migratory birds in Alaska – 1996 update. Unpublished report, Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska. 127 pp.

SDJV Continental Technical Team. 2001. Sea Duck Joint Venture Strategic Plan, 2001-2006. Available at: http://seaduckjv.org/pdf/StratPlan2001_06.pdf.

Syroechkovski, E., Jr., V. Buzun, E. Lappo, and K. Klokov. 2003a. Steller's eider in Chukotka: results of distribution and subsistence hunting surveys in 2002. Unpublished report of the Goose, Swan and Duck Study Group of Northern Eurasia. Moscow. 23 pp.

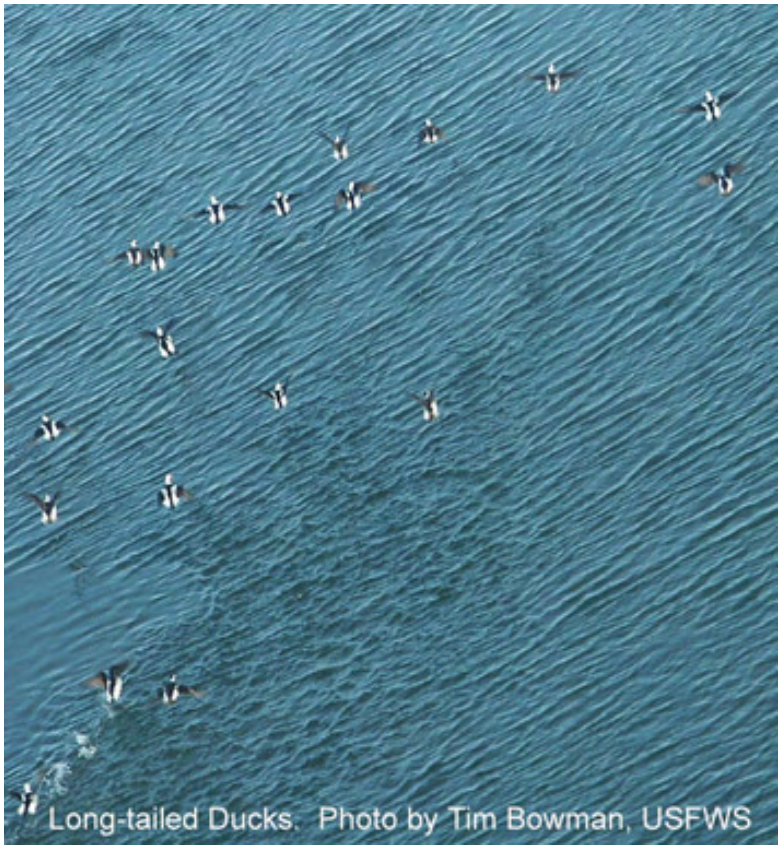
Syroechkovski, E., Jr., K. Klokov, and E. Lappo. 2003b. Waterfowl subsistence hunting in Lower Indigirka with special focus on eider harvest. Results of the year 1999. Unpublished report of the Goose, Swan and Duck Study Group of Northern Eurasia. Moscow. 17 pp.

Syroechkovski, E., Jr., and K. Klokov. 2004. Waterfowl subsistence harvest survey in Chukotka, 2003. Unpublished report of the Goose, Swan and Duck Study Group of Northern Eurasia. Moscow. 31 pp.

The Joint Working Group on the Management of the Common Eider. 2004. *Quebec Management Plan for the Common Eider Somateria* mollissima dresseri. A special publication of the Joint Working Group on the Management of the Common Eider, Quebec. 44 pp.

Wendt, J. S. and K. Dickson. 2001. An estimate of waterfowl harvest by aboriginal people in Canada. Unpublished report. Canadian Wildlife Service, Hull, Quebec, Canada.

Wetlands International. 2005 (in prep). Waterbird population estimates – Fourth edition. Wetlands International Global Series. Wageningen, The Netherlands.



Long-tailed Ducks. Photo by Tim Bowman, USFWS

APPENDICES

Appendix A. Abundance and harvest estimates for North American sea duck populations or stocks.

Information sources: Sport harvest estimates from USFWS and CWS. Sport harvest estimates for eastern Harlequin Duck and Barrow's Goldeneye represent incidental or illegal harvest. Alaska subsistence estimates from Paige and Wolfe (1998) and other USFWS data. Canada subsistence harvest estimates provided by Fabijan et al. (1997), Kathy Dickson (CWS) and other experts' opinion, apportioned to stock using best judgment from experts. Rough estimates of Russia harvest are based on scant data and reports of limited geographic extent.

				Harvest Estimates Derivation					
Species, "Stock" or Population	**Season**	**Abundance Estimate**	**Abundance Source**	**Sport 1992-2001 avg**	**Alaska Subsistence**	**Canada Subsistence**	**Total**	**Index of Percent of Population Harvested**	**Notes/assumptions**
Pacific Common Eider									
PCOEI- NW Canada & Alaska North Slope	breeding	120,000	Pt Barrow Counts	0	10,000	1500-3,000	11500-13,000	9.5-10.8	AK sub harvest = 6000 AK + est 4000 Russia; Can sub harvest estimate from Fabijan et al. 1997
PCOEI- Western Alaska	breeding and wintering	25,000	USFWS surveys	0	1,000	0	1,000	4.0	
PCOEI- Aleutians	breeding and wintering	22,000	WI 2005, V. Byrd & D. Gibson, pers.comm.	0	200	0	200	0.9	
Northern Common Eider									
NCOEI - NE Canada	breeding	600,000	Quebec Mgt Plan (2004)	20,000	0	74,500	94,500	15.8	Ungava Bay 5000, Nfld & Labrador 24,000, Baffin north 5000, Greenland 60,500
NCOEI - West Coast Greenland	wintering	460,000	Quebec Mgt Plan (2004), Merkel. Pers. comm..		0	60,500	60,500	13.2	
NCOEI- Eastern Canada	wintering	200,000	D. Bordage, pers. comm..	20,000	0	4,700	24,700	12.4	assumes 1/3 of Can subsistence targets the stock that winters in NA
Hudson Bay Common Eider									
HCOEI - Entire population (non-migratory)	breeding and wintering	225,000	Quebec Mgt Plan (2004)		0	3,000	3,000	1.3	
American Common Eider									
ACOEI - Northern range	breeding	82,000	Quebec Mgt Plan (2004)	4,500	0	7,000	11,500	14.0	Can subsistence estimates from S. Gilliland and G. Gilchrist
ACOEI - Southern range	breeding	190,000	B. Allen and D. Bordage, pers comm..	30,000	0	1,000	31,000	16.3	
ACOEI - Eastern NA	wintering	272,000	Various surveys, expert opinion	34,800	0	8,000	42,800	15.7	

Species, "Stock" or Population	Season	Abundance Estimate	Abundance Source	Sport 1992-2001 avg	Alaska Subsistence	Canada Subsistence	Total	Index of Percent of Population Harvested	Notes/assumptions
King Eider									
KIEI - Atlantic	breeding and wintering	200,000	Expert opinion	428	0	19,400	19,828	9.9	assumes Can sub harvest of 6000 is 40:60 Atlantic:Pacific; Can harvest = 3000 + 17000 harvested in Greenland
KIEI - Pacific	breeding and wintering	360,000	Pt. Barrow counts	30	19,500	3,600-5900	23,130-25,430	6.4 -7.0	Canadian sub harvest from Fabijan et al. 1997. AK sub harvest = 16500 AK + est 3000 Russia
Spectacled Eider									
SPEI - North Slope Alaska	breeding	9,000	USFWS surveys	0	50	0	50	0.6	
SPEI - Y-K Delta, Alaska	breeding	8,000	USFWS surveys	0	200	0	200	2.5	
SPEI – Bering Sea	wintering	360,000	USFWS surveys	0	4,000	0	4,000	1.1	
Steller's Eider									
STEI - North Slope Alaska	breeding	1,000	USFWS&ABR surveys	0	50	0	50	5.0	Harvest source: USFWS harvest surveys, adjusted by expert opinion.
STEI - Bering Sea	wintering	180,000	USFWS surveys	0	5,000	0	5,000	2.8	Harvest source: USFWS harvest surveys
Black Scoter									
BLSC - Pacific	breeding and wintering	150,000	USFWS 2004 surveys	275	10,000	0	10,275	6.9	Harvest source: USFWS harvest surveys
BLSC - Atlantic	breeding and wintering	200,000	NJ Sea Watch data	9,680	0	12,000	21,680	10.8	assumes Can sub scoter harvest of 20K is 60% blsc, 25% susc, 15% wwsc
Surf Scoter									
SUSC - North America	breeding	600,000	NAWMP	22,329	2,000	5,000	29,329	4.9	assumes Can sub scoter harvest of 20K is 60% blsc, 25% susc, 15% wwsc; 80% of harvest in east
SUSC - Pacific	wintering	400,000	Expert opinion	1,275	2,000	1,000	4,275	1.1	assumes Can sub scoter harvest of 20K is 60% blsc, 25% susc, 15% wwsc; 80% of harvest in east
SUSC - Atlantic	wintering	300,000	NJ Sea Watch data	21,054	0	4,000	25,054	8.4	assumes Can sub scoter harvest of 20K is 60% blsc, 25% susc, 15% wwsc; 80% of harvest in east
White-winged Scoter									
WWSC - North America	breeding	400,000	NAWMP – reduced based on expert opinion	12,311	5,000	3,000	20,311	5.1	assumes Can sub scoter harvest of 20K is 60% blsc, 25% susc, 15% wwsc; 80% of harvest in east

Species, "Stock" or Population	Season	Abundance Estimate	Abundance Source	Sport 1992-2001 avg	Alaska Subsistence	Canada Subsistence	Total	Index of Percent of Population Harvested	Notes/assumptions
WWSC - Pacific	wintering	300,000	guess re: E-W proportions	596	5,000	600	6,196	2.1	assumes Can sub scoter harvest of 20K is 60% blsc, 25% susc, 15% wwsc; 80% of harvest in east
WWSC - Atlantic	wintering	100,000	guess re: E-W proportions	11,714	0	2,400	14,114	14.1	assumes Can sub scoter harvest of 20K is 60% blsc, 25% susc, 15% wwsc; 80% of harvest in east
Long-tailed Duck									
LTDU - North America	breeding	1,000,000	NAWMP, expert opinion	20,113	13,000	6,000	39,113	3.9	
LTDU - Pacific	wintering	500,000	guess (some winter in Russia)	451	13,000	1,000	14,451	2.9	AK sub harvest = 11000 AK + est 2000 Russia
LTDU - Atlantic (MF and GL included)	wintering	500,000	guess re: E-W proportions	19,661	0	5,000	24,661	4.9	assumes ~80% of Can sub harvest of 6000 occurs in east
Barrow's Goldeneye									
BAGO - Eastern	breeding	4,250	D. Bordage, pers comm	300	0	50	350	8.2	assume Can sub harvest of 1000 is 10:90 east:west
BAGO - Western	breeding	200,000	NAWMP, expert opinion	1,500	2,000	950	4,450	2.2	assumes AK sub harvest is 2:1 bago"cogo; assume Can sub harvest of 1000 is 10:90 east:west
Common Goldeneye									
COGO - North America	breeding and wintering	1,300,000	USFWS 2005,NAWMP	102,212	1,000	11,000	114,212	8.8	assumes AK sub harvest is 2:1 BAGO:COGO
Bufflehead									
BUFF - North America	breeding and wintering	1,400,000	USFWS 2005, NAWMP	175,521	600	7,000	183,121	13.1	Likely that either harvest estimates are high or population estimate is low.
Harlequin Duck									
HARD - Pacific	breeding and wintering	200,000	Expert opinion, piecemeal surveys	519	2,200	0	2,719	1.4	
HARD - Eastern - GRLD-CAN	breeding and wintering	12,000	WI 2005	100	0	0	100	0.8	Greenland harvest unkown
HARD - Eastern - USA-CAN	breeding and wintering	1,800	WI 2005	30	0	0	30	1.7	
Common Merganser									
COME - North America	breeding and wintering	1,200,000	NAWMP, expert opinion	27,280	400	7,000	34,680	2.9	assumes AK sub harvest is 2:1 RBME:COME
Red-breasted Merganser									
RBME - North America	breeding and wintering	350,000	NAWMP, expert opinion	25,771	800	2,000	28,571	8.1	assumes AK sub harvest is 2:1 RBME:COME

Species, "Stock" or Population	Season	Abundance Estimate	Abundance Source	Sport 1992-2001 avg	Alaska Subsistence	Canada Subsistence	Total	Index of Percent of Population Harvested	Notes/assumptions
Hooded Merganser									
HOME - Eastern	breeding and wintering	400,000	NAWMP, WI 2005, increased based on magnitude of harvest data; guess re: E-W portions	83,324	0	6,000	89,324	22.3	Likely that either harvest estimates are high or population estimate is low.
HOME - Western	breeding and wintering	85,000	NAWMP, WI 2005; guess re: E-W proportions	8,000	0	0	8,000	9.4	

Citations for Appendix A.

Fabijan, M., R. Brook, D. Kuptana, and J. E. Hines. 1997. The subsistence harvest of King and Common eiders in the Inuvialuit Settlement Region. 1988-1994. *In*. D. L. Dickson [Ed.] King and Common Eiders of the western Canadian Arctic. Occ. Pap. No. 94. Can. Wildl. Serv., Ottawa, Canada.

NAWMP: North American Waterfowl Management Plan, Plan Committee. 2004. North American Waterfowl Management Plan 2004. Strategic Guidance: Strengthening the Biological Foundation. Canadian Wildlife Service, U.S. Fish and Wildlife Service, Secretaria de Medio Ambiente y Recursos Naturales, 22 pp.

Paige, A. W. and R. J. Wolfe. 1999. The subsistence harvest of migratory birds in Alaska – 1996 update. Unpublished report, Alaska Department of Fish and Game, Division of Subsistence, Juneau, Alaska. 127 pp.

Pt Barrow Counts: Suydam, R. S., D. L. Dickson, J. B. Fadely, and L. T. Quakenbush. 2000. Population declines of king and common eiders of the Beaufort Sea. Condor 102:219-222.

Quebec Management Plan (2004): The Joint Working Group on the Management of the Common Eider. 2004. *Quebec Management Plaln for the Common Eider Somateria* mollissima dresseri. A special publication of the Joint Working Group on the Management of the Common Eider, Quebec. 44 pp.

USFWS 2005: U.S. Fish and Wildlife Service. 2005. Waterfowl population status, 2005. U.S. Department of Interior, Washington, D.C. USA

USFWS harvest surveys: http://alaska.fws.gov/ambcc/harvest.htm

WI 2005: Wetlands International. 2005 (in prep). Waterbird population estimates – Fourth edition. Wetlands International Global Series. Wageningen, The Netherlands.

Appendix B. Summaries for sea duck monitoring surveys evaluated by Sea Duck Monitoring Working Group

Waterfowl Breeding Population and Habitat Survey

Status and/or Brief History of Survey: This aerial survey became operational in 1955 in core "mid-continent" survey areas. Since 1990 strata delineated in important duck breeding areas in eastern Canada and the northeast United States have been progressively phased into this long running wildlife survey (Fig. 1). The purpose of this survey is to provide reliable population indices of most dabbling duck species and to monitor population trends in habitats representative of primary North America duck breeding grounds. Because of the consistent survey effort, over a long time period, the WBPHS is an important, and often the only, source of trend data for some sea duck species or species groups.

Primary Species or Population Targeted and Proportion of Range Covered by the Survey: This survey provides information of uncertain and variable reliability and coverage for most species of sea ducks. It is probably more useful for widely distributed species that can be identified easily from the air or by geographic distribution, such as common goldeneye and bufflehead. The survey is less useful for species with ranges poorly covered by the survey (eiders, long-tailed duck) or for species that are lumped into species groups (scoters, mergansers) or forest- and stream-dwelling species not easily detected from air (harlequin duck, hooded merganser). Proportion of range covered varies by species. See *Limitations*, below.

Survey Objectives: Provide spring population size and trajectory for certain North American duck species (primarily dabbling ducks) to help establish hunting regulations in the U.S. and Canada. Sea ducks were not considered a priority for this survey, although they are counted.

Survey Platform: Fixed-wing aircraft

Survey Timing and Recommended Frequency: May and June, depending on latitude, with higher latitudes surveyed later; annually

Methods and Survey Design: The survey area now comprises more than 70 strata delineated according to habitat differences and political boundaries. Within strata, ducks are counted by two-person aerial crews while flying fixed-wing aircraft along established transect lines approximately 50 m above ground level (U.S. Fish and Wildlife Service and Canadian Wildlife Service 1987). Transects are 400 m wide and divided into segments, each roughly 29 km in length. Ponds are counted. In prairie and parkland strata, where ground transportation networks and access is good, ground crews survey a sub-sample of aerial segments. Ground counts are used to compute visibility correction factors that adjust the counts of each aerial crew for each species to account for birds not observed from the air. In the northern portions of the traditional survey area and the eastern survey area, duck estimates are adjusted using visibility correction factors derived from a comparison of airplane and helicopter counts. Records in this database include year, strata, transect, and segment identifiers, species, and the number of single drakes, pairs, and mixed sex flocks counted by the aerial survey crew.

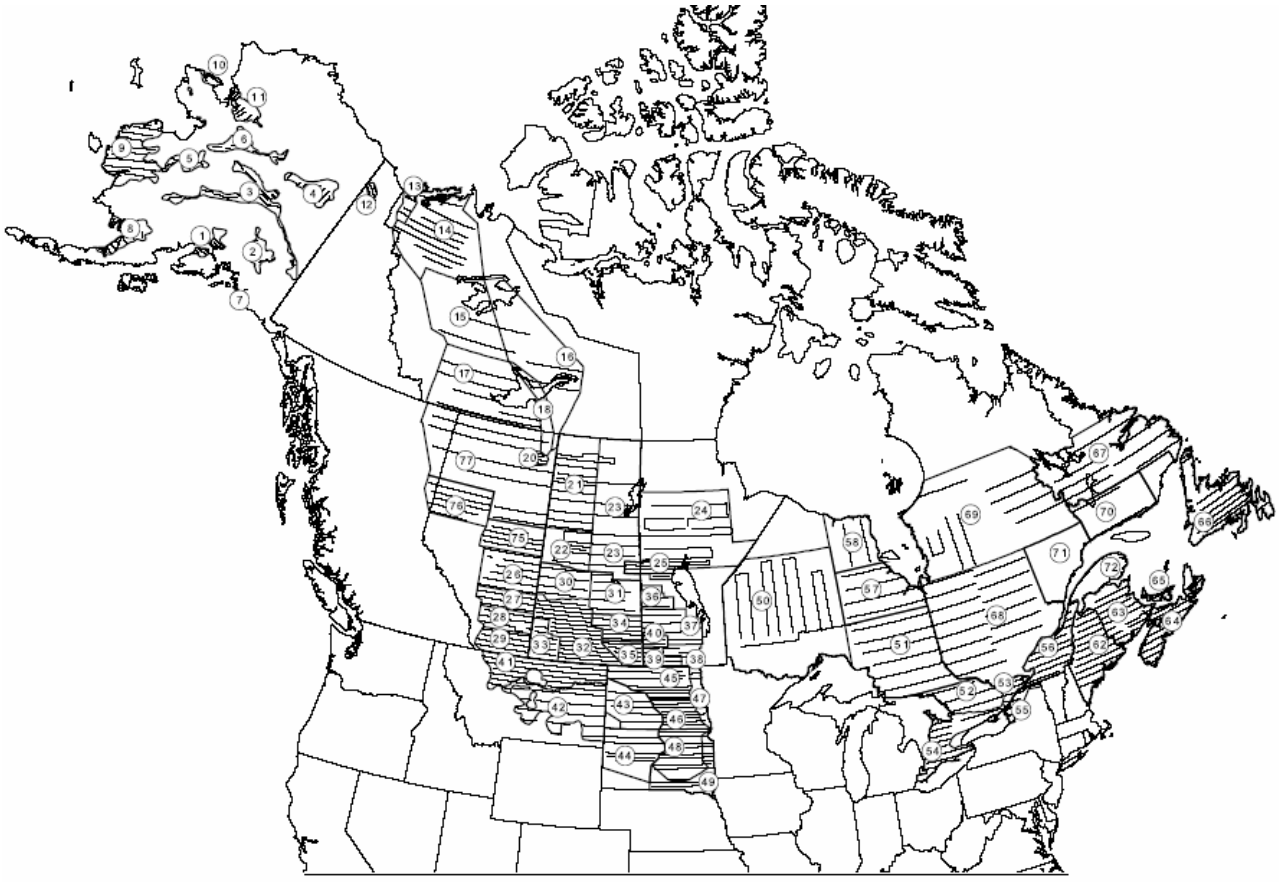


Figure 1. Strata and transects of the Waterfowl Breeding Population and Habitat Survey

Products: Population indices applicable to the survey area, with estimated detection rates that allow adjustment for differential visibility among species and habitats. A report is generated each year (U.S. Fish and Wildlife Service 2005) that includes population estimates for all species or species groups surveyed.

Survey Prerequisites: None

Primary Survey Strengths: Long-running survey (since 1955), broad geographic coverage, multi-species, consistent methodology.

Limitations of the Survey: The spatial sampling design and timing of the survey are focused primarily on mallards, an early-nesting species that is important in the annual duck harvest of both the United States and Canada. The survey has known limitations for species which breed in significant densities well beyond the strata boundaries of the survey such as many sea ducks. Likewise, the timing of the survey, while near optimal for mallards, may be too early for some diving ducks and sea ducks and may result in double counting of birds during migration, or in counting birds prior to reaching their breeding grounds terminus area.

Schedule for Proposed Survey, Analysis, and Reporting: Survey is flown from early May to mid- June, depending on latitude. Survey data are analyzed by Division of Migratory Bird Management in Laurel, MD. An annual report is generated in July of each year.

Potential Partners or Funding Sources: USFWS, CWS, state and provincial agencies.

Budget: Beyond the scope of this document.

Primary Contact for Survey: Mark Koneff, U.S. Fish and Wildlife Service, Chief, Branch of Population and Habitat Assessment**,** 11510 American Holly Drive
Merriam Building, Laurel, MD 20708-4016

Literature Cited:

U.S. Fish and Wildlife Service. 2005. Waterfowl population status, 2005. U.S. Department of the Interior, Washington, D.C. U.S.A

U.S. Fish and Wildlife Service and Canadian Wildlife Service. 1987. Standard operating procedures for aerial waterfowl breeding ground population and habitat surveys in North America. Dept. of Interior.

Alaska North Slope Waterfowl and Waterbird Survey

Status and/or Brief History of Survey: This survey will combine two aerial surveys previously conducted at different intensities and with slightly different timing to meet different objectives. The Arctic Coastal Plain Breeding Waterfowl Survey has been conducted since 1986 over the primary breeding range (61,645km^2) of all waterfowl species, at a systematic 2 percent sampling intensity, to provide breeding population indices for most waterfowl and other waterbirds (e.g., loons, gulls, jaegers). However, the late June-early July timing of this survey misses most of the spectacled and king eiders, whose males typically depart immediately following nest initiation, about 20 June. The Eider Breeding Population Survey, conducted during early to mid June and with a higher sampling intensity (4 percent) over only the wet tundra portion of the coastal plain (30,755km^2) was designed to complement the former survey by providing reliable breeding indices for the these two eider species. However, all other species surveyed during the former survey have also been recorded during the eider survey, and the results compared. In the area for which the two surveys overlap, it is believed that the primary component that is present during the later survey but not during the eider survey is composed of birds that will not breed on the coastal plain (e.g. post-breeding male pintails, subadult and failed breeding geese), and probably some local breeders that have already failed. Therefore, for more accurate results for breeding geese and ducks, and to improve statewide program efficiency in the face of shrinking budgets, we have decided to combine the two surveys, using the earlier (eider survey) window and sampling intensity, but the geographic coverage of the later survey.

Primary Species or Population Targeted and Proportion of Range Covered by the Survey: Species addressed, in suggested descending order of priority, are spectacled eider, yellow-billed Loon, long-tailed duck, red-throated loon, king eider, black brant, white-fronted goose, tundra swan, and northern pintail,. The area covered includes nearly all arctic coastal plain breeding habitat for these species. The area covered provides breeding habitat for: spectacled eider: >50% of N. Amer. (Alaska) breeding population; yellow-billed loon: 80% of Alaskan (U.S.), 25% of North American, and 20% of world breeding population; Long-tailed duck: approx. 56% of Alaska breeding population, at least 10% of the current N. American estimate; Red-throated loon: approx. 20% of Alaska breeding population; king eider: approximately 5% or less of Western Canadian/Alaskan, but 100% of U.S. (Alaskan) breeding population; brant: about 5-6,000 breeding birds, representing about 5% of the Alaska breeding population; White-fronted goose: about 40,000 apparently breeding birds (seen in singles and pairs), mostly belonging to the mid-continent population which numbers at least 700,000; tundra swan: about 10,000 birds, or 5-7% of the Alaska breeding population; northern pintail: about 10,000 birds, representing about 1% of the Alaska breeding population;

Survey Objectives: The primary objective is to provide annual breeding population indices suitable for monitoring long term trends, and precise distributional data. High-resolution distributional data is especially important for this area for predicting and reducing/avoiding negative impacts of the rapid changes occurring due to oil and gas development and arctic climate warming trends.

Survey Platform: Fixed-wing amphibious aircraft - Cessna 206.

Survey Timing and Recommended Frequency: Early June; actual dates dictated by field reports or reconnaissance surveys. Conducted annually.

Methods and Study Design: Systematic transects oriented east-west across the north slope of Alaska, spaced 2.3km apart. Every fourth transect is flown on a given year, and the adjacent set of transects the following year,etc., so each transect is flown once every four years. This maximizes long-term spatial coverage for a more precise portrayal of distribution. Two aircraft and aerial crews will be used to complete all transects within the optimal eider survey window. Pilot and right-seat observer will count all birds observed within 200m of the flight path using a computer recording program that links GPS coordinates to each observation. There is no plan for a detection-rate study for this survey. However, standard average detection rates as determined by a helicopter/fixed-wing study of tundra habitats on the YK Delta, 1989-91, will be applied to indices for some duck species, producing estimates that conform to the established SOP for the North American waterfowl breeding population surveys, so that they may be included in the continental data set.

Additional References:
http://alaska.fws.gov/mbsp/mbm/waterfowl/surveys/nsesurvy.htm
http://alaska.fws.gov/mbsp/mbm/waterfowl/surveys/acpbp.htm

Products: Population index used to track population trends

Survey Prerequisites: None

Primary Survey Strengths: Same pilot since initiation of survey; consistent methodology; broad and relatively intensive coverage

Limitations of the Survey: Timing is important – too early and habitat may still be snow/ice covered, too late and some male eiders may have departed from breeding grounds. This short window requires commitment of two aircraft and aerial crews during the peak of spring waterfowl studies in northern areas. Detection rate studies, which have been requested by many data user groups, have been attempted on a limited scale but not successfully completed due to logistic, cost and other constraints and difficulties. Phenology is variable across survey area – more simultaneous in some years than others.

Schedule for Proposed Survey, Analysis, and Reporting: The survey is conducted in early June. Preliminary results are usually available by mid-July and final annual reports will be completed by October of the same year.

Potential Partners or Funding Sources: USFWS Migratory Bird Management Alaska Region (primary responsibility and funding), Bureau of Land Management in some years.

Budget: $25K (US) not counting salaries. Currently funded entirely by USFWS Region 7 Migratory Bird Management.

Primary Contact for Survey: Bill Larned, USFWS, 1011 E. Tudor Rd., Anchorage, AK; William_larned@fws.gov, 907-260-0124; Ed Mallek, USFWS, 1412 Airport Way, Fairbanks, AK 99701, 907-456-0341, ed_mallek@fws.gov

James Bay Atlantic Molting Black Scoter Survey

Status and/or Brief History of Survey: New Survey. Exploratory surveys in eastern North America have located large concentrations of molting male Black Scoters in James Bay.

Primary Species or Population Targeted and Proportion of Range Covered by the Survey: Uncorrected estimates suggest that about 140,000 male Bay Black Scoters molt at sites along James Bay.

Survey Objectives: Estimate population trends.

Survey Platform: High-wing twin engine aircraft.

Survey Timing and Recommended Frequency: Annual surveys in late July or early August.

Methods and Survey Design: Surveys will employ model-based estimators to combine photo counts and visual estimates (see Bordage et al. 1998). A high altitude flight (300-500 m) will be conducted over all open water areas to locate flocks. Each flock will be approached to optimize visibility, photographed and the main observer will make a visual estimate of the number of birds. Ratio estimators will be used to produce estimates total number of birds (Bordage et al., 1998). Photographs will be taken with digital 10-12 mega-pixel SLR cameras fitted with 28-135 mm image stabilized lenses.

Figure 1. Location of core area (yellow) and prerequisite survey areas (adjacent light blue)in Hudson and James Bays.

Products: Population index and trend estimate.

Survey Prerequisites: Large areas of the coasts of James Bay remain to be surveyed. Additional exploratory surveys of the Hudson's Bay coasts (east, west and the Belcher Islands) are required to determine if important concentrations of molting scoters occur in these areas. This would require approximately 30 hrs air charter for West Coast Hudson's Bay, 20 hrs for East Coast Hudson's Bay, and 20 hrs for Ungava Bay (estimates do not include ferry time).

Studies of activity patterns are required to determine timing when diving is minimal (related to time and tide) and methods to estimate the proportion of birds underwater during the surveys may need to be developed.

These surveys rely on image-corrected estimates of flock size. This technique has been successfully used for estimating abundance of wintering concentrations of eiders ducks and provides estimates of precision. However, scoters are darker than eiders and flocks of molting scoters can be denser than the eider flocks encountered on the wintering areas. This may require a higher resolution camera (10-14 mega-pixel) to resolve the birds from the background and each other. Currently, these images are counted manually and an automated counting procedure should be developed.

Molting birds in James Bay should be marked to determine affiliations with the wintering areas.

Primary Survey Strengths: Relatively inexpensive survey to capture a significant proportion of the entire male population of Atlantic Black Scoters. Because birds are flightless during wing-molt, flocks should be stable and provide an ideal opportunity for monitoring.

Limitations of the Survey: Survey estimates the numbers of males only; not entirely known how numbers of molting males relates to total population size. Proper timing may be an important factor, although studies of Surf Scoter molting behavior in Labrador suggest the optimal window maybe 3-4 weeks. Currently, images are counted manually and processing takes a considerable amount of time which delays availability of results.

Schedule for Proposed Survey, Analysis, and Reporting: Survey completed by mid-August, depending on availability of technical support, photo-counts may be completed by January after which a report could be generated.

Partners or Collaborators: CWS to compete surveys, possibly USFWS provide assistance with photo-counts.

Budget:

	Funding Sources (in 2007)		
Expense Category	*Indicate in-kind* contributions in italics*		
Personnel	**SDJV or other sources**	CWS	OMNR
Observer(s)		*1500*	*1500*
Technician Salary		*1500*	
Biometrician/analysis		*1500*	
Survey aircraft costs	**13600**		
Travel & Accommodations			
Commercial travel		1100	1100
Lodging and meals		600	600
Materials & Equipment			
Film and Processing		300	
TOTAL	**13,600**	6500	3200

Estimated Cost to Accomplish Prerequisites: $20,000

Primary Contact for Survey: Ken Ross, Canadian Wildlife Service, 335 River Rd., Ottawa, ON K1A 0H3, (613) 949-8261, ken.ross@ec.gc.ca

Literature Cited:

Bordage, D., N. Plante, A. Bourget, and S. Paradis. 1998. Use of ratio estimators to estimate the size of common eider populations in winter. Journal of Wildlife Management 62: 185-192.

Pacific Flyway Winter Sea Duck Survey

Status and/or Brief History of Survey: New survey that would integrate portions of ongoing or previous local or regional surveys. Short-term and regional surveys have been conducted along the Alaska Peninsula, in Kodiak and Prince William Sound (since 1989 *Exxon Valdez* Oil Spill), and southeast Alaska; along the southern British Columbia coast; Puget Sound; and San Francisco Bay. Some of these surveys have targeted only one or a few species.

Primary Species or Population(s) Targeted and Proportion of Population or Range Covered by the Survey: Primarily white-winged Scoter, Surf Scoter, Black Scoter, Long-tailed

Duck, goldeneyes, Harlequin Duck, mergansers. Secondarily, data could be obtained for other waterfowl and waterbird species, including brant, Canada geese, diving ducks, loons, grebes, black oystercatchers, cormorants, murrelets, and guillemots. Until sea duck populations are better delineated, and adequate breeding grounds surveys are developed, this survey may provide interim indications of abundance and trends in Pacific Flyway aggregations of sea ducks in key areas.

Survey Objectives:

1. Document distribution and habitat relationships of sea ducks along the entire Pacific Coast to facilitate long-term habitat conservation.
2. Index abundance and trend of populations of sea ducks (such as Harlequin Ducks and possibly cavity nesting species) that cannot be monitored on the breeding grounds.

Survey Platform: Floatplane and boat where procedures allow. Twin-engine aircraft may be necessary to ensure safety over large or remote areas.

Survey Timing and Recommended Frequency: Mid- to late winter, but before northward migration begins. Simultaneous surveys would be ideal, but surveys that are not concurrent should be scheduled to reduce roll-up of birds over extended periods. Sampling should be done annually in core units, with rotation for full coverage of all areas every 10 years. Surveys to determine sea duck distribution and habitat associations may be scheduled more opportunistically (not necessarily annual), and should be prioritized in relation to habitat threats (e.g., more emphasis on developed southern areas).

Methods and Survey Design: Annual surveys of key coastal units representative of Pacific Flyway coastal habitats (CA to AK) should be conducted with a combination of boat and aerial surveys. Boat survey components are necessary to accurately assess abundance of nearshore and low-visibility species (e.g., harlequin, goldeneyes), and to index the extensive aerial survey components. Aerial surveys are needed to assess open-water species that are farther offshore (e.g., scoters, long-tailed ducks), cover large areas within the survey timeframe, and cover areas where boat access is not feasible.

Map of the survey area or site: To be developed

Products: Index to abundance for Pacific Coast aggregations, relative winter distribution, and indications of regional trends in core areas by species.

Survey Prerequisites: Delineation of manageable population units has not been achieved for most target species, although there is sufficient information to assume that harlequin ducks on the Pacific Coast do not have affiliations with mid-continent or Atlantic stocks. In the interim, there is value in monitoring coastal aggregations of all these species to detect significant changes in winter abundance or distribution.

Previous and ongoing survey projects need to be evaluated for design suitability and prospects for integration into a larger survey program. Consult with potential partners to develop common indexing techniques. Analyze existing mid-winter survey and Minerals Management Service

survey data for CA, WA, and OR to determine whether these provide useful distribution and abundance estimates. Evaluate satellite telemetry data for survey period to help identify important sea duck areas. A survey coordinator/analyst would need to be identified.

Primary Survey Strengths: Survey would provide distribution, habitat use, and trend estimation of wintering aggregations. It would provide more complete coverage of coastal sea duck habitats and unsurveyed areas (e.g., nearshore marine and offshore), as well as valuable information on habitat-species relationships. Although very extensive, the survey is logistically feasible (except possibly in some Alaskan areas), may be able to incorporate existing surveys with modifications, and there are many opportunities for partnerships to reduce costs.

Limitations of the Survey: For most species, the proportion of the population to be surveyed is unknown (until delineation improves); current survey efforts are not systematic and have significant spatial gaps; site-, time-, and species-specific detection rates are not known; will likely require significant changes to data processing/output from partners; accessibility of trained personnel (pilots, observers etc.); winter weather may cause operational delays. In Alaska, surveys of Kodiak and Bristol Bay would be very expensive; surveys of the Aleutian Islands would likely be cost-prohibitive due to weather constraints and the necessity of using a twin turbine aircraft and/or a large sea-going vessel.

Schedule for Proposed Survey: To be determined.

Partners and Collaborators: USFWS, CWS, USGS, Pacific Flyway state wildlife agencies, Pacific Coast Joint Venture, San Francisco Bay Joint Venture, Minerals Management Service, and other programs (e.g., Puget Sound Assessment and Monitoring Program; state and federal oil spill preparedness programs).

Budget: *(salary costs not included)* ($US)

1. Annual boat surveys in Alaska (3 key areas @ $20K) = $ 60K
2. Annual aerial surveys in Southeast Alaska or Prince William Sound, PSAMP, SF Bay (3 areas @ $50K) = $150K
3. Extensive aerial coverage (4 areas in BC, 2 in AK, 2 in CA-WA-OR) (1 area per year @ $20K)
4. Extensive boat coverage (4 areas in BC; 2 in AK, 2 in CA-WA-OR) 1 area per year @ $20K
5. Survey coordination, analysis, and reporting costs = $50K per year (note: this cost not identified in other survey descriptions, but this survey is far more complex than others and a dedicated part-time position seems prudent)
   Approx annual cost = about $ 300K (US)

(*Note: Winter work in western Alaska (if FWS is involved) will require use of twin turbine aircraft which are very expensive. Example: For the freighter Selendang Ayu spill evaluation, we chartered a twin turbine… in approx 60 days, we flew 8 days around Unalaska Island (2 of those days included Umnak) for a total cost of around $200,000+*.)

Primary Contact for Survey: Russ Oates, U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 East Tudor Road, Anchorage, Alaska 99503. Tel. (907) 786-3560, email: russ_oates@fws.gov.

Atlantic and Gulf Coasts Wintering Sea Duck Survey

Status and/or Brief History of Survey: The Atlantic Flyway Sea Duck Survey, which was conducted between 1991 and 2002, did not include important offshore areas and lacked measures of precision. Annual indices derived from the survey were highly variable. Financial shortfalls and concerns about its utility in regions with large offshore concentrations of scoters led to its cancellation.

Between 1999 and 2005, a series of more intensive surveys were conducted in near- and offshore waters of the mid-Atlantic Coast from New Jersey to Virginia, including the estuarine waters of the Delaware and Chesapeake Bays. These surveys included an experimental study that evaluated an adaptive 2-phase stratified sampling design. This study, conducted in 2005, was designed to estimate population sizes for aggregated wintering sea ducks (primarily scoters) and to provide information on bird distributions.

This document outlines plans for the development of a new coast-wide survey that would modify the discontinued Atlantic Flyway Sea Duck Survey and extend sampling to areas with offshore concentrations of sea ducks. The prerequisite work entails distributional surveys of six regions with extensive shoals, conducted for three years, leading to the development of a comprehensive operational sea duck survey for the Atlantic and Gulf coasts. Prerequisite requirements for 3 of these regions (all along the U.S. Atlantic Coast) are detailed in this description. Prerequisite requirements for regions in Canada (Bay of Fundy and Nova Scotia coast, and St. Lawrence Seaway, Gulf of St. Lawrence, and New Foundland coast) and for the Gulf of Mexico are yet to be described and will require further consultation with the Canadian Wildlife Service, Gulf States, and the Gulf Coast Joint Venture.

Species/Population Targeted: Primarily Atlantic wintering populations of White-winged Scoter, Black Scoter, Surf Scoter, American Common Eider, and Long-tailed Duck. Secondarily Red-breasted Merganser, Bufflehead, Common Goldeneye, loons, diving ducks, Northern Gannets, and gulls.

Survey Objectives: Prerequisite objectives include (1) estimation of population size for sea ducks wintering in surveyed areas, (2) assessment of yearly variation in sea duck distribution, and (3) determination of the ability of surveys to detect population trends and factors affecting the distribution patterns of wintering sea ducks. The objectives of the operational survey will depend on the results of prerequisite work and will include monitoring of spatial/temporal patterns in abundance and the effects of coastal development and activities on sea duck populations.

Survey Platform: Fixed-wing

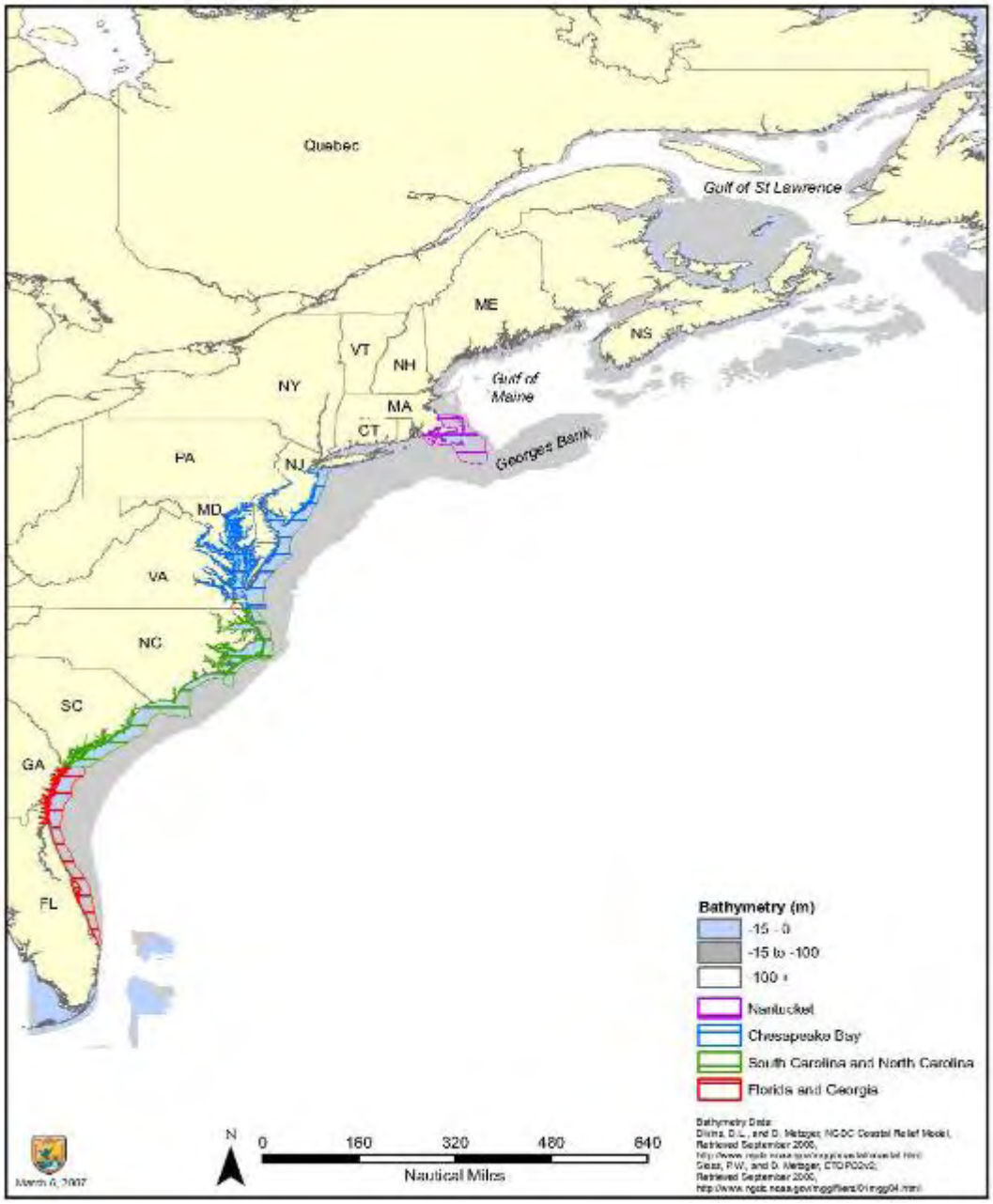
Survey Timing and Frequency: Early February, annual or bi-annual

Methods and Design: Prerequisite surveys will be conducted in three areas with extensive shoals and high offshore concentrations of sea ducks: Nantucket Shoals, Coastal North/South Carolina, and Coastal Georgia/Atlantic Florida. Additional prerequisite work in the Bay of Fundy and Nova Scotia coast, and St. Lawrence Seaway, Gulf of St. Lawrence, and Newfoundland coast, and in the Gulf of Mexico will be coordinated with the Canadian Wildlife Service, the Gulf states, and the Gulf Coast Joint Venture in subsequent years. The prerequisite surveys – continuous aerial transects across the depth gradient along even minutes of latitude – will identify offshore concentration areas and the timing and variation in their use. Data from these surveys will be combined with the results of the two-phase sampling (Manly 2004, M. D. Koneff, unpublished data) study and other survey data from the mid-Atlantic region to assess the ability of winter sea duck surveys to (1) detect population trends and (2) quantify associations with environmental variables and threats. The relative ability of sea duck surveys to achieve these two objectives is critical to the further development of a survey protocol, because the nature of the data and design differ between population trend detection (a "design-based" approach and objective) and understanding habitat association and potential threats (a "model-based" approach and objective). Prerequisite surveys will also allow for further development of survey methods: for example, previous studies suggest environmental effects (particularly glare) can have a significant effect on detection probability (M.D. Koneff, unpublished data). Environmental covariates thought to affect open-water detection rates will be collected to enable adjustment of counts. Prerequisite study data will also be useful for designing improved adaptive sampling designs for these highly aggregated populations, understanding the distribution of flock sizes, and accounting for flocking in sampling and estimation.

The operational survey developed out of the prerequisite surveys will cover the entire Atlantic coast, with intensive surveying in key offshore concentration areas and less intensive near-shore surveys along the rest of the coastline. We anticipate that they will cover 11% (based on experimental surveys of the Mid-Atlantic) of the available habitat area, with intensive perpendicular transects flown in areas of high offshore concentration, and zig-zag transects along areas with primarily near-shore populations.

Survey Prerequisites: The necessary prerequisite surveys are described above. Distributional surveys of key offshore concentration regions will support stratification and sample selection. These surveys will support work on estimates of detection rates that incorporate the effects of environmental factors and observers. They will also allow for continued evaluation of sampling plans for mobile, aggregated populations (adaptive plans).

Map of Survey Area:



Products: Population estimates and distribution maps for wintering sea ducks.

Primary Survey Strengths: Extensive winter range coverage, statistical sampling plan to quantify precision, collection of distributional information allows for development and testing of hypotheses about impacts of coastal development and activities.

Limitations of the Survey: Vast area, cost, logistical challenges particularly in the Maritimes (extensive ice coverage necessitates specialized equipment and survey operations far out to sea), requires multi-crew coordination, need complementary survey of Great Lakes for Long-tailed Duck. Highly aggregated distributions for some species (scoters) reduces precision with a fixed survey cost.

Schedule for Proposed Survey, Analysis, and Reporting:
Early February – Survey Conducted over 2 week period
Early March – Data Analyzed and Annual Report Produced
Late March – Data published to internet accessible repository on the USFWS-USGS Migratory Bird Data Center

Partners and Collaborators: USFWS-DMBM (survey design, field operations, data analysis, reporting, internet accessible database management), ACJV and GCJV (survey design and field operations), CWS (survey design and field operations)

Budget
Prerequisites:
Cost per year to fly one early February survey covering depths up to 15m and allocating one transect to each even minute of latitude in three regions with substantial offshore shoal-water in the U.S. portion of the Atlantic coast. Three years of systematic surveys in each region would be useful to assess distributional stability. Assume aircraft costs of $350/hr.

Region 1: Nantucket Shoals:
a. **Flight costs: $10,500 (30 hrs)**
b. **Travel costs: $2,100**

Region 2: North and South Carolina
c. **Flight costs: $26,300 (75 hrs)**
d. **Travel costs: $5,500**

Region 3: Georgia/Atlantic Florida:
e. **Flight costs: $19,250 (55 hrs)**
f. **Travel costs: $4,000**

Total Annual Costs: $67,650

The necessity of distributional surveys in the Bay of Fundy and Nova Scotia coastline, St. Lawrence Seaway, Gulf of St. Lawrence, NF and the Gulf of Mexico will be determined in consultation with the Canadian Wildlife Service, Gulf states, and the Gulf Coast Joint Venture.

Operational Survey:
Cost per year to fly one early February survey covering depths up to 15m and sampling 11% of the area in four regions with substantial offshore shoal-water in the U.S. portion of the Atlantic coast. Nearshore zig-zag transects in areas with little offshore shoal water. Assume aircraft costs of $350/hr.

Nearshore region 1: Maine to Nantucket
a. **Flight costs: $10,500 (30 hrs)**
b. **Travel costs: $2,100**

Shoal water region 1: Nantucket Shoals:

c. **Flight costs: $8,400 (24 hrs)**
d. **Travel costs: $1,750**

Nearshore region 2: Rhode Island, Long Island sound

e. **Flight costs: $3,500 (10 hrs)**
f. **Travel costs: $700**

Shoal water region 2: Mid-Atlantic

g. **Flight costs: $18,550 (53 hrs)**
h. **Travel costs: $3,850**

Shoal water region 3: North/South Carolina

i. **Flight costs: $21,350 (61 hrs)**
j. **Travel costs: $4,200**

Shoal water region 4: Georgia/Atlantic Florida

k. **Flight costs: $13,300 (38 hrs)**
l. **Travel costs: $2,800**

Total: $91,000

Primary Contact for Survey:

Mark D. Koneff
USFWS- Division of Migratory Bird Management
11510 American Holly Drive
Laurel, MD 20708
301-497-5648
Mark_koneff@fws.gov

Literature Cited:

Manly, B. F. J. 2004. Two-phase adaptive stratified sampling. Pages 123-133, *In* W. L. Thompson, *editor,* Sampling rare or elusive species. Island Press, Washington, D.C., USA

Point Barrow Eider Migration Survey

Status and/or Brief History of Survey: In western North America, King (*Somateria spectabilis*) and Common (*Somateria mollissima v*-nigra) eiders leave wintering areas in the north Pacific and the Bering Sea and migrate north to nesting areas. At the Bering Strait, the migration divides and some birds move west toward northern Russia and others east to Alaska and northwestern Canada (Suydam et al. 2006). The eiders moving east follow a series of leads and polynyas in the sea ice in April, May, and June through the Chukchi Sea off the west coast of Alaska (Woodby and Divoky 1982). At Point Barrow, Alaska, the spring migration passes very close to shore. Murdoch (1885), Bailey (1948), and Brueggeman (1980) documented the spring passage of eiders at Point Barrow, but the magnitude of the spring migration has been estimated on only a few occasions (1976, 1987, 1994, 1996, 2003, 2004) (Woodby and Divoky 1982; Suydam et al. 1997, 2000, 2006).

Primary Species or Population Targeted and Proportion of Range Covered by the Survey: King (*Somateria spectabilis*) and Common (*Somateria mollissima v*-nigra) eiders that breed on Alaska arctic coastal plain and barrier islands and western Canadian arctic. Potentially targets >90% of both breeding populations for both species.

Survey Objectives: To quantify the number, sex ratios, and timing of migrations of male and female King and Common eiders passing Point Barrow, Alaska, in spring.

Survey Platform: Locations on sea-fast ice and beach sites near Barrow, Alaska (see Methods and Survey Design for coordinates).

Survey Timing and Recommended Frequency: Late April to early June, every three to five years (Suydam et al. 2006).

Methods and Survey Design: The following account of methods and design is excerpted from Suydam et al. (2006): Typically a count session lasted two hours, and the next count session would start two hours after the previous ended. Several counts did not last for the entire two hours for various reasons, including extreme weather conditions and polar bears near the observation site. We used only completed two-hour counts for estimating the number of eiders passing. For each counting period we collected data on weather including cloud cover, fog, precipitation, temperature, visibility, wind speed, and wind direction. For each flock sighted, we recorded time, direction of travel, species composition, number sighted, ratio of males to females for each species, and comments on behavior, as possible. Observers were trained on species identification and flock estimation by experienced observers. At the beginning of the migration season and continuing through the season, observers independently estimated the size of each flock, and then arrived at a consensus for an estimate for each flock. Estimates between and among observers were generally within 10% of each other.

Sometimes flocks would pass and then turn and pass contrary to the direction of migration. These flocks would then pass again to continue migration, resulting in one flock being counted three times. To reduce the potential for bias, we subtracted the number of eiders moving contrary to the direction of migration from the number of eiders moving the direction of migration.

We were often unable to identify birds to species in eider flocks that were at a distance, although we were able to estimate the size of the flock. In these cases, the flock was categorized as unidentified eiders. To estimate passage rates by species, we divided the number of unidentified eiders between King and Common eiders based upon the proportion of King and Common eiders that were identified during each counting period.

During summer and fall, we observed migrating eiders from the base of the Point Barrow spit (71^o 21' N, 156^o 36' W). In the spring, we observed eiders from a combination of locations on the ice and shore. On 26 April 2003, we established an observation site on an ice pressure ridge on the nearshore lead edge of shorefast sea ice. The site (71^o 20.5' N, 156^o 44' W) was located about 8 km southwest of Point Barrow and was approximately 9 m above sea level. By 27 May the sea ice was no longer safe and we moved the counting location to a 4 m high platform situated on the beach (71^o 19.5' N, 156^o 14' W). On 28 April 2004, we established an observation site on an ice pressure ridge on the nearshore lead edge of shorefast sea ice. The site (71^o 23' N, 156^o 41' W) was located about 5 km west of Point Barrow, and was situated approximately 4 m above sea level. Because of deteriorating ice conditions we moved to a second site on 22 May located approximately 3 km southwest of the initial observation site. Additionally, 2 counts on 27 May and 1 count on 29 May were conducted from the bluffs near the gravel pits, by one observer (71^o 17' N, 156^o 46' W).

Estimation of Sex Ratios

We compared sex ratios for both King and Common eiders during each observed migration, from 2002 and 2004. To examine sex ratios, we counted the number or estimated the proportion of males in each flock. Observed sex ratios were compared to a 1:1 ratio using contingency tables and chi-square tests with 1 degree of freedom (Zar 1998).

Estimation of Population Size and Trend

We estimated the total number of eiders passing during each migration event between summer/fall 2002 and spring 2004. Eider migration is quite variable from day to day (Thompson and Person 1963; Johnson 1971; Timson 1976; Woodby and Divoky 1982; Suydam et al. 1997, 2000b; Day et al. 2004). To account for daily variation in our estimate of total population size, we treated our sample as coming from a stratified design, where days represent separate strata. Within each day (*d*), the average number of eiders passing ($\bar{y}_d$) is estimated across all 2-hour periods sampled. This average is then multiplied by the total number of 2-hour sampling periods that are possible within each day ($N_d = 12$). Following Thompson (2002; page 119), the population total is thus defined as the sum of the daily totals:

$$total = \sum_{d=1}^{L} N_d \bar{y}_d ,$$

where L is the total number of days sampled. The variance estimator for the population total accounts for the number of 2-hour periods sampled within each day (n_d), the variance within each day (σ_d^2), and is defined as:

$$\text{var}(total) = \sum_{d=1}^{L} N_d (N_d - n_d) \frac{\sigma_d^2}{n_d}.$$

We estimated the trend in population totals between 1994 through 2004. Trends were estimated for King and Common eiders, separately, by fitting a regression line to the point estimates. We assumed the point estimates were invariant.

Wind and Passage Rates

We modeled the daily counts of King and Common eiders as a function of wind direction and velocity using zero-inflated negative binomial models (Lambert 1992; Martin et al. 2005). Count data typically have skewed distributions, where counts of small size are more common than counts of large size. Although such data are typically examined via Poisson regression, count data often has features that the Poisson distribution cannot account for. For example, the Poisson distribution restricts the variance to equal the mean, but count data generally have variances that are larger than the mean. Furthermore, count data often have more zero counts than what the Poisson distribution allows (e.g., Bohning et al. 1999; Martin et al. 2005; Welsh et al. 1996).

These restrictions have lead to the use of distributions that allow for larger variances or extra zeros (e.g., Lambert 1992; Welsh et al. 1996). The negative binomial distribution is often used to account for extra-Poisson variation (e.g., Welsh et al. 1996; Martin et al. 2005). This distribution is similar to the Poisson distribution, but has an extra parameter, θ, that scales the distribution to account for extra variance. As θ approaches zero, the negative binomial distribution converges on the Poisson distribution. Likewise, mixture distributions, also known as "zero-inflated" distributions, are commonly used to account for extra zeros. Such distributions typically combine distributions suitable for binomial and count data. In effect, if a count is zero, it is modeled as a mixture of zeros from the negative binomial process with additional zeros from a Bernoulli process. If the count is greater than zero, the count is modeled as resulting from a negative binomial process. Where p is the probability that an observation is generated from a negative binomial process, μ is the mean count, r is the specific count size, θ is the over-dispersion parameter, and Γ is the gamma function:

$$\Pr(Y_i = 0) = 1 - p + p\left(\frac{1}{1+\theta\mu}\right)^{1/\theta}, \text{ if } y_i=0, \text{ and}$$

$$\Pr(Y_i = y) = p\left(\frac{\Gamma(y+1/\theta)}{y!\Gamma(\frac{1}{\theta})}\right)\left(\frac{\theta^y \mu^y}{(1+\theta\mu)^y (1+\theta\mu)^{\frac{1}{\theta}}}\right), \text{ if } y_i>0.$$

Within this model, covariates for *p* are modeled with a logit link and covariates for μ are modeled with a log link (Martin et al. 2005).

Preliminary analyses indicated that the count data were strongly skewed, had larger than Poisson variance, and were zero-inflated, indicating that a zero-inflated negative binomial regression was appropriate. Models were optimized in *R* (*R* Development Core Team 2005) using package *pcsl* (Jackman 2005). We selected models using an information theoretic approach (AIC, Burnham and Anderson 1998) and considered all models within 4 AIC of the best approximating model. Goodness-of-fit (GOF) was assessed for the most parameterized model using a log-likelihood G-statistic (Sokal and Rolf 1995; White and Bennetts 1996) where *O* and *E* are observed and expected frequencies, respectively, $G = 2\sum O_i \ln(O_i / E_i)$. The *G*-statistic is approximately chi-square distributed with degrees of freedom equal to the number of categories minus 1 (Sokal and Rolf 1995).

All models assumed the count varied by species, year, and season; they only differed in how wind direction and velocity related to the count. In effect, we wanted to know if wind direction and velocity accounted for variation in addition to inherent differences in the average count. We examined multiplicative and additive relationships between the count and daily wind direction, daily wind velocity, and species. Counts were the number of birds of each species recorded during each 2-hour period. For this analysis, we only considered eiders flying the direction of migration. Occasionally, groups are observed flying the opposite direction. These groups made up less than 1% of the total count of both species (King Eiders = 0.56%; Common Eiders = 0.28%) and were subtracted from the daily counts. Daily wind direction and speed was recorded as the daily resultant (i.e., the vector sum divided by the number of observations) by the National Climate Data Center (NCDC) weather station located at the Wiley Post – Will Rodgers Memorial Airport (WBAN: 27502). We assigned wind velocity into one of three categories: <10, 10–20, or >20 km/hr. Following Day et al. (2004), we categorized wind direction as headwinds, tailwinds, or neutral winds. In the fall, as eiders migrate west along the coast, the direction of migration is approximately 315° and, again following Day et al. (2004) we classified winds originating between 270° and 360° as headwinds, 180° and 270° as tailwinds, and all other winds as neutral. In the spring, the main direction of migration to Point Barrow is approximately 45°. For spring periods, we classified winds originating between 0° and 90° as headwinds, 180° and 270° as tailwinds, and all other winds as neutral.

Because we used a joint-probability model, and cannot interpret the binomial and count portions of the models separately (Cunningham and Lindenmayer 2005), sequential fitting of model parameters may prevent us from converging on the best model structure. To ensure that we converged on the best model structure, we examined all combinations of all parameters, resulting in 36 separate models.

Products: Periodic abundance estimates and long-term trends

Survey Prerequisites: None

Primary Survey Strengths: Methods are well-established

Limitations of the Survey: Visual methods are limited by both distance and weather conditions; observers can only detect eiders within approximately 2 km of the survey location and cannot detect eiders in fog or darkness (Suydam et al. 2006). These limitations may be overcome by combining visual counts with radar methods (Suydam et al. 2006; Day et al. 2004).

Schedule for Proposed Survey, Analysis, and Reporting: Since the last survey was conducted in Spring 2004 the next effort should be timed to coincide with recommendations made by Suydam et al. (2006), which would be in Spring 2008, or 2009.

Potential Partners or Funding Sources: North Slope Borough – primary funding and oversight of survey. Other partners or funding sources include University of Alaska—Fairbanks, Alaska Department of Fish and Game, Canadian Wildlife Service, U.S. Fish and Wildlife Service.

Budget: Estimated total cost is $50-70K/yr, including salaries, which comprise bulk of costs.

Primary Contact for Survey: Robert S. Suydam, North Slope Borough, Department of Wildlife Management, Barrow, Alaska, 99723, Phone: 907-852-0350, robert.suydam@north-slope.org

Literature Cited:

Bailey, A. M. 1948. Birds of Arctic Alaska. Colorado Museum of Natural History Popular Series 8. 317 pp.

Bohning, D., E. Dietz, and P. Schlattmann. 1999. The zero-inflated Poisson model and the decayed, missing and filled teeth index in dental epidemiology. Journal of the Royal Statistical Society, Series A. 162:195–209.

Brueggeman, J. J. 1980. Coastal occurrence of birds at Point Barrow, Alaska, in spring. Murrelet 61: 31–34.

Burnham, K. P., and D. R. Anderson. 1998. Model selection and inference. Springer-Verlag, New York, NY, USA. 353 pp.

Cunningham, R. B., and D. B. Lindenmayer. 2005. Modeling count data of rare species: some statistical issues. Ecology 86:1135–1142.

Day, R. H., J. R. Rose, A. K. Prichard, R. J. Blaha, and B. A. Cooper. 2004. Environmental effects on the fall migration of eiders at Barrow, Alaska. Marine Ornithology 32:13–24.

Jackman, S. 2005. pscl: R in the Political Science Computational Laboratory, Stanford University. R package version 0.52. URL http://pscl.stanford.edu.

Johnson, L. L. 1971. The migration, harvest and importance of waterfowl at Barrow, Alaska. M.S. thesis. University of Alaska, Fairbanks.

Lambert, D. 1992. Zero-inflated Poisson regression with an application to defects in manufacturing. Technometrics 34:1–14.

Martin, T. G., B. A. Wintle, J. R. Rhodes, P. M. Kuhnert, S. A. Field, S. J. LowChoy, A. J. Tyre, and H. P. Possingham. 2005. Zero tolerance ecology: improving ecological inference by modeling the source of zero observations. Ecology Letters 8:1235-1246.

Murdoch, J. 1885. Birds. Pages 104–128 *in* Report of the International Polar Expedition to Point Barrow, Alaska. Part 4. P. H. Ray (ed.). Government Printing Office, Washington, D.C.

R Development Core Team. 2005. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org.

Sokal, R. R., and F. J. Rolf. 1996. Biometry. 3rd edition. W. H. Freemand and Company, New York, NY, USA. 887 pp.

Suydam, R., L. Quakenbush, M. Johnson, J. C. George, and J. Young. 1997. Migration of King and Common eiders past Point Barrow, Alaska, in spring 1987, spring 1994, and fall 1994. Pages 21–28 *in* King and Common Eiders of the western Canadian Arctic. D. L. Dickson (ed.). Occasional Paper Number 94. Canadian Wildlife Service, Ottawa.

Suydam, R.S., L.T. Quakenbush, D. L. Dickson, and T. Obritschkewitsch. 2000. Migration of King, *Somateria spectabilis*, and Common, *S. mollissima v-nigra*, Eiders past Point Barrow, Alaska, during spring and summer/fall 1996. Canadian Field-Naturalist 114(3):444–452.

Suydam, R.S., L.T. Quakenbush, R. Acker, M. Knoche, and J. Citta. 2006. Migration of King and Common Eiders past Point Barrow, Alaska during Summer/Fall 2002 through Spring 2004: analyses of population trends and effects of environmental conditions on migration. Draft Final Report, North Slope Borough, Department of Wildlife Management, Barrow Alaska.

Thompson, D. Q. and R. A. Person. 1963. The eider pass at Point Barrow, Alaska. Journal of Wildlife Management 27:348-356.

Thompson, S. K. 2002. Sampling. John Wiley & Sons, Inc. New York. 367 pp.

Timson, R. S. 1976. Late summer migration at Barrow, Alaska. Pages 354–400 *in* Environmental Assessment of the Alaskan Continental Shelf. Principal Investigator's Reports, April - June 1976, Volume 1. National Oceanic and Atmospheric Administration, Boulder, Colorado.

Welsh, A. H., R. B. Cunningham, C. F. Donnelly, and D. B. Lindenmayer. 1996. Modeling the abundance of rare animals: statistical models for counts with extra zeros. Ecological Modeling 88:297–308.

White, G. C., and R. E. Bennetts. 1996. Analysis of frequency count data using the negative binomial distribution. Ecology 77:2549–2557.

Woodby, D. A. and G. J. Divoky. 1982. Spring migration of eiders and other waterbirds at Point Barrow, Alaska. Arctic 35:403–410.

Zar, J. H. 1998. Biostatistical Analysis, 2nd ed. Prentice-Hall, Inc., Princeton, N.J.

Pacific Black Scoter Breeding Survey

Status and/or Brief History of Survey: Although the Waterfowl Breeding Population and Habitat Survey (WBPHS) provides an index to the size of the black scoter breeding population, the survey is improperly timed for scoters, the indices are highly variable, and habitats are not sampled representatively, which may produce biased indices. This study is intended to improve accuracy and precision of estimates for this species, which preliminary data indicates has declined at 3-4 % per year.

A pilot survey was successfully completed in 2004 and was fully implemented in 2005, 2006, and 2007. It was funded in part during these three years as part of SDJV Project #38, Black Scoter Integrated Study, although 2006 was the last year this survey would be funded as part of that study. This survey is intended to become an annual survey with occasional minor adaptive improvements to survey design.

Comparable historical population estimates from the same areas were derived from 1989-97 surveys of similar design and intensity (i.e., piecemeal surveys combined provide one estimate for the 1989-97 period). Estimates from the 2004-2007 surveys indicate a significant drop in population size from the earlier period.

Primary Species or Population Targeted and Proportion of Range Covered by the Survey: Primary target species are the Pacific breeding population of black scoters and Alaskan population of greater scaup. The survey covers 90% of the breeding population of Pacific black scoters, and 70% of the Alaska population of both species of scaup including probably about 95% of the greater scaup. The survey is timed late for long-tailed ducks and, although these are counted to better interpret scoter and scaup detection rates, estimates of long-tailed duck abundance are not expected to be useful.

Survey Objectives:
1. Provide annual population estimates of breeding black scoters and greater scaup with improved precision and accuracy in comparison to the WBPHS.
2. Document regional population trends with statistically rigorous analysis.
3. Derive unbiased estimates of population size to provide perspective on the potential impact of harvest or other estimated losses.

Survey Platform: Fixed-wing amphibious aircraft

Survey Timing and Recommended Frequency: Mid- to late June; annually. Optimal survey timing was determined from considerations including movements of satellite radio-tagged black scoters, ground observations of nesting chronology, and replicated aerial survey observations. It is optimally timed to estimate breeding pairs.

Methods and Survey Design: Stratified systematic transects across most black scoter breeding areas with two levels of sampling intensity corresponding to high and low density regions (Fig. 1). Data from a series of intensive systematic surveys flown 1989-1997 were used to guide the sampling design. Survey rotation among a panel with four sets of lines will provide excellent distribution data. After completion of 4 years data collection, we plan to carefully analyze the results and revise the design to increase efficiency and decrease cost while maintaining a practical survey that still provides accurate and precise estimates.

Figure 1. Location of survey area and cumulative transects flown in 2004, 2005, and 2006.

Transects are flown in float-equipped Cessna 206 or 185 aircraft at 30-46m altitude and 135-157 km/hr. Only three species are counted: black scoter, greater scaup, and long-tailed duck. Species, group size, and location are recorded for each observation.

Detection rates are estimated annually using the independent double-count method (Magnussen et al. 1978, Pollock and Kendall 1987, Graham and Bell 1989) to adjust for environmental and observer variability. Details about this methodology are reported in the field report for the 2004 and 2005 survey effort at:
http://www.r7.fws.gov/mbsp/mbm/waterfowl/surveys/pdf/BLSC%20survey%202004%20report2.pdf

The objective is to obtain an annual population estimate to monitor black scoters on 154,475 sq km of breeding habitat in western Alaska. The visibility-corrected estimate should have adequate precision to ensure the detection of a significant biological change in population size within a time frame appropriate for management. We adopted a standard similar to Bart et al. (2004) and set a specific goal that with 10 years of survey data, we should be able to detect an annual rate of population change of 3.41%, equivalent to a 29.2% change in abundance in 10 years, with probability set at 0.10 and 80% power. According to an approximate power formula (Gerrodette 1987, eq. 20), a survey with a sampling error CV of <12.5% should meet this goal. The average CV from the 2004 and 2005 surveys was about 15%, although given the apparent rate of change, a statistically significant change will be detected in less than 10 years.

Products: Annual population estimates adjusted for incomplete detection, distribution maps, trend data

Survey Prerequisites: No survey prerequisites, but we recommend improvements in harvest estimates to enable better evaluation of effects of harvest. Recommend continued efforts to determine links among population segments (breeding, molting, staging, and wintering areas).

Primary Survey Strengths: Covers nearly the entire breeding range for Pacific black scoter. The survey was designed to obtain unbiased estimates of population with high precision. The goal is to obtain annual estimates with sampling error CVs of <12.5% that should detect a trend with 3.4% annual change, about a 30% change in 10 years. Double count sampling will be used to estimate average detection rates to reduce bias resulting from annual variation in observers and environmental factors.

Limitations of the Survey: Some assumptions for estimation of detection rates may not be met. Survey does not include non-breeding birds that remain in marine waters.

Schedule for Proposed Survey, Analysis, and Reporting: Survey was last flown in June 2007. Analysis and detailed report to be done by December 2007. Same schedule for future years.

Potential Partners or Funding Sources: Several National Wildlife Refuges in Alaska, USFWS Migratory Bird Management, National Park Service, Sea Duck Joint Venture

Budget:

Expense Category	**Funding Sources -2008**					
Personnel	**SDJV or other sources**	USFWS-Alaska MBM	Yukon Delta NWR	Selawik NWR	Izembek NWR	AK Pen / Becharof NWR
Pilot		*8000*			*600*	
Observer			*4200*	*1200*	*900*	
Biometrician/analysis		*5000*				
Survey aircraft costs	**6500**		3400	1500	1500	
Travel & Accommodations	**2500**		900	*670*		*400*
Materials & Equipment						
Fuel	**2000**		1500		900	
TOTAL	**11,000**	13,000	10,000	3370	3900	400

- *in-kind* means people or resources that are directed or redirected to the project that require no additional funds (e.g., staff, use of existing equipment or facilities)

Primary Contact for Survey: Bob Stehn, USFWS, Migratory Bird Management, 1011 East Tudor Rd., Anchorage, AK 99503; (907) 786-3504; robert_stehn@fws.gov

Literature Cited:

Bart, J., K. P. Burnham, E. H. Dunn, C. M. Francis, and C. J. Ralph. 2004. Goals and strategies for estimating trends in landbird abundance. J. Wildl. Manage. 68:611-626.

Gerrodette, T. 1987. A power analysis for detecting trends. Ecology 68:1364-1372.

Graham, A. and R. Bell. 1989. Investigating observer bias in aerial survey by simultaneous double-counts. J. Wildl. Manage. 53:1009-1016.

Magnusson, W. E., G. J. Caughley, and G. C. Grigg. 1978. A double-survey estimate of population size from incomplete counts. J. Wildl. Manage. 42:174-176.

Pollock, K. H. and W. L. Kendall. 1987. Visibility bias in aerial surveys: A review of procedures. J. Wildl. Manage. 51:502-510.

Yukon-Kuskokwim Delta Aerial and Nest Surveys

Status and/or Brief History of Survey: Aerial survey conducted with onboard duck observer since 1988, nest surveys since 1986. The nest survey is linked to the aerial survey to enable extrapolation to areas outside the nest surveyed area.

Primary Species or Population Targeted and Proportion of Range Covered by the Survey: Primarily species are Spectacled Eider and Pacific Common Eider, secondarily Long-tailed Duck (2%) Greater Scaup , Northern Pintail, Emperor Goose, White-fronted Goose, Brant, Cackling Canada Goose, Tundra Swan, Sandhill Cranes, Pacific and Red-throated Loons. Survey covers the entire range of western Alaska Spectacled Eider breeding population (45-50% of North American population), about 30-50% of western Alaska Pacific Common Eider breeding population, (4-8% of North American population and <10% of continental Long-tailed Duck breeding population.

Survey Objectives: Aerial survey provides an index to total population size of birds, whereas nest survey directly estimates the population size of nests and eggs, an indication of potential annual production.

Survey Platform: Fixed-wing amphibious aircraft and ground counts of nests

Survey Timing and Recommended Frequency: Early- to mid-June; annually

Methods and Study Design: Aerial survey uses east-west transects across the entire coastal zone of the Y-K Delta (Fig. 1) A pilot and right front observer count geese, cranes, and swans, whereas the back seat observer counts ducks, loons, and gulls. During the nest survey, ground observers search randomly located plots for all nests within a core 716 km^2 area of the coastal zone that includes most of the medium to high density eider habitat (Fig. 1). At each nest observers record species, clutch size, nest status, and stage of incubation.

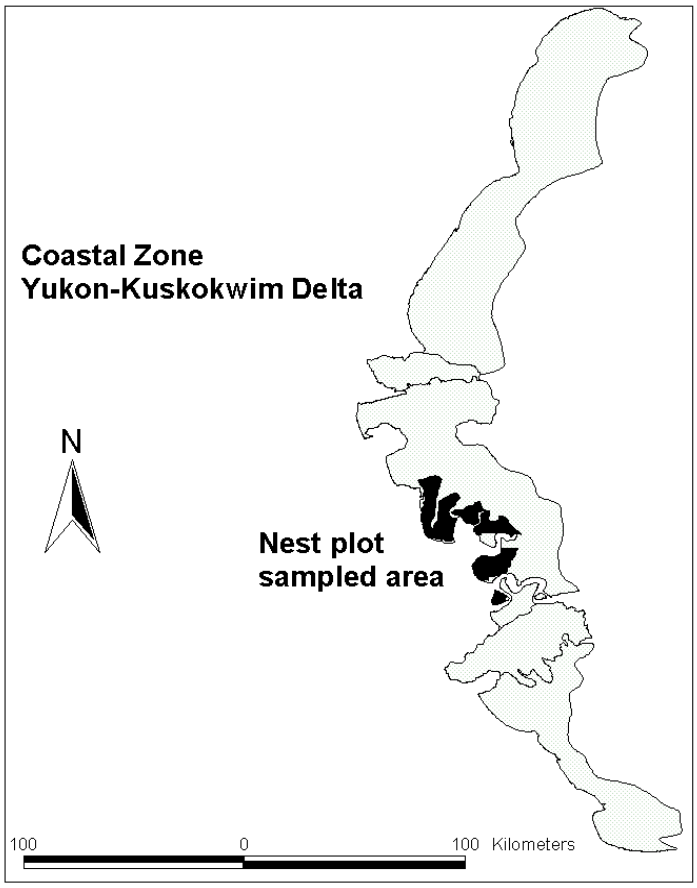


Figure 1. Area sampled by aerial survey (light gray) and by nest plots (solid black) on the Yukon-Kuskokwim Delta, Alaska

Products: For aerial survey, an index of total population size. For nest surveys, an estimate of population size of nests and eggs produced. Nest estimates are adjusted for incomplete detection of nests (Bowman and Stehn, unpublished data).

Survey Prerequisites: None

Primary Survey Strengths: Nest survey is currently the primary monitoring survey for threatened Y-K Delta Spectacled Eiders. Detection rates of nests have been estimated and annual estimates of nest population and production are adjusted for differences in nest detection attributed to annual variability in nest success and observer experience. Aerial survey monitors entire populations of several species of geese. The two surveys together are complementary and contribute to a better understanding of waterfowl population ecology and population status.

Limitations of the Survey: The nest survey alone applies to only part of Y-K Delta and is dependent on the aerial survey for expansion to a larger geographic area. Annual timing of aerial survey affects counts of spectacled eiders – if flown too late some males may have departed from

breeding grounds. Aerial survey timing may be adjusted slightly in some years based on reports on nesting chronology from ground-based observers.

Schedule for Proposed Survey, Analysis, and Reporting: The two surveys are conducted concurrently during early June. Preliminary results are usually available by mid-July and final annual reports are completed by September of the same year.

Partners or Collaborators: USFWS Migratory Bird Management Alaska Region (primary responsibility and funding for both surveys), Yukon Delta NWR (additional funding, equipment, aircraft and logistical support), USGS (assistance with searching nest plots)

Budget: $20K (US) for aerial survey, $45K (US) for nest survey.

Primary Contact(s) for Surveys: Nest survey: Julian Fischer, USFWS, 1011 E. Tudor Rd., Anchorage, AK julian_fischer@fws.gov; 907-786-3644. Aerial survey: Bob Platte, USFWS, 1011 E. Tudor Rd., Anchorage, AK bob_platte@fws.gov ; 907-786-3565.

Additional References:
Nest survey: http://alaska.fws.gov/mbsp/mbm/waterfowl/surveys/nestplo.htm
Aerial survey: http://alaska.fws.gov/mbsp/mbm/waterfowl/surveys/ykgi.htm

---

Waterfowl Breeding Population Survey for Central and Western Arctic Canada

Status and/or Brief History of Survey: The current Waterfowl Breeding Population and Habitat Survey (WBPHS) does not cover the breeding range for King Eiders and includes only a small portion of the breeding range for Long-tailed Ducks. Systematic surveys of much of their breeding range in western and central arctic Canada were conducted in the early 1990's and again starting in 2002 on an opportunistic basis (Table 1).

Table 1. Summary of systematic Breeding Waterfowl Population aerial surveys that have been conducted in western and central arctic Canada.

Region	Earlier surveys	Recent surveys
Mackenzie Delta/Tuktoyaktuk Pen./C. Parry	1989-93	2002-06
Banks Island	1992-93	-
Western Victoria Island	1992-94	2004-05
Southeastern Victoria Island	-	2003-05
Queen Maud Gulf Bird Sanctuary	1990-92	2002-03, 2006
Adelaide Peninsula	-	2005-06
King William Island	-	2005-06
Kent Peninsula	-	2004-05
Rasmussen Lowlands	1994-95	2006

Prior to 2005 all surveys were conducted by helicopter, which required high hourly charter costs and the additional required costs of fuel caches. Beginning in 2005, a turbine fixed-wing aircraft (turbine beaver) was used in some areas to survey and to evaluate the safety and logistic suitability of this aircraft for future surveys. These evaluations were resolved affirmatively. The cost-effective turbine fixed-wing aircraft increases the affordability of frequent (annual) surveys, and thus improves utility of the surveys in detecting population trends. These surveys should be conducted on an annual basis using these more cost-effective aircraft.

Species or Populations Targeted and Proportion of Range Covered by the Survey: Primary target sea duck species are Long-tailed Duck and King Eider. The survey likely covers about 90% of the important breeding areas of King Eiders that winter west of the continent (excluding Alaska Coastal Plain which is already surveyed). Due to the lack of information on population delineation for Long-tailed Ducks, it is difficult to estimate proportion of that species' range covered by the survey. Adding the proposed survey areas to those already included in the WBPHS would result in coverage of an estimated 60-90% of the presumed Pacific Long-tailed Duck breeding population.

This survey will concurrently fulfill population monitoring needs of the Arctic Goose Joint Venture (AGJV) for Canada Geese (Cackling Geese) and Greater White-fronted Geese. It will also provide much needed information on population trend and distribution of swans, loons, cranes, gulls, terns, jaegers, hawks and owls. Several of these species including the Short-eared Owl are of special concern due to their apparent low and perhaps declining numbers.

Survey Objectives: Obtain indices to population size and monitor long-term population trends of several migratory bird species and stocks.

Survey Platform: Turbine-powered fixed-wing aircraft
Turbine aircraft such as the de Havilland beaver use jet fuel, commonly available in communities in arctic Canada. The turbine beaver is particularly suitable, having excellent reliability, range (7 hours), and operating cost. Other turbine aircraft that could potentially be used include the Cessna turbine 206 (amphibious) and Kodiak Quest (available from June 2008 onward).

Survey Timing and Recommended Frequency: Annually; June 18-30, except on Mackenzie Delta and Tuktoyaktuk Peninsula where survey should be 1 week earlier. Due to the immense size of the area to be surveyed, it will require two aircraft to complete the survey each year. Timing of survey in late June corresponds with when the peak number of paired male King Eiders is on the breeding area. For geese, it represents mid-incubation. Timing for King Eiders was determined by examining 6 years of satellite telemetry data showing timing of movement of King Eiders, plus one year of ground observations of nesting chronology on Banks and Victoria islands.

Methods and Study Design: Surveys will consist of stratified systematic transects (Fig. 1) and will follow the same protocol as WBPHS (USFWS and CWS 1987). Strata are the same as were developed for surveys in the early 1990's based on physiographic and habitat similarities (Dickson et al. 1997). Transects will generally be 20 km apart.

The fixed-wing aircraft that will be used for the surveys in 2008 are a turbine-powered de Havilland beaver that has been used for waterfowl surveys in Alaska since 1977 (Conant and Groves 2005), and a Kodiak Quest (new in 2008). The aircraft will be flown at 145-170 km/h and an altitude of 30-45m, using a Global Positioning System (GPS) in the aircraft panel to navigate along transects to preprogrammed end-point co-ordinates. Observations will be entered directly into panel-mounted computers with GPS coordinates automatically attached to each observation via a custom-designed computer program (Conant and Groves 2005). Both pilot and front-right-seat observer will record all observations of birds by species (or group) within 200 m from the flight path (USFWS and CWS 1987).

Plans for 2008 are to survey all areas indicated in Figure 1 using the two turbine aircraft. Time permitting, exploratory transects will be flown on northeast side of Victoria Island where satellite telemetry suggests there could be reasonable number of King Eiders nesting. Exploratory flights might also occur in south central Victoria Island and eastern Banks Island. Should only one aircraft be available, first priority will be to survey western Victoria Island and Banks Island, since these areas were not covered in 2007. Statisticians, biologists, and pilot-biologists involved in the project will fine-tune survey design over the next couple of years based on survey results and satellite imagery.

Detection rates for several target species will be estimated using the independent double-count method (Magnussen et al. 1978, Pollock and Kendall 1987, Graham and Bell 1989) to adjust for environmental and observer variability. This will require an additional observer in the back of the aircraft for a portion of the survey (for likely 2-3 days of survey).

A helicopter will be used to replicate a sample of survey transects done by the fixed-wing aircraft (likely on Victoria Island). Results of these "matched" surveys will help interpret results of current fixed-wing surveys versus previously conducted helicopter surveys (e.g., address problem of differential bird behavioral avoidance of aircraft type).

Population estimates will be derived using the standard protocol for breeding waterfowl surveys (USFWS and CWS 1987). For ducks such as King Eiders which are easy to differentiate by sex from the air, observations will be divided into the following categories: lone males, flocks of two to four males, pairs, and groups of five or more birds. Observations of one hen and two drakes will be treated as a pair and a lone drake. Likewise, a hen and three drakes will be treated as a pair and two drakes. The number of indicated breeding pairs will be calculated by adding together the number of lone males, males in flocks of two to four, and pairs. Total indicated birds will be calculated by multiplying the number of indicated breeding pairs by two and adding the number of grouped birds. Observations of one to four females will not be included in the calculations. For geese, and those duck species that can not be reliably differentiated by sex during aerial surveys (e.g. Long-tailed Duck), single observations will be doubled to account for incubating mates.

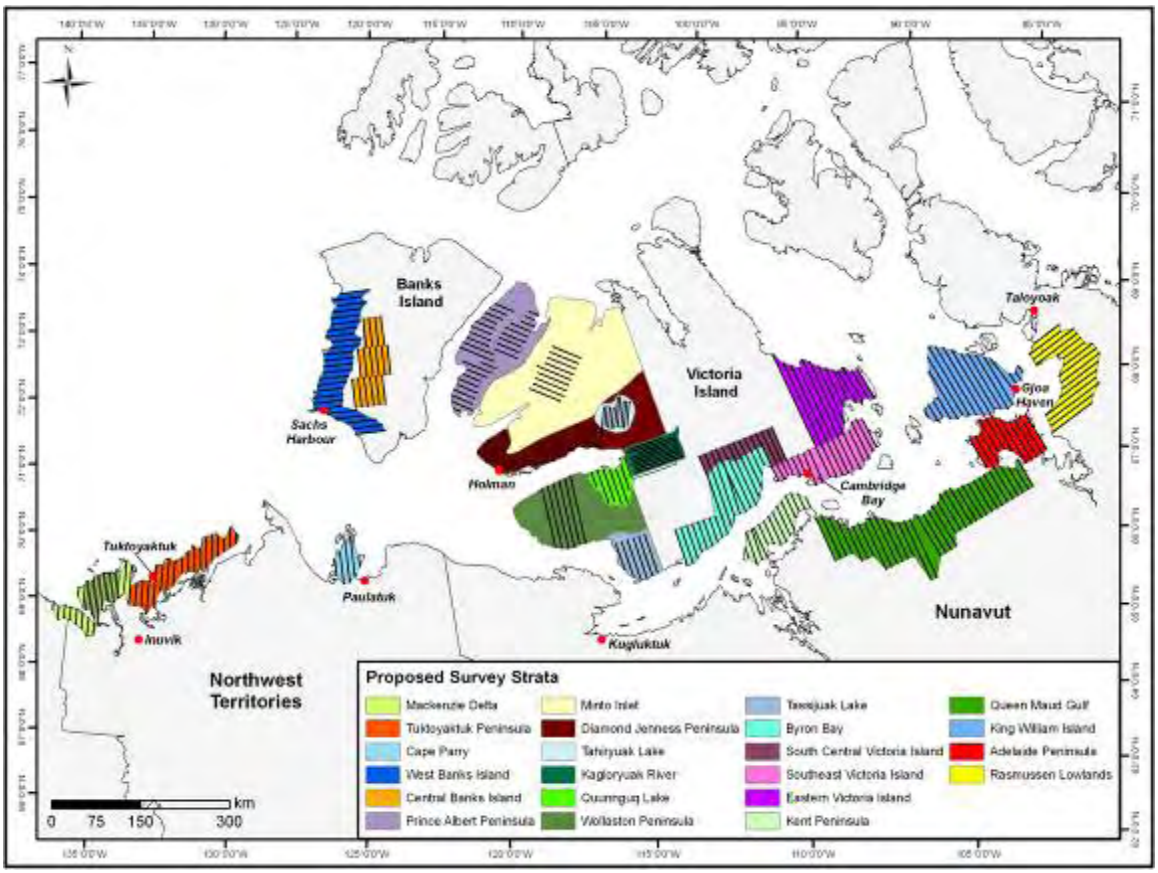


Figure 1. Location of proposed survey strata and transect lines.

Products: Annual population index used to track population trends. Maps that show distribution of breeding birds. Population estimates adjusted for detection rates.

Survey Prerequisites: Information on population delineation is lacking for Long-tailed Ducks. Although the population estimates and trends obtained from the survey will still be of value, it would be easier to interpret the results if the three stocks that likely breed in the survey area were delineated.

In 2006 and 2007 transects on King William Island and Mackenzie Delta, respectively, were surveyed by both the turbine beaver and Bell 206 helicopter to compare detection rates when surveying from a helicopter versus a fixed-wing aircraft. An additional year of information should be collected to facilitate comparison of fixed-wing survey results to results of earlier surveys that were conducted from a helicopter. This is particularly needed for results obtained from Kodiak aircraft.

Primary Survey Strengths: The proposed survey technique has been proven successful. The methods incorporate detection rates to reduce bias resulting from annual variation in observers or environmental factors. Surveys will provide population trend data for numerous species other than sea ducks including geese and swans. Hence, surveys are a cooperative effort by SDJV and

AGJV to monitor species with shared ranges and habitat. This increased data-gathering efficiency for both programs will result in cost savings to all partners.

Survey Limitations: Logistically expensive. Also, banding, satellite telemetry and stable isotope data suggest that the eastern part of the proposed study area (east of about 105°W) contains King Eiders that winter both east and west of the continent. Consequently, it might be difficult to interpret population changes in this part of the survey area. For Long-tailed Duck, there are likely east, west and Great Lakes stock in the survey area, and little is known about the breeding range of each stock.

Schedule: Surveys will be done annually during last 12 days of June. Analysis and report production will be completed by the following December.

Partners or Collaborators: Primary partners in this proposed long-term operational survey are SDJV, AGJV, USFWS and CWS. There are several other partners that could contribute at least in the short term including Central Flyway Council (Canada Geese and Greater White-fronted Geese), Mississippi Flyway (Greater White-fronted Geese), Atlantic Flyway (Tundra Swans), FWS Region 9 (DMBM), and Inuvialuit Wildlife Management Advisory Council.

USFWS will supply the aircraft, pilot-observers and second observers. They will be responsible for completing the aerial survey, analysis of results and production of an annual report. The CWS will assist in obtaining the necessary permits for doing the work.

Budget:
For this to be a long-term annual survey, it would be most efficient if long-term relatively stable funding were identified. Securing a long-term commitment will take time, so in the interim period, we are proposing to fund the surveys with multiple partners on an annual basis.

Budget in 2008:

Expense Category	**Funding Sources - 2008**					
Personnel	**SDJV**	AGJV	USFWS -Alaska MBM	CWS	Flyway Councils	USFWS Other regions
Pilot -2			*12,000*			
Observer -2			*12,000*			
Observer 2 for detection rates				*2,000*		
Field preparation, analysis, report			*12,000*	*2,000*		
Survey aircraft costs -2 aircraft -total of 185 h survey plus 40 h ferry time		30,000			15,000	2,500
Travel & Accommodations						
Lodging -4 for 16d at $200/d						13,000
Per diem 4 x $105 x 16						6,800
2 observers for detection rates (airfare, per diem, lodging for 4d)						5,200
Materials & Equipment						
Fuel at $1.50/litre	**30,000**					25,000
TOTAL	**30,000**	30 000	*36,000*	*4,000*	15,000	52,500

Budget is in US dollars
Budget does not include 28K USD to conduct replicate helicopter survey on Victoria Island. Funding for this survey will come from CWS and Polar Continental Shelf.

Status of funding from Partners in 2008

Central Flyway Council	$15,000	secured
AGJV	$30,000	secured
FWS Region 9 (DMBM)	$30,000	requested
FWS Region 6	$7,500	requested
FWS Region 3	$7,500	requested
FWS Region 2	$7,500	requested
SDJV	$30,000	requested

Estimated Cost to Accomplish Prerequisite: $120K/year for 6 years for satellite telemetry of Long-tailed Duck or possibly less costly stable isotope analyses to delineate east-west populations if that technique, currently under investigation, proves informative for Long-tailed Ducks.

$28 K in 1 year to compare detection rates in the fixed-wing Kodiac Quest to the helicopter assuming repeat about 15 hours of surveys. If this is done near Cambridge Bay on Victoria Island, likely funding partners for this are Polar Continental Shelf Project and CWS.

Primary Contacts for Survey: Tim Moser, U.S. Fish and Wildlife Service, tim_moser@fws.gov; 303-275-2391 or Lynne Dickson, Canadian Wildlife Service, lynne_dickson@ec.gc.ca; 780-951-8681

Literature Cited

Conant, B., and D. J. Groves. 2005. Alaska-Yukon waterfowl breeding population survey May 15-June 7, 2005. Unpublished report, U.S. Fish and Wildlife Service, Juneau, Alaska.

Dickson, D. L., R. C. Cotter, J. E. Hines and M. F. Kay. 1997. Distribution and abundance of King Eiders in the western Canadian Arctic. *In* Dickson, D. L. (ed.) King and Common Eiders of the western Canadian Arctic. Canadian Wildlife Service Occasional Paper No. 94. 75pp.

Graham, A. and R. Bell. 1989. Investigating observer bias in aerial survey by simultaneous double-counts. J. Wildl. Mange. 53:1009-1016.

Magnusson, W .E., G. J. Caughley and G. C. Grigg. 1078. A double-survey estimate of population size from incomplete counts. J. Wildl. Manage. 42:174-176.

Pollock, K. H. and W. L. Kendall. 1987. Visibility bias in aerial surveys: a review of procedures. J. Wildl. Manage. 51:502-510.

USFWS and CWS. 1987. Standard operating procedures for aerial waterfowl breeding ground population and habitat surveys in North America. U.S. Fish and Wildlife Service, Washington and Canadian Wildlife Service, Ottawa.

Breeding Scoter Survey

Status and/or Brief History of Survey: Current breeding waterfowl surveys conducted by the U.S. Fish and Wildlife Survey (Waterfowl Breeding Population and Habitat Survey, WBPHS) and the Canadian Wildlife Service (Eastern Waterfowl Survey) cover much of the presumed scoter breeding ranges (Fig. 1), but omit portions of northern Quebec and Labrador, as well as the mountainous areas of British Columbia, the Yukon, and central and eastern Alaska. More importantly, these surveys are conducted several weeks too early to appropriately monitor breeding scoter populations.

Several recent or ongoing surveys have provided piecemeal information on scoter distribution and relative densities. A breeding survey for Pacific black scoters has been conducted since 2004 by U.S. Fish and Wildlife Service in Western Alaska. Additionally, USFWS conducted a

scoter survey on Yukon Flats, Alaska from 2000-2004, for which proper timing and design have been established. Survey timing in WBPHS stratum 14 (and perhaps 15 and 16) in the northwestern part of the Northwest Territories may be appropriate for breeding scoters. An operational survey conducted cooperatively by the CWS, USFWS, and Atlantic Flyway to monitor Atlantic Population Canada geese (AP Goose Survey) is timed properly for breeding scoters (primarily black and surf) and currently counts all waterfowl. Although some of the above surveys could be integrated into this survey, much of the range of scoters remains inadequately surveyed.

This survey is largely conceptual at this point. It would involve an extensive new transect survey that is appropriately timed for scoters, and would complement or incorporate existing regional surveys that are believed to be timed appropriately for scoters.

Primary Species or Population(s) Targeted and Proportion of Population or Range Covered by the Survey: White-winged Scoter, Surf Scoter, and Black Scoter. When fully implemented, survey would cover about 80% of the breeding range for all three species.

Survey Objectives: Population estimate and trend; maps of relative density and distribution.

Survey Platform: A combination of fixed wing aircraft and helicopter

Survey Timing and Recommended Frequency:: Late-May to mid- or late-June depending on latitude and phenology; Annual

Methods and Survey Design: Survey design for most of the survey area would be similar to that used in the WBPHS. A transect survey design would be used. The survey would be flown primarily with fixed-wing aircraft. Secondarily, helicopters may be used to sample "cluster" areas that are logistically feasible based on operational range. Data from areas of overlap between the two types of surveys could be used to generate visibility correction factors. Also, helicopters may be required for the mountainous areas of British Columbia, the Yukon, and central and eastern Alaska, as fixed-winged aircraft may not have sufficient performance to fly transects through this more remote and difficult terrain.

The survey area will be stratified based on densities and habitat features that will likely affect visibility. Strata boundaries may reflect, in part, boundaries from existing waterfowl breeding surveys. However, careful consideration needs to be given to how these strata are defined and what area the surveys represent. Prerequisite pilot surveys (see Prerequisites, below) should provide further information for refining these strata. These could be done on a rotational basis for several years to yield more complete coverage for distribution and density information.

Scoter breeding ranges (Fig. 1) make up the conceptual survey area. However, the operational survey area will likely be much reduced from this area and will concentrate on core or high-density area. Transect locations will need to be determined as part of sample design exercises based on prerequisite work.

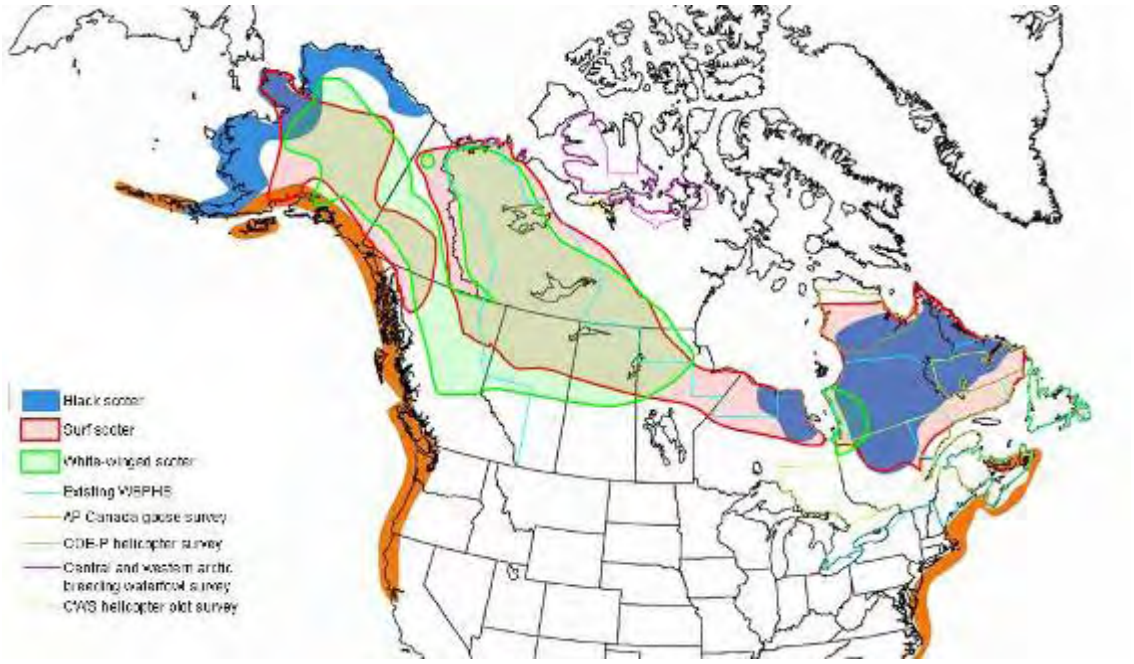


Figure 1. Presumptive breeding ranges for the three scoter species, and the boundaries of existing breeding waterfowl surveys in Canada.

Products: Maps of relative distribution, indices to population size (adjusted for detection), and estimated trends.

Survey Prerequisites: At this point, we have little information to assess likely precision of estimates for population size or trend. The current, presumptive breeding ranges of the three scoter species covers vast and remote areas of northern Canada (Fig. 1). Surveying these areas is logistically difficult because of the sparseness of fuel supplies and resulting long ferry times to survey lines. For this reason, it will be necessary to determine if there are core areas or areas of high concentration that can be surveyed to reasonably represent the populations and still be logistically feasible. This likely will involve relatively low-intensity, broad scale exploratory surveys for several years to gather baseline data for determining final survey areas, stratification, and optimal sample allocation.

Prerequisite work will also need to be done to assess the ability of observers to differentiate scoter species. Initial work in Alaska indicates that scoters can be speciated reliably out to about 100 meters from the aircraft (about ½ the transect width). It may be possible to use species composition within this inner band to allocation unspeciated observation in the outer band.

Transect segment length may also need to be assessed after examination of preliminary survey data. Some work in Quebec and Labrador indicates that segment length may need to be extended from 18 nautical miles (33 km) to about 32 nautical miles (60 km) to avoid negative bias in estimates due to zeros on some transects.

Analysis of considerable satellite telemetry data for scoters on the west coast may help define limits of survey area and key breeding areas.

Primary Survey Strengths: The survey techniques are proven and have been used for more than 50 years as part of the WBPHS. Detection rates will be estimated as part of the double-sampling design. The survey would cover large areas of currently unsurveyed breeding range.

Limitations of the Survey: This study would be extremely expensive and logistically difficult. In addition to the scattered and infrequent availability of fuel, the survey would occur shortly after existing WBPHS is completed. Even though aircraft would likely be available, it might be difficult to assemble qualified crews to conduct the survey.

Schedule for Proposed Survey, Analysis, and Reporting: Survey would be conducted roughly 20 May through 20 June, depending on conditions. Analysis: Survey data should be analyzed by the second week in July. Reporting: By the July Flyway meetings to provide information for harvest management decisions.

Potential Partners or Collaborators: USFWS would povide fixed-winged aircraft and crews for secondary survey. CWS would provide funding for helicopter and crews for primary survey. Other potential sources of funding or personnel include the Atlantic and Pacific Flways or the SDJV.

Budget: Considerable prerequisite work is required to determine the amount of flight time, number of crews, and time in the field required for an operational survey on a continental scale. This preliminary information is essential to evaluate survey design alternatives and realistically estimate costs. Consequently, costs are difficult to estimate without addressing prerequisites, but operational cost (no salaries) may be in the range of $90-150K per year.

Primary Contacts for Survey: James S. Wortham, USFWS, Chief, Branch of Wildlife Population Surveys, 11510 American Holly Drive, Laurel, Maryland 20708, (301) 497-5882, jim_wortham@fws.gov or Mark Koneff, USFWS, Chief, Branch of Population and Habitat Assessment, 11510 American Holly Drive, Laurel, Maryland 20708, (301) 497-5648, mark_koneff@fws.gov

---

Northern Common Eider Canada Winter Survey

Status and/or Brief History of Survey: Surveys of Quebec portion of wintering range conducted in 1980, 1989, 2003, 2006, and in Newfoundland and St. Pierre & Miquelon in 2003 and 2006.

Primary Species or Population Targeted and Proportion of Population or Range Covered: The segment of the northern Common Eider (*Somateria mollissima borealis*) population that winters in Canada (i.e., not Greenland). Survey covers nearly the entire wintering range in Canada.

Survey Objectives: Population trends and indices to total population size in Canada

Survey Platform: Fixed-wing

Survey Timing and Recommended Frequency: February to March; Every 3 years

Methods and Survey Design: A two-phase survey: one pass at high altitude to get photo counts and visual estimates of adult males, plus ideally one pass at low altitude to get photo counts of adult males to immatures+females ratios. We are currently evaluating use if digital cameras for photographing flocks. Initial results suggest photo counts of males and ratios of adult males to immatures+females maybe acquired from a single high altitude pass. If results are positive, the need for the second low-level pass would be eliminated reducing the cost of the survey.

Product(s): Population index that closely approximates population size.

Survey Prerequisites: Delineate races within stock (i.e., *S. m.* dresseri and *S. m.* borealis races are mixed in some areas) which requires collection of birds. Reconnaissance of Labrador coast is required to determine if a significant portion of the population over-winter in this region. A concomitant Northern Common Eider Greenland winter survey would be highly desirable.

Primary Survey Strengths: Gives reliable estimates (with SE) of population size adjusted for the observer variability and counting bias. Preliminary results from the 2006 survey suggest that it maybe possible to measure the age ratios of males from digital images taken on low-altitude passes. If successful, age-ratios estimated from aerial surveys would be representative of populations and not have the biases associated with age ratios estimated from harvest surveys.

Limitations of the Survey: Affiliation to breeding population unclear. Proportions of borealis and dresseri could change among years. Timing of the survey is important to avoid very big flocks at the beginning of winter. Currently, images are counted manually which is labor intensive and time consuming. This delays release of the final estimates.

Schedule for Proposed Survey, Analysis, and Writing: Surveys would be flown February to March, image analyses will be contracted out and takes about six months. Data analyses and final reports should be available by the following December.

Partners or Collaborators (and respective responsibilities): CWS, France (St. Pierre & Miquelon). CWS will organize the survey, perform the data analyses, and prepare report; St. Pierre and Miquelon will provide a participant for all, or part, of the survey.

Estimated Operational Cost of Survey: *(salary costs not included)*
$25-35K (Cd) $22-32K (US)

Table 1. Estimated costs for aerial survey

Segment	Estimated Airtime (hr)	Estimated Cost[1]
Quebec (North Shore)	20	7,500
Quebec (Madeleine Is & Gaspe)	12	4,500
Newfoundland	18	6,750
St. Pierre & Miquelon	2	750
Labrador	20	7,500
Total[2]	72	27,000

1. USFWS aircraft rate of $375 US/hr used in cost estimates.
2. Costs maybe within ±25% of actual effort.

Estimated Cost to Accomplish Prerequisites: (*salary costs not included*)
More current collection of birds to assess mixing of subspecies ($10-15K Cd every few years). Improve key to distinguishing borealis from sedentaria (minimal cost). Reconnaissance of Labrador coast $10K (Cd).

Primary Contacts for Survey: Daniel Bordage, Canadian Wildlife Service, Quebec, (418) 649-6133; daniel.bordage@ec.gc.ca; Scott Gilliland, Canadian Wildlife Service, (709) 772-2013; scott.gilliland@ec.gc.ca

---

Northern Alaska Coastal Pacific Common Eider Breeding Survey

Status and/or Brief History of Survey: Conducted annually since 1999.

Primary Species or Population Targeted and Proportion of Range Covered by the Survey: Primary target species are the Pacific Common Eiders breeding along the Arctic Coastal Plain and barrier islands of Alaska from Omalik Lagoon (Chukchi Sea) to Canadian border (Fig. 1). Virtually complete coverage of Alaska north slope breeding population, which represents approximately 3-5% of the combined northern Alaska – western Canada Pacific Common Eider population.

Survey Objectives: Estimate size and trend of breeding population

Survey Platform: Fixed-wing amphibious aircraft

Survey Timing and Recommended Frequency: Late June; annually

Methods and Survey Design: Complete aerial survey coverage up to 1.6 km seaward of mainland areas where open water exists, plus barrier islands. Includes 30 mainland segments and 22 islands or island groups. Deviations are made to count larger flocks detected up to 3 km offshore. Survey is flown in an amphibious Cessna 206 aircraft at approximately 45m altitude and 145 km/hr. All bird species are counted, entered directly into onboard computers linked to GPS units. Counts are summarized by survey segment. General notes on habitat conditions and ice coverage are also recorded.

Survey is timed to coincide with egg laying and early incubation while pair bonds are intact and males remain in the vicinity of breeding sites. Nesting studies during previous years were used to estimate breeding phenology and appropriate survey timing.

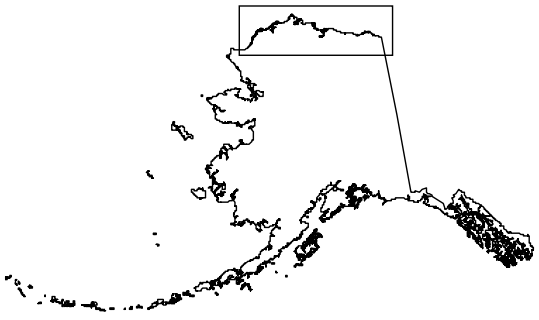


Figure 1. Coastal areas covered by survey

Products: Annual estimates of size of breeding population (# breeding pairs and total population size), distribution maps, trend data

Survey Prerequisites: None

Primary Survey Strengths: Complete coverage of breeding population on Arctic Coastal Plain and nearshore areas. May be useful for evaluating potential impacts of on- and offshore petroleum development and other activities in northern Alaska. Estimates and trend of Alaska

population can be compared to long-term migration counts of the combined Alaska and Canada populations at Point Barrow.

Limitations of the Survey: Annual estimates and distribution of birds subject to variability in ice conditions and nesting chronology. No estimates of precision or detection.

Schedule for Proposed Survey, Analysis, and Reporting: Survey is scheduled for June 2007. Analysis and report to be done by February 2008. Similar schedule each year.

Potential Partners or Funding Sources: USFWS Migratory Bird Management

Budget:

	Funding Sources (in 2007)			
Expense Category	*Indicate in-kind* contributions in italics*			
Personnel	**SDJV or other sources**	USFWS-Alaska MBM		
Pilot		*7500*		
Observer(s)		*7500*		
Biometrician/analysis				
Survey aircraft costs		5000		
Travel & Accommodations				
Commercial travel		500		
Lodging and meals		1500		
Materials & Equipment				
Fuel		3000		
TOTAL	**0**	25,000		

* *in-kind* means people or resources that are directed or redirected to the project, which require no additional funds (e.g., staff, use of existing equipment or facilities)

Primary Contact for Survey: Chris Dau, USFWS, Migratory Bird Management, 1011 East Tudor Rd., Anchorage, AK 99503; (907) 786-3908; christian_dau@fws.gov

---

Atlantic Surf Scoter Fall Staging Survey

Status and/or Brief History of Survey: This would be a developmental survey. Preliminary surveys were conducted in the falls of 2001 (2 surveys) and 2002 (1 survey). These surveys have shown that nearly over 90% of the scoters observed in the fall in the St. Lawrence estuary and gulf are Surf scoters which eliminate identification problems that plague spring surveys when all three species of scoters occurs simultaneously in the St. Lawrence and often in mixed flocks. In August 2006, 15 molting Surf Scoter drakes and 2 breeding males and 2 breeding females were implanted with satellite transmitters. These birds will permit to evaluate the turnover time of Surf Scoter in fall in the St. Lawrence estuary and permit a more efficient survey design.

Primary Species or Population Targeted and Proportion of Range Covered by the Survey: Eastern population of Surf Scoters (*Melanitta perspicillata*). Probably >70% of this population.

Survey Objectives: Obtain an index of population size for the eastern population of Surf Scoter. The objective of the prerequisite work is to determine the potential of fall aerial surveys for adequately monitoring the size of the Atlantic population of Surf Scoters. To achieve this, we will pursue the following sub-objectives:

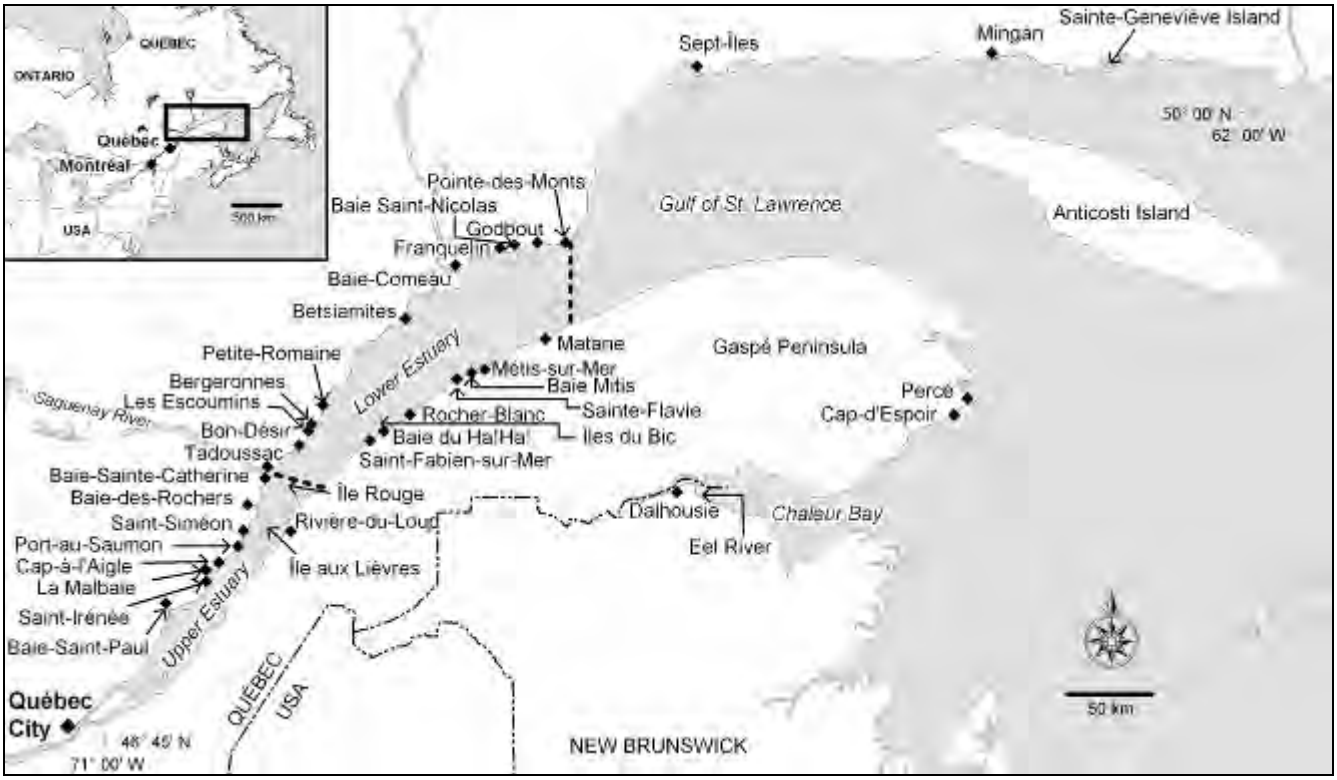
1) Determine the applicability of using aerial photos to correct visual estimates of flock size;
2) Determine variability within and between years: three surveys will be done each year (replicates) of the three years study which will permit to estimate various source of variability.
3) Develop *Standard Operating Procedures* (SOP) for surveying this population.

Survey Platform: Fixed-wing aircraft.

Survey Timing and Recommended Frequency: Every year for the next three years (2008-09-10) with three surveys per year. After this, every three years (2013-16-19 etc.) at possibly two surveys per year. If variability low between replicates, two surveys may be sufficient every three years. Surveys are to be conducted in the last week of September and the first two weeks of October.

Methods and Survey Design: The methodology will be based on the Common Eider winter survey technique using ratio estimators (Bordage et al. 1998). The study area will encompass part of the north and the south shores of the St. Lawrence estuary (Québec) where significant numbers of Surf Scoters were observed in 2001 and 2002. A survey team is making up of a pilot, an observer, a photograph and a compiler. Fixed-wing survey (BN Islander or other available fixed-wing with twin engines and high wings): Altitude of 500 m to locate Surf Scoter (SUSC) flocks; When a flock is detected the navigator assigns a flock number, enters the location using the USFWS GPS Voice Recording System and compiles the photos number from the photograph as well as the flock size estimate from the observer; A second pass over the flock is made at 200 m in order to photography scoter flocks and to visually estimate scoter numbers; A third pass is done at 20-50 m where the photograph and the compiler take photo samples of the flock to estimate immature/adult ratio and species composition, also visually estimated by the observer.

Survey Area: Survey between Tadoussac and Pointe-des-Monts on North shore and Île aux Lièvres and Matane on South shore



Products: For each of 2007 and 2010, three independent estimates of the number of Surf Scoters present in the fall in the study area. This will provide as well an estimate of observer variability as well as of variability due to survey timing.

Survey Prerequisites: 1) Determine the length of stay of Surf Scoters in the fall and whether turnover of birds is a major issue. This is currently being done as 18 Surf Scoters have been implanted with satellite transmitters. 2) Determine the level of variation due to observer and survey timing. This will be evaluated as the survey proceeds.

Primary Survey Strengths: Surf Scoters stage in large numbers in the St. Lawrence estuary and Gulf in the fall where they are more concentrated than on their wintering areas. At this time, they are the dominant scoter species in the St. Lawrence. This greatly facilitates survey efficiency. Also the Surf Scoter's distribution is more concentrated in the fall than in the spring, again facilitating surveys. Each survey requires only about 5 hours of flying time which is quite economical for a total of 15 hours for three surveys.

Limitations of the Survey: In 2001 and 2002 a few aerial scoter surveys in fall were done to evaluate the repartition of scoters in the St. Lawrence and Gulf and to try the helicopter and fixed-wing aerial platforms. Helicopter (Bell 206L) offered high manoeuvrability and very good visibility while fixed-wing (BN Islander) offered speed, high fuel range and lower costs. However, no tests were made to compare precision of population size estimates resulting from the helicopter and the fixed-wing surveys (uncorrected visual observations only). One obvious result of these prior surveys was that population size estimates of a flock from the 3 observers

aboard the helicopter or the fixed-wing could vary a lot. Therefore, the need for corrected estimates to account for observer variability in estimating population size is clearly needed.

Schedule for Proposed Survey, Analysis, and Reporting: Fixed-wing survey: one day between Sep 18th and October 20th 2008 (approx 5 hours). Compilation and analyses: November and December 2008. Report and/or Paper February 2009

Partners and Collaborators: Canadian Wildlife Service (field work); USFWS (funding), Patuxent WRC (automatic photo counts analyses)

Budget:

Expense Category	SDJV or Other Sources	CWS
Personnel		
Professional salaries		3000
Technician salaries		1000
Travel/Accommodations		
Car rental		300
Materials/Equipment		
Fixed-wing rentals	6000	4000
Helicopter rentals		
Contractual		
Photos analyses	1000	
TOTALS BY FUNDING SOURCE	7000	8300

Primary Contacts for Survey: Christine Lepage, Canadian Wildlife Service, 1141 Route de l'Église, P.O. Box 10100, Sainte-Foy, Québec, G1V 4H5. E-mail: Christine.lepage@ec.gc.ca Phone: (418) 649-6506; **Daniel Bordage,** Canadian Wildlife Service, 1141 Route de l'Église, P.O. Box 10100, Sainte-Foy, Québec, G1V 4H5. E-mail: Daniel.bordage@ec.gc.ca Phone: (418) 649-6133; **Jean-Pierre L. Savard,** Canadian Wildlife Service, 1141 Route de l'Église, P.O. Box 10100, Sainte-Foy, Québec, G1V 4H5. E-mail: Jean-pierre.savard@ec.gc.ca Phone: (418) 648-3500.

Literature Cited:

Bordage, D., N. Plante, A. Bourget and S. Paradis. 1998. Use of ratio estimators to estimate the size of Common Eider populations in winter. J. Wildl. Manage. 62: 185-192.

Great Lakes Wintering Sea Duck Survey

Status and/or Brief History of Surveys: Since the late 1980s / early 1990s, non-native zebra and quagga mussels have greatly increased throughout the lower Great Lakes. During the same time, winter diving duck and sea duck use has increased greatly, especially on the Canadian side of Lake Ontario, in response to the increase in prey abundance and milder winter conditions.

State, federal and private organizations conduct aerial waterfowl surveys throughout much of the Great Lakes as part of the annual Mid-Winter Inventory (MWI) (Fig. 1). In Canadian portions of Lake Ontario, more expanded and systematic flights are conducted to capture the largest concentration of sea ducks that congregate in the Lower Great Lakes (LGL; SDJV Project #83). Although the majority of the US Great Lakes is surveyed during the MWI, the Long Point Waterfowl and Wetlands Research Fund (LPWWRF) and Canadian Wildlife Service (CWS) have been coordinating and conducting a complete LGL January Waterfowl Survey of the shorelines of lakes Ontario, Erie and St. Clair since 2002. The survey is flown in early-mid January (similar time to the Mid-winter Inventory at traditional wintering areas) to estimate numbers of wintering waterfowl along shorelines of the Canadian and US sides of the LGL. The survey provides data on numbers of dabbling ducks and Canada Geese, but also on several diving duck and sea duck species, most notably Long-tailed Ducks (LTDU).

Primary Species or Population(s) Targeted and Proportion of Population or Range Covered by the Survey(s): The LGL January Waterfowl Survey provides data on many species of ducks, geese and swans, but also on several diving duck and sea duck species, most notably Long-tailed Ducks (LTDU). For example, an average of 50,214 LTDU were counted each January during the LGL January Waterfowl Survey, and > 90% of those birds were located on the Canadian side of Lake Ontario. Based on these survey results, the northern portions of Lake Ontario have been identified as the most important wintering area for LTDU on the LGL. Possibly 100,000 to 200,000 Long-tailed Ducks (perhaps 10-20% of continental population) winter on the Great Lakes. In exceptionally cold years they may migrate to southern wintering areas, but for most years this population remains in offshore waters and would not likely be surveyed in other MWI surveys.

Survey Objectives: Develop operational surveys that provide reliable annual estimates of abundance and long term trends of primary target species of sea ducks wintering on the Great Lakes.

Survey Platform(s): Multiple survey platforms are currently used depending on state, provincial, federal and private partners. Aircraft types include twin engine and single engine high-winged aircraft.

Survey Timing and Recommended Frequency: Surveys are flown annually in early to mid-January (similar time to the Mid-winter Survey at other wintering areas). Surveys conducted earlier than that could include birds that spend most of winter on Great Lakes but may leave during cold winters. Recommended frequency of the survey is annual or bi-annual.

Methods and Survey Design: During the MWI survey in the US and Canadian portions of Lakes Ontario, Erie, and St. Clair transects are flown only in nearshore habitats, parallel to the shoreline 0.5 km offshore. On the Canadian side of Lake Ontario (initiated in 2006) an additional transect is flown parallel to the shoreline 2 km offshore. Offshore transects are flown

before nearshore transects to minimize double counting large numbers of waterfowl in nearshore areas that might relocate offshore due to aircraft disturbance. Two observers estimate abundances of all waterfowl observed along each side of transects out to a distance of 0.5 km from shoreline at a height of 100 m during the mid-day (10:00 – 15:00 EST) period. The MWI survey likely provides reasonably good estimates for species that frequent shoreline or nearshore habitats. See Table 1 for results for the Lower Great Lakes January Waterfowl Survey.

Some sea duck species, particularly Long-tailed Ducks and scoter spp, often forage far offshore because of their deep diving abilities. In the Canadian portion of Lake Ontario, a more systematic survey has been developed by LPWWRF and CWS in 2006 to establish a better survey framework (survey intensity, stratification, etc.) for these sea ducks (Petrie et al., unpubl. progress report, SDJV Project #83). Only Lake Ontario was chosen initially because the LGLJWS data, plus long-time observation (K. Ross and N. North, CWS), showed the most significant concentrations of Long-tailed Duck and scoter were typically located along the Ontario shoreline. This survey included additional transects at 2, 4, 10, and 20 km offshore on the Canadian side of Lake Ontario (Fig. 2).

Figure 1. Survey routes and respective responsibilities for surveys

Results suggest that 83% to 100% of scaup (primarily Greater Scaup) spp, Bufflehead, Common Goldeneye, Common Merganser, and Red-breasted Merganser were counted on the shoreline transect, but all individuals of these species were accounted for by addition of the 2 km offshore transect. The shoreline transect contained 57% of LTDU and 48% of scoter spp. About an additional 30% of both LTDU (cumulative = 87%) and scoter spp (cumulative = 76%) were counted on the 2 km transect, and more than 98% of individuals of each species observed were accounted for after inclusion of the 4 km transect. These results suggest that expanding the current Lower Great Lakes Survey to include offshore transects out to 4 km offshore would provide more reliable counts of LTDU and scoter spp, but would not be cost effective on a large scale given that sea duck numbers are generally low and groups are widely distributed.

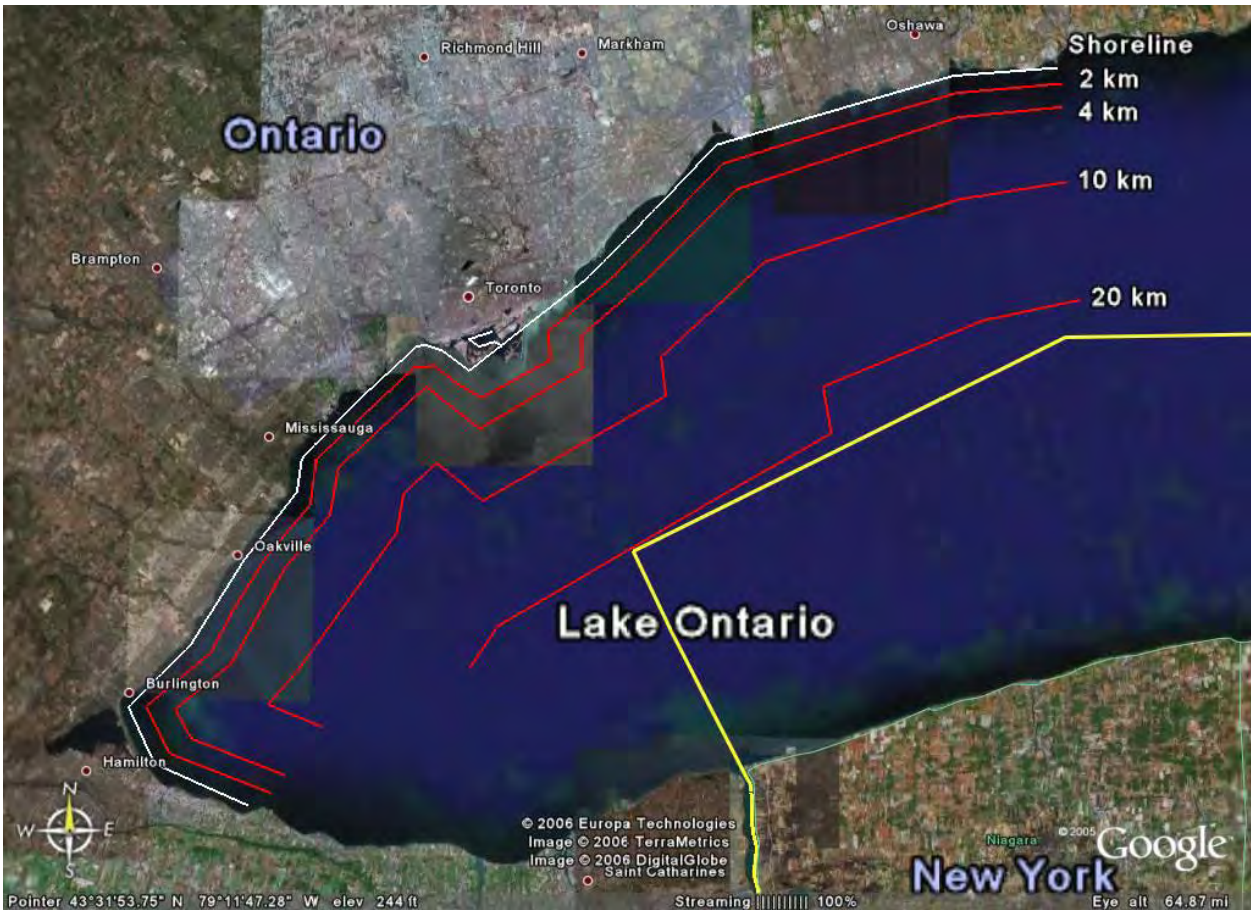


Figure 2. Survey transects on western Lake Ontario described by Petrie et al. (2006) showing the 5 transects on which diving and sea ducks were counted from mid-January to late-February 2006. The shoreline transect (white) is 0.5 km offshore and is traditionally flown during the Lower Great Lakes January survey; the additional transects (red) were added to determine offshore abundances of sea ducks.

Table 1. Select waterfowl species observed during LGL January Waterfowl Surveys, 2002-2007 (LPWWRF, unpubl. data). Estimates include nearshore waterfowl on both the U.S. and Canadian sides of Lake Ontario, Lake Erie, and Lake St. Clair, but do not include offshore (>1 km) transects.

	Year					
Species	2002	2003	2004	2005	2006	2007
Long-tailed duck	47,914	48,935	39,595	48,355	66,269	77,974
White-winged Scoter	780	2,354	7,743	4,312	807	5,443
Black Scoter	8	902	5,251	4,660	2334	0
Unid. Scoter spp.	0	0	0	0	204	2,457
Total Scoter spp.	**790**	**3,256**	**12,999**	**9,075**	**3,424**	**7,979**
Common Goldeneye	21,681	18,259	21,105	16,137	28,472	9,768
Bufflehead	8,987	7,170	6,895	9,377	13,110	6,594
Scaup spp.	105,656	86,219	107,603	64,502	106,395	192,704

Common Merganser	19,500	15,186	40,039	29,387	38,698	9,584
Red-Breasted Merg	856	11,717	1,769	5,389	7,852	37,355
Unid. Merg	16,311	28,050	17,232	13,354	35,775	42,607
Total Mergansers	**36,667**	**54,953**	**59,040**	**48,130**	**82,325**	**89,546**
Swan	12,211	11,090	9,874	5,156	13,982	17,682

Products: Population size, distribution estimates, and maps and long-term trends for sea ducks and other waterfowl species wintering in the Great Lakes region. Information on the distribution and seasonal abundance of sea ducks will help guide conservation efforts of habitat joint ventures, and will help predict and mitigate the effects of environmental and human/industrial activities. In addition to agencies that are conducting the surveys, increased coordination and data compilation is needed to make this information readily available to the SDJV and partners. The goal is to have one comprehensive report for the Great Lakes that encompasses survey data from the MWI, LGL January Waterfowl surveys, and any other surveys flown annually on the Great Lakes.

Survey Prerequisites: Two to three years of offshore transects are required to establish variability and verify survey design; only one year (2007) has included transects out to 2 km. Repeated surveys within a season would be useful in assessing the potential of that survey and the within-season variability. Satellite telemetry would also help answer this question. Need to coordinate the MWI with Lower Great Lakes Survey conducted by LPWWRF and CWS. Coordination/communication is needed among partners at least 2 months prior to the survey window to ensure adequate coverage of survey areas. Anticipated or unplanned shortfalls in the availability of aircraft or personnel may require partners to shift their effort to ensure continuity.

Primary Survey Strengths: This survey is designed to ensure adequate coverage of key areas, including offshore transects to 2 km, to provide estimates of the number of Long-tailed Ducks and other sea/diving ducks wintering in the Great Lakes. The survey helps to document changes in diving and sea duck use in response to increasing prey abundance and milder climatic conditions.

Limitations of the Survey: Unless a 4 km offshore transects are included, sea ducks using deep-water habitats beyond the nearshore to 2-km range may not be detected and counted. Other limitations may be the annual variability in the timing of sea ducks migration through the survey area. Some sea ducks may remain in the Upper Great Lakes during mild winters. Increased coordination and data compilation among agencies responsible for these surveys is needed to make this information consistently comparable among years and readily available to the SDJV and partners. Funding limitations may prevent completing all sections of the survey in some years.

Schedule for Proposed Survey, Analysis and Reporting: Survey would be conducted in January. Analysis and report done by end of September.

Potential Partners or Funding Sources: State and Federal agencies, Long Point Waterfowl and Wetlands Research Fund.

Budget:

Expense Category	**Funding Sources -2008**						
Personnel	**SDJV or other source**	Long Point WWRF	USFWS	CWS[a]	PA Game	OH DNR	MI DNR
Pilot							
Observer(s)		*800*	*600*	*1600*	*300*	*600*	*600*
Field preparation, analysis, report	**1500**	*2080*					
Survey aircraft costs							
Single engine aircraft			2500		1250	1250	1250
Twin engine aircraft –CWS portions	**5300**			(5300[a])			
Twin engine aircraft -LPWWRF portions	**4050**						
Travel & Accommodations							
Lodging		600		1000			
Food / Per diem		410					
Materials & Equipment							
Fuel at $2.00/gallon							
Survey supplies		200		100			
TOTAL	**10,850**	4090	3100	2700	1550	1850	1850

Budget is in US dollars

[a] Because of budget shortfalls, CWS will likely not be able to contribute to this survey in 2008, thus the costs for their portions are included under SDJV or other source as well. All of the other costs listed under SDJV would be needed by LPWWRF.

Estimated Cost to Accomplish Prerequisites: $5-10K (USD) for 2-3 years to determine annual and within-season variability in numbers and species composition.

Primary Contact for Surveys: Currently, the Long Point Waterfowl and Wetlands Research Fund coordinates the Lower Great Lakes Wintering Sea Duck Survey, and compiles comprehensive data collected by partners federal, provincial and state partners that conduct the MWI and LGL surveys in Lake St. Clair, Lake Erie and Lake Ontario. It seems logical that LPWWRF would continue to compile existing and additional survey data from the Great Lakes into one comprehensive database.

Shannon Badzinski, LPWWRF; 519-586-3531 ext. 220; sbadzinski@bsc-eoc.org.

Scott Petrie, Long Point Waterfowl & Wetlands Research Fund, P.O. Box 160, Port Rowan, Ontario N0E 1M0; 519-586-3531 ext. 208; spetrie@bsc-eoc.org.
Ken Ross, Environment Canada, Canadian Wildlife Service – Ontario Region, 49 Camelot Drive, Nepean, Ontario K1A 0H3; 613-949-8261; ken.ross@ec.gc.ca.
Norm North, Environment Canada, Canadian Wildlife Service – Ontario Region, 465 Gideon Drive P.O. Box 490, Lambeth Station, London, Ontario N6P 1R1; 519-472-8022; north@execulink.com

---

Northwestern Alaska Pacific Common Eider Breeding Survey

Status and/or Brief History of Survey: Pacific common eiders were chosen as a Focal Species by the U.S. Fish and Wildlife Service for which an action plan will be completed in 2006. Pacific Common eiders were noted during spring waterfowl surveys along the west coast of Alaska in 1992 and 1993. However, these surveys did not thoroughly search common eider habitat. Another survey has been flown annually from 1999 – 2005 to census common eiders along the arctic coast from Point Lay to the Canadian border by covering all barrier island and lagoon habitat (Dau and Larned, 2005). The study proposed here is intended to use the same protocol as the arctic coast common eider survey and essentially extend it along Alaska's west coast to the Yukon Delta. A pilot survey was attempted in 2006, but was only partially completed due to unforeseen aircraft scheduling and environmental constraints.

Primary Species or Population Targeted and Proportion of Range Covered by the Survey: Primary target species is Pacific common eider, however all waterfowl species observed will be recorded. The survey will cover about 50% of the breeding population of Pacific common eiders in Alaska. Secondary target species is long-tailed ducks.

Survey Objectives:
1. Obtain an estimate of common eiders along the northwest coast of Alaska.
2. Determine distribution of common eiders and relative importance of different geographic habitat areas

Survey Platform: Fixed-wing amphibious aircraft

Survey Timing and Recommended Frequency: The third week of June; annually. Survey timing was determined by analysis of ground observations of nesting chronology – it is optimally timed to estimate breeding pairs.

Methods and Survey Design: Total count by thorough search of all barrier island and lagoon habitat, shoreline, and a narrow (<= 1 mile) strip of onshore wetlands from St. Michael to Pt. Hope (Fig. 1). Data from 1992-1993 reconnaissance aerial surveys were used to guide delineation of the survey area. Data collection by computers linked to GPS will provide accurate location information for birds observed. Aircraft track will also be recorded to show area surveyed.

Survey will be flown in float-equipped Cessna 206 aircraft at 30-46m altitude and 135-157 km/hr. All species of waterbirds will be counted where doing so does not detract from censusing common eiders. Species and group size are recorded for each observation. Sex and age are recorded for common eiders when possible.

Fig. 1. Location of proposed west coast survey area (red) and existing north coast survey area (blue).

Products: Annual estimates for common eiders observed plus distribution maps.

Survey Prerequisites: No survey prerequisites.

Primary Survey Strengths: Extends coverage to the entire breeding range for Pacific common eider in Alaska, with the exception of the Aleutian Islands.

Limitations of the Survey: Assumes 100% detection rate; since some birds are undoubtedly missed, the estimates are considered minimum. Survey may also include some non-breeding birds that remain in marine waters.

Schedule for Proposed Survey, Analysis, and Reporting: Pilot survey was initiated in June 2006. Data analysis and report to be done by February 2007.

Potential Partners or Funding Sources: USFWS focal species program (funding), USFWS Alaska Migratory Bird Management (implementation), Yukon Delta and Selawik National Wildlife refuges (logistical support).

Budget:

	Funding Sources (for 2007)			
Expense Category	*Indicate in-kind* contributions in italics*			
Personnel	**SDJV or other sources**	USFWS Focal Species Program	USFWS-Alaska MBM	USFWS – Alaska refuges
Pilot			*4000*	
Observer(s)			*4000*	
Survey aircraft costs		6400		
Travel & Accommodations				
Commercial travel		500		
Lodging and meals		2200		*1000*
Materials & Equipment				
Fuel		2600		
TOTAL	**0**	11,700	*8000*	*1000*

- *in-kind* means people or resources that are directed or redirected to the project that require no additional funds (e.g., staff, use of existing equipment or facilities)

Primary Contact for Survey: Karen Bollinger, USFWS, Migratory Bird Management, 1412 Airport Way, Fairbanks, AK 99701; Karen_bollinger@fws.gov; (907) 456-0427

Literature Cited:

Dau, C. P., and W. Larned. 2005. Aerial population survey of common eiders and other waterbirds in near shore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 24-27 June 2005. Unpublished USFWS report, Anchorage, Alaska.

Central Arctic Canada Pacific Common Eider Breeding Survey

Status and/or Brief History of Survey: There is currently no regular breeding population survey to monitor Pacific Common Eider population trends in Canada. The area that we are proposing be used for this purpose was surveyed in 1995 as part of a larger survey that encompassed much of central arctic Canada. The area in question was surveyed again in 2006 and 2007 with funding in part by SDJV as Project #80. We are proposing a third year of this survey, and that it becomes a regular operational survey.

Primary Species Targeted and Proportion of Range Covered by the Survey: Primary target species is the Pacific Common Eider *(Somateria mollissima v nigra).* About 25% of the Canadian Pacific Common Eider breeding population occurs in the proposed survey area while it only encompasses about 15 % of the breeding range within Canada. Secondary species include Long-tailed Ducks *(Clangula hyemalis),* Black Brant *(Branta bernicla nigricans),* Red-throated Loons *(Gavia stellata),* Pacific Loons *(Gavia pacifica),* Yellow-billed Loons *(Gavia adamsii),* Glaucous Gulls *(Larus hyperboreus),* and Thayers Gulls *(Larus thayeri).* However, due to survey coverage (offshore islands and early open water) and survey methods (often survey at an altitude of 100 m), information collected on other species is of limited value.

Survey Objectives:
1. Population trend and abundance obtained from core part of breeding range.
2. Possible hypothesis testing of impact of local mining and port development.

Survey Platform: Bell 206B Helicopter (Bell 206L if 206B is not available)

Survey Timing and Recommended Frequency: 7 day period between June 20 to July 4. Conducted annually. Alternatively, the survey could be completed at a scaled-back frequency (e.g. for 3 years every 6 years), but this would result in a decreased ability to detect population changes by trend analyses. The optimal time to survey is during early stages of egg-laying when most pairs are near their nesting colony, pair bonds are still intact, and males have not yet departed on moult migration. At Bathurst Inlet, timing was determined by analysis of satellite telemetry data of Pacific Common Eiders (Dickson et al. 2005) and from 5 years of ground observations of nesting chronology (Hoover and Dickson 2007).

Methods and Survey Design: Survey is conducted from a Bell 206B (or 206L) helicopter flown at 60 to 100m (200-300 feet) and at 130-145 kph (80-90 mph). The flight path follows the coast as well as circles islands and open water areas to get a complete count of eiders (Falardeau et al. 2003, Dau and Larned 2005). At that time of year most coastlines typically have open water leads < 400m wide. To maximize visibility of birds on the water, the surveys are conducted during mid-day hours and when winds are calm or light.

There are two observers during the survey, one in the left front seat and the other in the rear right seat. Species, number, and when possible, sex and age of birds are recorded as well as the time of the observation. Observations of ducks, including the Pacific Common Eider, are recorded as flock size, noting the number or proportion of adult males and number or proportion of "brown" birds. In areas of high bird concentrations, air speed is reduced to the point accurate counts can be made. Observations are recorded into a cassette tape recorder to allow observers to keep their eyes on the survey area. FUGAWI GIS mapping software (Northport Systems Inc., Toronto, Ontario, Canada) log all aircraft movements and provide real time locations at 2 second intervals, allowing observations to later be merged with specific locations using the time. Additional information on survey date and time, weather, amount of open water, and visibility are also recorded. Shoreline segments used during the surveys conducted in 1995, 2006 and 2007 will be used so direct comparisons can be made and population trend information ascertained.

A double-counting technique is used to correct for differences in detection rate caused by annual variation in observers and environmental factors. The technique follows methods described in (Caughley and Grice 1982, Pollock and Kendall 1987, Anthony et al. 1992, Hines and Kay 2006, Raven and Dickson 2006) with modifications developed from the first two years of this study (see 2007 SDJV Annual Report for details).

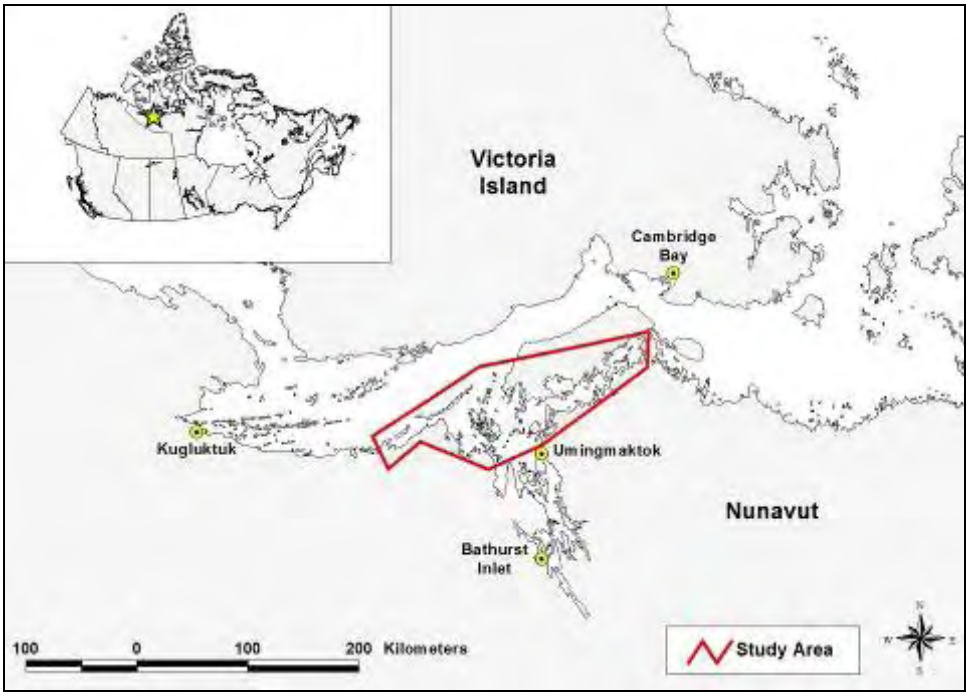


Figure 1. Map showing extent of study area for proposed Pacific Common Eider breeding pair surveys in the Bathurst Inlet area.

Products: In a core breeding area, a population estimate that has been adjusted for detection; distribution maps; population trend data

Survey Prerequisites: None

Primary Survey Strengths: Core breeding area allows 25% of population to be monitored in 15% of Canadian breeding range (cost effective). Boundaries of this breeding area are distinct from surrounding breeding areas. Incorporates detection rates to reduce bias resulting from annual variation in observers and environmental factors.

Limitations of the Survey: Due to immense size of breeding range and high cost of operations in arctic, survey doesn't cover entire breeding area. Annual population estimates and distribution of birds are both subject to variability in ice conditions and nesting chronology. Technique use to determine detection rates is not entirely suitable for Common Eider surveys (see 2007 annual report to SDJV for details).

Schedule for Proposed Survey, Analysis, and Reporting:
Survey is scheduled for late June/early July.
Preliminary analysis and progress report for SDJV to be completed by end of September.
Analysis and report to be completed by the following March.

Potential Partners or Funding Sources:
Canadian Wildlife Service
USFWS-Sea Duck Joint Venture
Polar Continental Shelf Project (PCSP)

Canadian Wildlife Service will be responsible for all aspects of the study, including the surveys, data analysis and reports, with financial support from SDJV and logistical support from PCSP.

Budget in 2008:

BUDGET (US Dollars)	**Funding Sources --- In-kind contributions are in *italics***			
Expense Category	SDJV	CWS*	PCSP*	**TOTAL**
Personnel				
PI salary		*10,000*		*10,000*
Technician salaries		*16,000*		*16,000*
Travel/Accommodations				
Commercial Travel		4,600		4,600
Chartered aircraft: Bell 206L helicopter 55 hours at $1600/h Twin Otter 7 hours at $1550/h	25,000	18,000	45,000 11,000	88,000 11,000
Lodging		1,500		1,500
Freight		1,500		1,500
Materials/Equipment				
Food and supplies		2,100		2,100
Contractual				
Vehicle/Vessel charter		300		300
Administrative Overhead				
Is this overhead required by your agency? Indicate yes or no, or explain under #15, Budget Justification			No	
TOTALS BY FUNDING SOURCE	**25,000**	**28,000** ***26,000***	**56,000**	**109,000** ***26,000***

* cannot give firm commitment due to budgetary cycle, but CWS (Canadian Wildlife Service) and PCSP (Polar Continental Shelf Project) have supported the Common Eider surveys in Bathurst Inlet area for previous 2 years and we anticipate a similar level of funding in 2008. Assuming Canadian dollar equal in value to U.S. dollar

Primary Contacts for Survey:

Lynne Dickson, CWS, 4999, 98th Ave., Edmonton, AB T6B 2X3, (780) 951-8681, lynne.dickson@ec.gc.ca
Garnet Raven, CWS, 4999, 98th Ave., Edmonton, AB T6B 2X3, (780) 951-8912, garnet.raven@ec.gc.ca

Literature Cited:

Anthony, R. M., W. H. Anderson, J. S. Sedinger, and L. L. McDonald. 1992. Estimating populations of Black Brant on the Yukon-Kuskokwim delta with airborne video: 1991 progress report. Unpublished Report, Alaska Fish and Wildlife Research Center, Anchorage, Alaska. 30pp.

Caughley, G. and D. Grice. 1982. A correction factor for counting Emus from the air, and its application to counts in western Australia. Australian Wildlife Research 9: 253-259.

Dau, C.P. and W.W. Larned. 2005. Aerial population survey of common eiders and other waterbirds in near shore waters and along barrier islands of the Arctic Coastal Plain of Alaska, 24-27 June 2005. Unpublished Report, U.S. Fish and Wildlife Service, Anchorage, AK 19 pp.

Dickson, D.L., T. Bowman, A. Hoover, G. Raven and M. Johnson. 2005 Tracking the movement of Pacific Common Eiders from nesting grounds near Bathurst Inlet, Nunavut to moulting and wintering areas using satellite telemetry. 2003-2004 progress report. Unpublished Report, Can. Wildl. Serv., Edmonton Alberta. 105pp.

Falardeau, G., J-F. Rail, S. Gilliland, J-P. L. Savard. 2003. Breeding surveys of Common Eiders along the west coast of Ungava Bay, in summer 2000, and a supplement on other nesting aquatic birds. Can. Wildl. Serv. Technical Report Series Number 405, Sainte-Foy, Quebec 67 pp.

Hines, J. E. and M. F. Kay. 2006. Minimum visibility correction factors for some species of waterfowl encountered in helicopter surveys in Arctic Canada. Pages 68-69 in Hines, J. E. and Wiebe, M. O (ed.). Surveys of geese and swans in the Inuvialuit settlement region, western Canadian arctic, 1989-2001. Can. Wildl. Serv. Occas. Pap. (draft). Ottawa, Ontario.

Hoover, A.K. and D.L. Dickson. 2007. Nesting ecology and survival of the Pacific Common Eider (somateria mollissima v-nigra) in central arctic Canada. Can. Wildl. Serv. Technical Report Series No. 471, Edmonton, Alberta.

Pollock, K. H. and W. L. Kendall. 1987. Visibility bias in aerial surveys: a review of estimation procedures. Journal of Wildlife Management 51: 502-510.

Raven, G.H. and D.L. Dickson. 2006. Changes in distribution and abundance of birds on western Victoria Island from 1992-1994 to 2004-2005. Can. Wildl. Serv., Technical Report Series No. 456, Edmonton, Alberta.

Atlantic Black Scoter Spring Staging Survey

Status and/or Brief History of Survey: Aerial survey initiated in spring 2005; conducted to assess use of staging area by Black Scoters and determine departure dates to breeding areas. Preliminary ground surveys (shore and kayak) were conducted from 1999-2001.

Primary Species or Population Targeted and Proportion of Range Covered by the Survey: Greater than 50% of entire Atlantic population of Black Scoters.

Survey Objectives: Determine abundance over a 6-week migration period (mid April to end of May). Determine seasonal peak numbers and estimate total bird use based on knowledge of turnover rates.

Survey Platform: Fixed-wing aircraft.

Survey Timing and Recommended Frequency: Annual; multiple aerial surveys mid April to end of May; surveys spaced 10 days apart.

Methods and Survey Design: Initially, surveys will be conducted over the entire Bay Chaleur and north shore St. Lawrence estuary at an altitude of 215-365 m asl. Observations and flight path recorded using USFWS GPS-voice recording software. Visual estimates will be adjusted for counting errors by comparing with photo counts. Ground counts provide estimates sex ratios, ratio of Black to Surf Scoters and total numbers for comparison to aerial survey.

Figure 1. Location of survey area (green area), Bay Chaleur, New Brunswick, Canada.

Products: An annual index of population size and trends.

Survey Prerequisites: The survey will focus on staging Black Scoters during spring migration. Estimates of turnover rates or length-of-stay are required to estimate total birds moving though the staging area. This maybe achieved by radio telemetry studies.

Primary Survey Strengths: A large portion of Atlantic Black Scoter migration appears to be focused in a relatively small area over a short period. Because the area is located near air support and field staff, the survey maybe more cost effective for monitoring Black Scoters than breeding, molting, or wintering ground surveys.

Limitations of the Survey: Unknown turnover rates, probability of detection variability in species composition, observer error in flock size estimation.

Schedule for Proposed Survey, Analysis, and Reporting: Multiple aerial surveys mid April to end of May; analysis and report by fall of same year.

Potential Partners or Collaborators: CWS will conduct surveys. Funding by CWS, USFWS and SDJV.

Budget:

	Funding Sources (in 2007)		
Expense Category	*Indicate in-kind* contributions in italics*		
Personnel	**SDJV or other sources**	CWS	
Observer(s)		*3000*	
Technician Salary		*1000*	
Biometrician/analysis		*500*	
Survey aircraft costs	**12000**		
Travel & Accommodations			
Commercial travel		500	
Lodging and meals		500	
Materials & Equipment			
TOTAL	**12000**	6500	

Estimated Cost to Accomplish Prerequisites: *(salary costs not included)*
$20K (US) per year for 2 years to examine turnover rates using VHF telemetry.

Primary Contact for Survey: Keith McAloney, Canadian Wildlife Service, 17 Waterfowl Lane, Sackville, NB E4L 1G6, (506) 364-5013, keith.mcaloney@ec.gc.ca

Avalon New Jersey Sea Watch

Status and/or Brief History of Survey: Assessing population status and trends in many Arctic and sub-Arctic breeding waterfowl is challenging because counting them across their range during the nesting season is logistically difficult. On their wintering range, they can also be difficult to count as they may be widespread across offshore waters of large lakes and coastal habitats. Counts of birds passing during migration can be useful in assessing population trends in species that are difficult to monitor during the breeding season (Bart and Ralph 2005, Hoffman and Smith 2003, Dunn and Hussell 1995). In particular, systematic counts of migrating diurnal raptors from fixed locations along migration routes have proven useful in identifying trends in several species (Hoffman and Smith 2003, Titus and Fuller 1990). Data has been collected at some survey locations for over thirty years (e.g., Cape May, Hawk Mountain).

Waterbird migration counts operated by New Jersey Audubon Society (NJAS) at Avalon, NJ, also known as the Avalon Sea Watch, have been conducted consistently since 1995 (Figure 1). The survey counts all visible migrating birds passing to the southwest within about 5.5 km of shore between 22 September and 22 December each year. The most abundant 20 species counted are listed in Table 1. While sea ducks are the most numerous group of birds counted, this survey provides information on a number of waterbirds including double-crested cormorants, northern gannets, red-throated loons, and common loons.

Figure 1. Location of Avalon Sea Watch

Primary Species or Population Targeted and Proportion of Range Covered by the Survey: With an average of approximately 160,000 surf scoters (*Melanitta perspicillata*), 140,000 black scoters (*Melanitta nigra*) and 85,000 unidentified "dark-winged" scoters counted each fall, this survey potentially counts the majority of black and surf scoters wintering south of Delaware Bay. Maximum counts in 2001 of 208,857 surf, 256,633 black, and 36,895 unidentified "dark-winged" scoters, were a major rational for the monitoring committee increasing the population estimates for the Atlantic populations of these scoters (Table 1, Figure 2). In the absence of adequate population data we speculate that possibly half of the Atlantic populations of these scoters could be counted each year, although estimates of the populations vary widely depending on the survey referenced (Savard et al.1998, Bordage and Savard 1995).

Survey Objectives:

1. The objective of the sea watch is to count the majority of dark-winged scoters and 30 other species of waterbirds migrating past Avalon Beach, New Jersey.
2. To determine trends in migration counts and insure managers are aware of trend data.
3. Determine daily and seasonal variation in migration and correlate movements with environmental conditions to inform management and mitigation of human impacts such as development of offshore wind turbines.

Table 1. Total counts of the most abundant birds observed flying southwest past Avalon, New Jersey between 22 September and 22 December. These data indicate the relative numbers of birds counted each year from 2000 through 2004, the 1995-2004 mean count, the maximum count on a single day between 1995 and 2004, and the date of that count.

Species	2000	2001	2002	2003	2004	Mean 95-04	Max Daily Count	Date of Max Count
Red-throated Loon	63,558	73,704	54,210	49,294	51,645	58,302	10,978	12-Nov-97
Common Loon	4,134	3,648	1,815	2,591	1,655	3,537	687	31-Oct-96
Northern Gannet	49,101	30,960	38,951	38,990	34,125	48,401	6,913	12-Dec-98
Double-crested Cormorant	221,525	169,144	195,473	232,661	157,179	194,656	24,078	21-Oct-04
Brant	6,881	7,380	6,445	8,396	5,123	9,348	3,915	30-Oct-95
American Black Duck	2,711	1,563	2,302	2,007	1,277	2,688	647	30-Oct-95
Northern Pintail	635	1,528	985	1,865	378	1,135	677	30-Oct-95
Green-winged Teal	7,612	5,483	4,901	9,943	5,399	7,521	3,197	27-Oct-96
Scaup	1,367	953	2,603	3,770	1,411	1,738	356	02-Nov-03
Long-tailed Duck	1,250	968	1,976	3,033	1,807	2,440	1,603	08-Dec-93
Surf Scoter	157,123	144,436	150,108	212,008	117,249	158,650	42,522	28-Oct-99
Black Scoter	134,872	128,669	111,657	153,369	103,525	141,590	42,507	26-Oct-98
Dark-winged Scoters	47,041	55,934	88,632	43,901	66,104	84,052	27,681	02-Nov-96
White-winged Scoter	1,877	2,205	2,036	1,805	2,067	3,254	961	23-Nov-95
Bufflehead	1,344	553	1,235	1,364	568	1,376	1,432	13-Nov-98
Red-breasted Merganser	2,523	1,879	3,517	3,995	1,755	3,925	1,252	19-Nov-98
Bonaparte's Gull	5,324	293	4,088	5,986	5,142	4,938	2,746	11-Dec-95
Laughing Gull	33,222	13742	11,596	20,718	6,513	18,782	6,603	12-Oct-00
Ring-billed Gull	8,991	4,990	5,346	25,177	5,327	13,684	9,081	10-Dec-95
Herring Gull	4,697	2,158	3,980	6,452	2,875	10,649	8,309	05-Nov-96
Forster's Tern	1,856	5,749	3,941	5,894	6,274	6,316	3,284	05-Nov-96

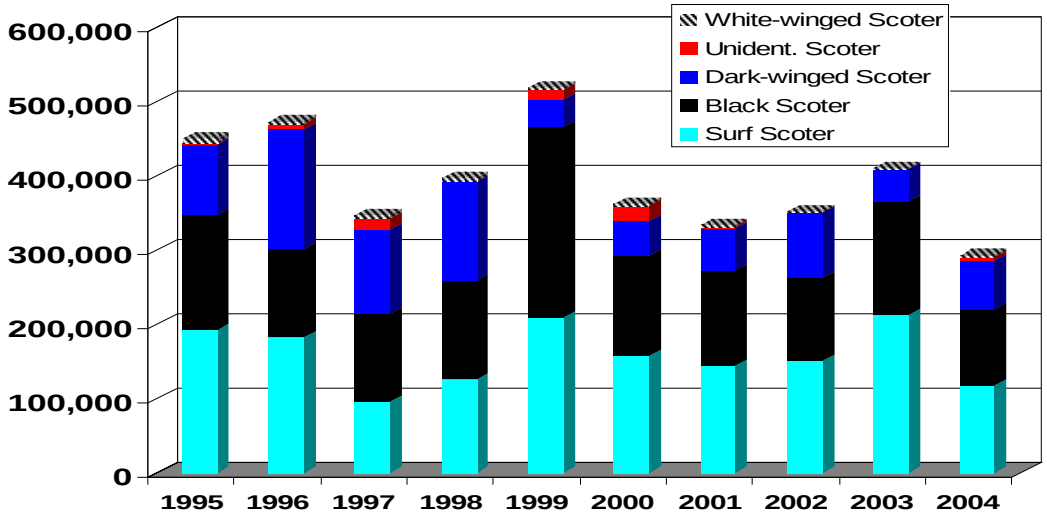


Figure 2. Scoters counted flying southwest past the Avalon Sea Watch between 22 September and 22 December, 1995 through 2004.

Survey Platform: We will conduct visible waterbird migration counts from the sea wall at the eastern end of the Avalon/Stone Harbor barrier island (~74.71^{o} W, 39.11^{o} N), Cape May County, New Jersey (Figure 1). The site provides an unobstructed view of the Atlantic Ocean and is close to several offshore shoals that appear to channel passage of migrating waterbirds toward the coast. The observer's eye height is about 6 meters above the water.

Survey Timing and Recommended Frequency: An observer conducts surveys daily from sunrise to sunset between 22 September and 22 December every year since 1994.

Methods and Survey Design: Generally, a single observer counts the migration on a given day, using tally counters and recording hourly tallies on data sheets. Additionally, on two days per week, a second observer will count all species and individuals flying in northeasterly direction. Birds are counted using a combination of binoculars (e.g., 8x42, 20x60 image stabilized) and spotting scopes.

Products: Annual reports containing summary counts of over 30 species of waterbirds migrating southwest past Avalon Beach and a comparison with previous years data to evaluate trends. Periodic analysis of the variation in the timing and magnitude of migration in relation to environmental variables.

Survey Prerequisites: Three potential biases should be addressed before counts of visible migration can be used reliably for monitoring population trends (*see Limitations, below*). A separate marine radar study to address the following limitations of data interpretation will occur in 2007, but is not necessary to continue the survey.

Primary Survey Strengths: The sea watch is an actual count of a large proportion of scoters and loons in the Atlantic Flyway. Actual counts are far better than dealing with the variances and possible errors associated with extrapolation of populations from small sample sizes.

Limitations of the Survey: Counts of waterbirds from fixed locations may be subject to inherent methodological biases that could affect the proportion of a population actually counted. These biases include:
1. Sea ducks could also migrate at night, thus, counts of diurnal migrants alone would underestimate the number of birds passing.
2. Observations are limited to approximately 5.5 km from shore, the extent of detection using conventional optical equipment. What proportion of waterbird migration occurs beyond this limit is unknown. Additionally, how is the spatial extent of migration relative to the coastline affected by meteorological conditions (e.g., wind direction and speed, visibility)?
3. Daily or multi-day movements of waterbirds could bias migration counts. Although we believe that most birds passing Avalon continue on their southward migration, it is possible that some birds are moving south along the coast and back north offshore or at night, thus inflating the migration count.

Schedule for Proposed Survey, Analysis, and Reporting:
Data Collection: 22 September-22 December; Data Entry/Database: 1-31 January;
Data Analyses and Report Preparation: 1 February-30 May; Annual Report: 31 May

Potential Partners or Funding Sources: USFWS Migratory Bird Management, Chesapeake Bay Field Office, Minerals Management Service, plus various optics manufacturers have supported the sea watch in the past.

Avalon Sea Watch Budget			
Personnel	**SDJV or other sources**	NJ Audubon	USFWS, MMS or Private
Project manager		8,000	
Primary Observer	**5,500**		
Secondary Observer	**1,500**		3,000
Employee Benefits		4,500	
Travel & Accommodations			
Mileage			1,680
Lodging			1,500
Materials & Equipment		500	
TOTAL	**7,000**	13,000	6,180

Primary Contact for Survey:
David S. Mizrahi, Ph.D. Vice-president for Research, New Jersey Audubon Society, 600 Route 47 North, Cape May Court House, NJ 08210 Ph: 609.861.0700, Fax: 609.861.1651
david.mizrahi@njaudubon.org

Literature Cited:

Bart, J., and C.J. Ralph. 2005. Coordinated bird monitoring. *In*, Proceedings of the Third Partners in Flight International Symposium. (C.J. Ralph and T.R. Rich, Eds.). Department of Agriculture, Forest Service General Technical Report PSW-191. *In press*.

Bordage, D., and J.L. Savard. 1995. Black Scoter (*Melanitta nigra*). In The Bird of North America, No. 177 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

Dunn, E.H., and D.J.T. Hussell. 1995. Using migration counts to monitor landbird populations: review and evaluation of current status. Pp. 43-88 *in*, Current Ornithology, Vol. 12 (D.M. Power, Ed.). Plenum Press, NY.

Hoffman, S.W., and J.P. Smith. 2003. Populations trends of migratory raptors in western North America, 1977-2001. Condor 105:397-419.

Savard, J-P.L., D. Bordage, and A. Reed. 1998. Surf Scoter (*Melanitta perspicillata*). In The Bird of North America, No. 363 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

Titus, K., and M.R. Fuller. 1990. Recent trends in counts of migrant hawks from northeastern North America. Journal of Wildlife Management 54:463-470.

Point LePreau, New Brunswick Migration Count

Status and/or Brief History of Survey: The Point Lepreau Bird Observatory is operated by the Saint John Naturalists' Club Inc. in New Brunswick. Created in 1995, the Observatory was formed to address the lack of information available about seabirds migrating through the Bay of Fundy and concerns about the impact of potential oil spills (there is a large refinery located in Saint John). The Bay of Fundy functions as a funnel for migrating seabirds and Point Lepreau is perfectly situated on the coast to view large numbers of migrating seabirds. Since 1995, more than 100 volunteers have participated in the counts and in 1999 a dedicated observer was hired to cover the most intensive spring and fall migration periods to ensure consistent coverage.

One result of the study is the discovery that significant numbers of Black and Surf Scoters migrate through the area each spring. Preliminary analysis indicates decreasing population trends for scoters but further work required to standardize count period across years. Honours Thesis by Alexander Bond (2005) of Mount Allison University analyzed data for migration chronology and generated population estimates.

Primary Species or Population Targeted and Proportion of Range Covered by the Survey: Primarily Atlantic Flyway populations of Black Scoter and Surf Scoter, with data secondarily on White-winged Scoter, Common Eider, and Common Loon. Population estimates generated from

birds observed per hour over migration period are Black Scoter 127,740 and Surf Scoter 92,627, which would be >60% of estimated Atlantic flyway population of Black Scoter and about 30% of the estimated Atlantic flyway population of Surf Scoter.

Survey Objectives: Generate population trends

Survey Prerequisites: Radar verification is required for two seasons to estimate the proportion of birds passing too far off shore to be recorded and determine numbers moving at night. Existing data set should be compared with that obtained by Avalon New Jersey to see if trends track each other.

Survey Platform: Ground surveys from observation booth at end of peninsula

Survey Timing and Recommended Frequency: 15 March to 25 May. Four-hour count periods with alternating 15 min ON and 15 min OFF. Average 200 hours observations per year. Survey to be conducted annually.

Methods and Survey Design: Daily 4-hour observations periods with 15 minutes of observation alternating with 15 minutes of rest. Passing birds are counted and categorized by flight direction, number, species and hour of day. Observations made with spotting scope and binoculars.

Products: Estimates of population trend

Primary Survey Strengths: Potentially counts most Black scoters and a reasonable portion of Surf Scoters on spring migration in Atlantic flyway. All scoters of both species summer north of

this latitude so there is no concern over annual variations in per cent of population summering south of the observation point.

Limitations of the Survey: Present survey technique cannot account for birds that may be passing too far off shore to be observed or birds passing at night. Radar will be used to provide a correction factor. Use of this survey to determine population trends assumes that the same proportion of the Atlantic population of Black and Surf Scoter migrates past Point Lepreau each year.

Schedule for Proposed Survey, Analysis, and Reporting: An annual report is generated each year.

Potential Partners or Funding Sources: Saint John Naturalists' Club for visual observations, Acadia University for radar verification. Acadia University has the radar capability and experience in bird counting using that technology and is interested in participating in the survey. Other potential contributors include the Canadian Wildlife Service, SDJV.

Budget: Estimated total cost of $8K (US) per year, mainly personnel costs. Radar verification would cost about $25K (US) for two years.

Primary Contact(s) for Survey: Keith McAloney – CWS Atlantic (keith.mcaloney@ec.gc.ca, Dr. Phil Taylor – Acadia University (ptaylor@acadiau.ca, Jim Wilson – Saint John Naturalists (jwilson@nbnet.net)

Hudson Bay Common Eider Colony Counts

Status and/or Brief History of Survey: Detailed colony counts done in 1980 (and 1997 provide excellent basis for future comparisons.

Species/Population Targeted: Hudson Bay Common Eider (*Somateria mollissima sedentaria*)

Survey Objectives: Population size and trend

Survey Platform: Ground and aerial surveys

Survey Timing: July for ground surveys (when sea ice abates allowing boating); late June early July for aerial surveys. Timing may be different for some archipelagos.

Methods and Study Design: Every 5 years about 400 randomly selected islands in the Belcher Archipelago are surveyed at 50% intensity. A sub sample of those 400 islands would be surveyed annually. An aerial survey will be conducted annually in some of the most important archipelagos.

Map of Survey Area or Site: The whole of Hudson Bay

Products: Population estimate for breeding birds only. Ratio of nest and air counts for a sample of islands. Estimate of the eider population males of the surveyed archipelagos.

Survey Prerequisites: Recommended to monitor sea ice conditions in winter because of history of ice-related die-offs. Estimate magnitude of egg and down harvest. Need to calibrate aerial survey and estimate their efficiency in different archipelagos.

Primary Survey Strengths: Sampling protocol is established for ground surveys, high proportion of population sampled.

Limitations of the Survey: Estimates are subject to variability in annual nesting effort and nesting chronology; Variability of the ratio adult males and nesting density not known at this time. In combination with the monitoring of the Northern Eiders, an intensive initial evaluation of aerial surveys is needed to estimate the variability of the counts, its sensitivity to breeding chronology, and the relationship between ground and air counts.

Schedule for Proposed Survey, Analysis, and Reporting: Annual reporting

Partners or Collaborators: Nunavut Wildlife Management Board; Makivik Research Center; Canadian Wildlife Service Prairie and Northern Region, Québec Region, Sanikiluaq Hunters and Trappers Association (local community).

Budget: Ground survey: $70K (Cd) every 5 yrs; $40K (Cd) annually; Aerial surveys: $40k (Cd) annually.

Primary Contacts for Survey: This population covers two CWS jurisdictions: Prairie and Northern (**Dr. Grant Gilchrist**); Ontario and Québec (**Dr. Jean-Pierre Savard**, Louis Lesage)

Literature Cited:

Gilchrist, H. G., J. P. Heath, L. Arragutainaq, S. Gilliland, K. Allard, and M. L. Mallory. 2006. Studies of common eider ducks wintering in Hudson Bay: applying complimentary methods of scientific research and local ecological knowledge. In, People and Environmental Change, R. Riewe, Ed. Manitoba Aboriginal Issues Press. University of Manitoba.

Nakashima, D. J., and D. J. Murray. 1988. The Common Eider (*Somateria mollissima sedentaria*) of eastern Hudson bay: a survey of nest colonies and Inuit ecological knowledge. 0-921652-02-X, Makivik Corporation, Research Department, xxiv + 174pp.

Robertson, G. R., A. Reed, and H. G. Gilchrist. 2001. Clutch, egg, and body variation among Common Eiders, *Somateria mollissima sedentaria*, breeding in Hudson Bay. Polar Research 20: 1-10.

Robertson, G. R., and H. G. Gilchrist. 1998. Evidence of population declines among female Common Eiders breeding in the Belcher Islands. Arctic 51: 300-315.

Schmutz, J. K., R. J. Robertson, and F. Cooke. 1983. Colonial nesting of the Hudson bay eider duck. Canadian Journal of Zoology 61: 2424-2433.

Northern Common Eider Nest Counts

Status and/or Brief History of Survey: Colony counts have been done along the south coast of Baffin Island (1996, 1997, and 1998); in west Ungava Bay (1980, 2000), in east Ungava Bay (1980), parts of Frobisher Bay (2000, 2001), at small colonies near Cape Vera in the Canadian High Arctic (2002, 2004, 2005, 2006), and parts of the Labrador coast (1980, 1998-2003). Aerial counts of males have been conducted along coast of Labrador (1980, 1994 and 1996) and the south coast of Baffin Island (1998).

Primary Species or Population Targeted and Proportion of Range Covered by the Survey: Northern race of Common Eider (*Somateria mollissima borealis*)

Survey Objectives: Obtain accurate nest counts at major breeding colonies to provide an index to abundance and trends, and aerial counts of males to monitor trends over broader geographic scales

Survey Platform: Ground and aerial surveys.

Survey Timing and Recommended Frequency: Varies with latitude: late June to early July. Community monitoring program of eider colonies should be built into local eider down collection operations and occur each year. Aerial surveys should be conducted every five years.

Methods and Survey Design: Community monitoring under CWS guidance. Most sampling would be near communities to minimize costs, although far enough away from communities to get beyond the effects of intensive egg and down harvest. Semi-annually sample colonies. The method of surveying common eider by aerial counts of the highly visible adult males adjacent to nesting islands during the breeding season has been successfully employed in Maine, Scandinavia, Labrador and the Maritimes (Lock 1986). In this survey, a comprehensive aerial survey around all eider colonies to estimate the number of adult males is required. There is potential for photographing males at colonies to estimate counting bias and obtain more reliable estimates.

Products: Colony monitoring program will provide estimates of trends across the breeding range, while aerial surveys will provide an assessment of trends over a much larger geographic area,

Survey Prerequisites: Estimate magnitude of egg and down harvest. Need to calibrate aerial survey and estimate their efficiency in different archipelagos. Better data on proper timing of

surveys. This is especially crucial for nests counts but is also important for the proper timing of aerial surveys. In combination with the monitoring of the Hudson Bay Eiders, an intensive initial evaluation of aerial surveys is needed to estimate the variability of the counts, its sensitivity to breeding chronology, and the relationship between ground and air counts. Distribution and abundance of eiders breeding along the east coast of Baffin Island is not well known and reconnaissance surveys are required to design a survey program for this area.

Primary Survey Strengths: Sampling protocol is established for ground surveys. Breeding is distributed in several archipelagos that can be sampled as a unit. Aerial counts of colonies could give relatively inexpensive but reliable estimates of nesting population, especially when coupled with complete nest counts on a portion of the nesting population.

Limitations of the Survey: The logistics of organizing a survey for breeding Northern eiders, which extends over expansive remote areas of the eastern Canadian Arctic, are difficult. Hence, only segments if the population is likely to be monitored. Estimates are subject to variability in annual nesting effort and nesting chronology (e.g. due to heavy sea ice conditions); Variability of the ratio adult males and nesting density not known at this time. Timing is extremely important and aerial counts should be conducted in early to the middle of the incubation period. Nest counts should be conducted in the last half of incubation and reflect that year's breeding effort but not necessarily the overall population size. Accuracy of aerial counts may require some kind of correction adjustment for counting bias.

Schedule for Proposed Survey, Analysis, and Reporting: Still to be worked out.

Partners or Collaborators: Nunavut, Nunavik, Nunatsiavut, Greenland.

Budget:
Ground counts: About $50K (Cd) south Baffin; $50K east Baffin; $60K Ungava; $30K Labrador(Cd). (Total of $190K (Cd)).

Aerial surveys:
About $30K (Cd) south Baffin; $30K east Baffin; $40K Ungava; $30K Labrador(Cd)

Primary Contact for Survey: This population covers three CWS jurisdictions: Prairie and Northern (Dr. Grant Gilchrist); Québec (Dr. Jean-Pierre L. Savard, Louis Lesage); Atlantic (Keith Chaulk, Scott Gilliland).

Literature Cited:
Chaulk, K. G., G. J. Robertson and W. A. Montevecchi. 2004. Regional and annual variability in common eider nesting ecology in Labrador. Polar Research 23: 121-130.

Chaulk, K. G., G. J. Robertson, W. A. Montevecchi and P. C Ryan. 2005. Aspects of Common Eider nesting ecology in Labrador. Arctic 58: 10-15.

Chaulk, K. G., G. J. Robertson, B. T. Collins, W. A. Montevecchi and B. Turner. 2005. Evidence of recent population increases in common eiders breeding in Labrador. Journal of Wildlife Management 69: 805-809

Chapdelaine, G., A. Bourget, W. B. Kemp, D. J. Nakashima, and D. J. Murray. 1986. Population d'Eider à duvet près des côtes du Québec septentrional, pp. 39-50 *in* Reed, A. ed. Eider ducks in Canada. Canadian Wildlife Service, Ottawa. Report Series No. 47.

Cooch, F. G. 1986. The number of nesting Northern eiders on the West Foxe Islands, NWT, in 1956 and 1976, pp. 114-118 *in* Reed, A. ed. Eider ducks in Canada. Canadian Wildlife Service, Ottawa. Report Series No. 47.

Falardeau, G., Rail, J.-F., Gilliland, S. and Savard J.-P. L. 2003. Breeding survey of Common Eiders along the west coast of Ungava Bay, in summer 2000, and a supplement on other nesting aquatic birds. Technical report Series No. 405, Canadian Wildlife Service, Quebec Region, Environment Canada, Sainte-Foy, vii + 32pp.

Lock. A. R. 1986. A census of Common Eiders in Labrador and Maritime Provinces, pp. 30 – 36. *in* Reed, A. ed. Eider ducks in Canada. Canadian Wildlife Service, Ottawa. Report Series No. 47.

Nakashima, D. J. 1986. Inuit knowledge of the ecology of the Common Eider in northern Québec, pp. 102-113 *in* Reed, A. ed. Eider ducks in Canada. Canadian Wildlife Service, Ottawa. Report Series No. 47.

Prach, R. W., A. R. Smith, and A. Dzubin. 1986. Nesting of the Common Eider near the Hell Gate- Cardigan Strait polynya, 1980-81, pp. 127-135 *in* Reed, A. ed. Eider ducks in Canada. Canadian Wildlife Service, Ottawa. Report Series No. 47.

Breeding Survey for the American Common Eider

Status and/or Brief History of Survey: Currently there exists no comprehensive breeding survey of this subspecies of the common eider. Their breeding range spans eastern Canada and the northeastern U.S. Various state, federal and Provincial agencies have intermittently conducted surveys over the past 40 years of breeding areas within their jurisdictions. Long term ground counts have been done in north shore Gulf of St. Lawrence, within the St. Lawrence estuary, and in Nova Scotia. Unfortunately, no coordinated, international survey of this breeding population of common eiders has occurred.

Primary Species or Population Targeted and Proportion of Population or Range Covered: The target population is the American Common Eider (*Somateria mollissima dresseri*) breeding in the Atlantic Canada, Quebec, Maine, and Massachusetts. Potentially, complete coverage of the breeding population could be realized by aerial methods, but only 10% of all colonies could be searched for nests.

Survey Objectives: Improve total population estimate and monitor long-term trend.

Survey Platform(s): Aerial fixed-wing amphibious aircraft and ground counts.

Survey Timing and Recommended Frequency: Aerial surveys beginning in early to mid May in United States, later in Canada. Ground surveys from May to mid-June, depending on latitude. Both surveys should be conducted once every 5 years.

Methods and Survey Design: Nest counts are made via systematic searches of the entire nesting area of a sample of nesting colonies across their range. In this survey, a comprehensive aerial survey around all eider colonies to estimate the number of adult males is required. The method of surveying common eider by aerial counts of the highly visible adult males adjacent to nesting islands during the breeding season has been successfully employed in Maine, Scandinavia, Labrador, and in the Maritimes (Lock 1986). The ratio of adult males per nest has been shown to be very close to 1:1. Discrepancies from the expected 1:1 ratio are ascribed to a dispersal of some males from the census area after breeding. There is potential for photographing males at colonies to estimate counting bias and obtain more reliable estimates. Further, data comparisons from nesting islands that receive both survey treatments can be used to substantiate survey timing.

Products(s): Population indices provide an approximation of the population size over the breeding range. Nest counts are considered a complete census of a portion of the population for that particular year. A subsample of islands are censused – the subsample is the same subset each year in some provinces and a slightly different set of islands in Maine.

Survey Prerequisites: None; there is agreement on SOP.

Primary Survey Strengths: Aerial counts of colonies could give relatively inexpensive but reliable estimates of nesting population, especially when coupled with complete nest counts on a portion of the nesting population. Complete nest counts are more useful for local management actions (i.e. permit review) and may provide information not obtainable from aerial surveys.

Limitations of the Survey: Timing is extremely important and aerial counts should be conducted in early to the middle of the incubation period. Nest counts should be conducted in the last half of incubation and reflect that year's breeding effort but not necessarily the overall population size. Accuracy of aerial counts may require some kind of correction adjustment for counting bias.

Schedule for Proposed Survey, Analysis, and Writing: Survey scheduled for early to mid May in United States, later (and variable) in Canada. Ground surveys would be conducted from May to mid-June, depending on latitude. Analysis and write-up in July and August.

Potential Partners or Funding Sources: CWS (aerial surveys and ground counts in Canada,), USFWS (aerial surveys and ground counts in states), Atlantic Flyway States and Provinces (personnel for surveys), and Duvetnor (ground counts in St. Lawrence estuary)

Estimated Operational Cost of Survey: $45K for aerial surveys *(salary costs not included)*, and $80K for ground counts (largely for salary costs for additional people).

Table 1. Estimated costs for aerial survey

Segment	Estimated Flight Time (hr)	Estimated Cost[1]
Maine	40	15000
New Brunswick	8	3000
Nova Scotia	15	5600
Quebec (estuary)	7	2600
Quebec (Gulf)	23	8600
Newfoundland (north)	6	2300
Labrador	20	7500
Total[2]	**120**	**45000**

[1] USFWS aircraft rate of $375 US/hr used in cost estimates.
[2] Costs may be within ±25% of actual effort.

Estimated Cost to Accomplish Prerequisites: NA

Primary Contact(s) for Survey: For U.S.: Brad Allen, Maine Dept. Inland Fisheries and Wildlife, (207) 941-4469; brad.allen@maine.gov. For Canada: Scott Gilliland, Canadian Wildlife Service, (709) 772-2013; scott.gilliland@ec.gc.ca

Literature Cited:

Lock A.R. 1986. A census of common eiders breeding in Labrador and the Maritime provinces. Pages 30–38 *in* A. Reed, editor. Eider ducks in Canada. Canadian Wildlife Service Report Series, Number 47.

Pacific Barrow's Goldeneye Breeding Survey

Status and/or Brief History of Survey: This would be a combination of new and existing ecosection-based helicopter surveys in British Columbia and Alaska.

Primary Species or Population(s) targeted and proportion of population or range Covered by the Survey: Western breeding population of Barrow's Goldeneyes. Estimated 75% of breeding range, 50-75% of the breeding population. The proportion of the population is uncertain, as their breeding range is not well defined and large areas of potential breeding habitat remain unsurveyed. Surveys in parts of British Columbia have failed to find the number of breeding Barrow's Goldeneyes expected to be present in their presumed core breeding range (Breault, unpubl. data), suggesting there are either fewer Barrow's Goldeneyes breeding in B.C. (and possibly in the world population) than currently estimated or the current understanding of the distribution of this population (Savard 1987) needs to be revisited.

Survey Objectives:

1. Validate the 2006 breeding population estimate for previously surveyed areas in BC and assess trends
2. Conduct reconnaissance-level surveys of potential breeding areas in unsurveyed areas in BC and Alaska to better define distribution and relative densities.
3. Establish the relationship between distribution/abundance and habitat features

Survey Platform: Helicopter

Survey timing and recommended frequency: May; annually

Methods and Study Design: Rotational plot design, stratified by habitat; combination of permanent and annual plots.

Products:

1. Maps showing relative densities in surveyed area.
2. Annual population estimate and trends over the presumed core breeding area.
3. Analysis of habitat-species relationships (for streams, rivers, floodplains, lakes/wetlands, by order or size class) throughout range.
4. Annual report to the SDJV, U.S. Fish and Wildlife Service, Ducks Unlimited Canada, Canadian Wildlife Service and other interested parties on population estimate and trends

Survey Prerequisites: Reconnaissance surveys to document breeding range of Barrow's goldeneye and possibly ground-truthing to better define species composition (Barrow's versus Commons). Could possibly be accomplished via more extensive coverage in first year or two of survey.

Primary Survey Strengths: Addresses the uncertainty associated with the size of the world and of the B.C. breeding population of Barrow's Goldeneyes and of their population trend. Woud establish habitat-species relationships across landscapes and habitat types. Habitat-species relationships can be used to model (predict) Barrow's Goldeneye distribution and abundance across landscapes and landscape features. Survey addresses data needs for other sea ducks (most notably Hooded, Common and Red-breasted Merganser, Bufflehead, Common Goldeneye) and diving ducks (Lesser Scaup and Ring-necked Duck) breeding in surveyed areas. Survey may contribute to the USFWS and PFC's development and implementation of the Western Mallard (AHM) Model and to NAWMP goals by providing Mallard and other waterfowl species population estimates in unsurveyed ecosections of British Columbia.

Limitations of the Survey:
High cost; availability of aircraft, pilots, and observers during May.

Partners and Collaborators: Helicopter Surveys of Breeding Waterfowl in the BC Interior are jointly funded by the U.S. Fish and Wildlife Service, the Pacific Flyway Council, Ducks Unlimited Canada and the Canadian Wildlife Service of Environment Canada. A similar collaborative arrangement is expected for the surveys that would cover most of the Barrow's Goldeneye (presumed) core breeding range.

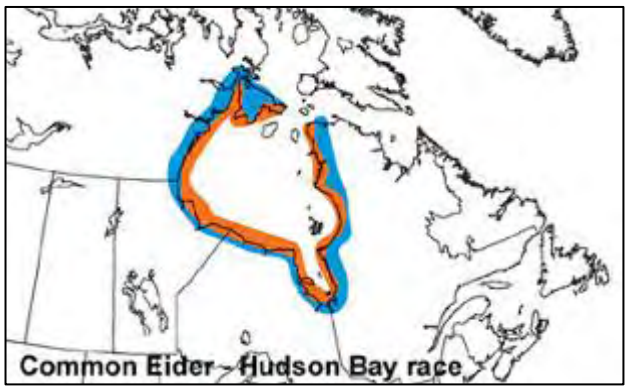
Budget: *(salary costs not included)* The delivery of helicopter surveys over the core and non-core breeding areas of Barrow's Goldeneyes in British Columbia is expected to cost ~ $185,000.00 USD annually (see details below), of which well over $150,000.00 USD is already committed. New funding to expand into unsurveyed areas of BC and Alaska would be approximately $60-80K/year.

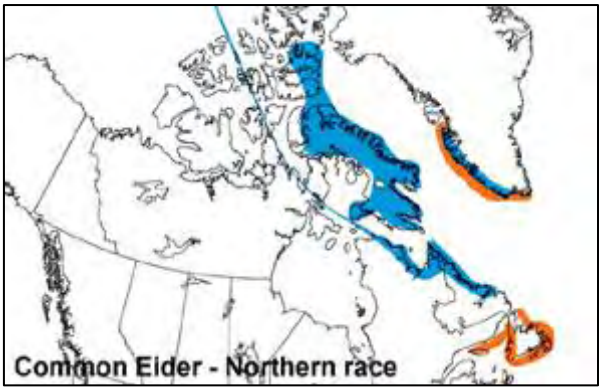
Primary Contact for Survey: Andre Breault, Canadian Wildlife Service, Pacific Wildlife Research Centre, 5421 Robertson Road, RR1, Delta, British Columbia Canada V4K 3N2. Tel. (604) 940-4662, email: Andre.Breault@ec.gc.ca

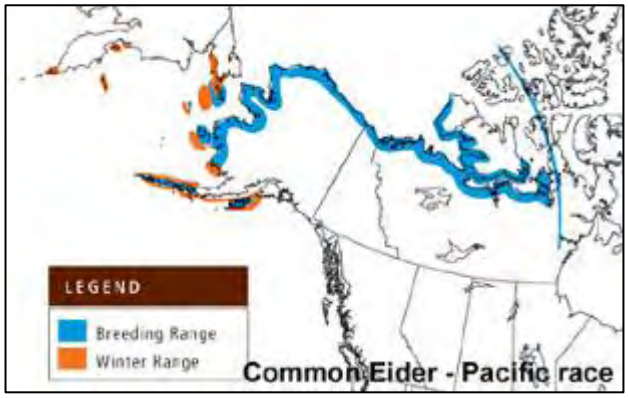
Literature Cited:

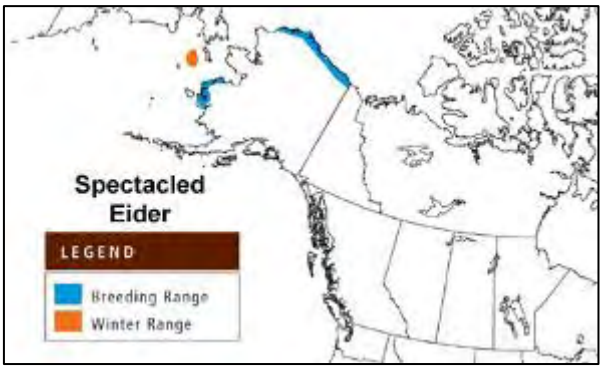
Savard, J.-P. L.. 1987. Status report on Barrow's Goldeneye. Tech. Rep. Ser. no. 23. Can. Wildl. Serv., Pacific and Yukon Region.

Appendix C. Range maps of North American sea ducks









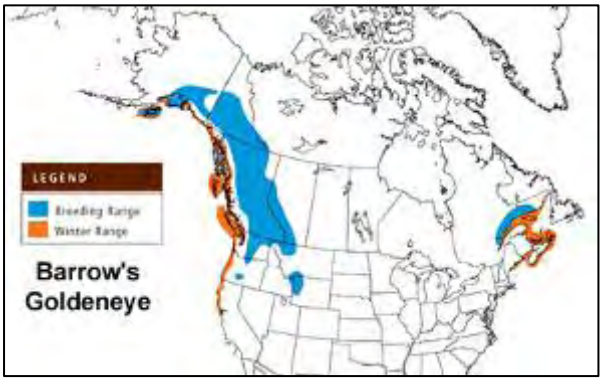

LEGEND
Surf Scoter


LEGEND
Black
Scoter

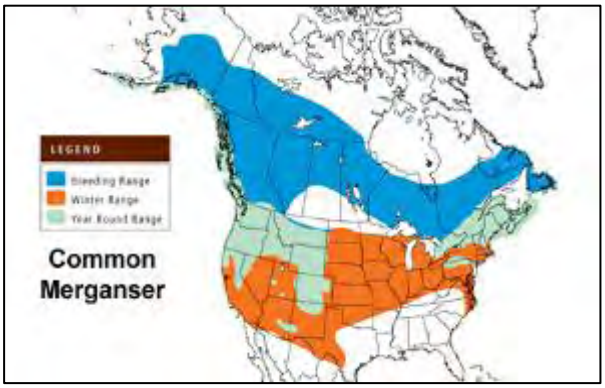

LEGEND
Long-tailed
Duck


LEGEND
Harlequin
Duck

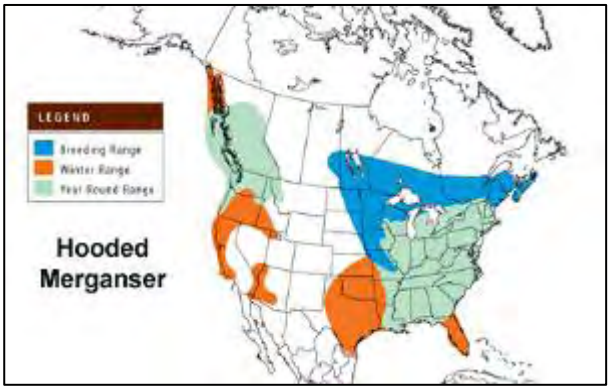

LEGEND
Common
Goldeneye


LEGEND
Barrow's
Goldeneye


LEGEND
Bufflehead


LEGEND
Common
Merganser


LEGEND
Red-breasted
Merganser


LEGEND
Hooded
Merganser