Technical Paper No. 384

Saint Lawrence Island Subsistence Harvest of Birds and Eggs, 2011–2012, Addressing Yellow-billed Loon Conservation Concerns

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In collaboration with the Native Villages of Gambell and Savoonga

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Alaska Department of Fish and Game
Division of Subsistence

Alaska Migratory Bird
Co-Management Council

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the reports by the Division of Subsistence. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly-accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly-accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures)	first three letters (Jan,...,Dec)
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

TECHNICAL PAPER NO. 384

SAINT LAWRENCE ISLAND SUBSISTENCE HARVEST OF BIRDS AND EGGS, 2011–2012, ADDRESSING YELLOW-BILLED LOON CONSERVATION CONCERNS

NOVEMBER 2013

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The Division of Subsistence Technical Paper series was established in 1979 and represents the most complete collection of information about customary and traditional uses of fish and wildlife resources in Alaska. The papers cover all regions of the state. Some papers were written in response to specific fish and game management issues. Others provide detailed, basic information on the subsistence uses of particular communities which pertain to a large number of scientific and policy questions.

Technical Paper series reports are available through the Alaska Resources Library and Information Services (ARLIS), the Alaska State Library and on the Internet: http://www.adfg.alaska.gov/sf/publications/. This publication has undergone editorial and professional review.

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Front cover photo: Fish, birds, and seal on a drying rack. The communities of Gambell and Savoonga, on St. Lawrence Island, rely on marine mammals as their main subsistence resource and also harvest a diversity of other wild animals and plants. Photograph by Liliana Naves, ADF&G Division of Subsistence.

TABLE OF CONTENTS

Page

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

LIST OF APPENDICES

Appendix **Page**

ABSTRACT

This report presents results of bird counts, harvest surveys, and local and traditional knowledge collected in 2011 and 2012 in Gambell and Savoonga, Alaska, to address conservation concerns regarding the yellow-billed loon *Gavia adamsii*. Sixty species were observed during fall bird counts and loons represented up to 0.1% of the number of birds. Four loon species were observed: Pacific (94.5%), yellow-billed (4.2%), red-throated (0.5%), and Arctic (0.4%) loons. Loons occurred as single birds (66.4%), pairs (18.7%), groups of 3–9 loons (13.8%), and groups of 10–182 loons (1.1%). Pacific/Arctic loons constituted 94.0% of loons in breeding plumage and 96.9% of loons in nonbreeding plumage. Yellow-billed loons represented 5.6% of loons in breeding plumage and 1.6% of loons in nonbreeding plumage. The annual average subsistence harvest was 5,171 birds for Gambell and 4,038 birds for Savoonga. Loons represented 0.3% of the average annual bird harvest in Gambell and 3.7% in Savoonga. Harvest of loon eggs was not reported. In 2011, harvest estimates included 151 loons composed of common (53.6%), Pacific/Arctic (27.8%), yellow-billed (11.3%), and red-throated (7.3%) loons. In 2012, harvest estimates included 179 loons composed of nonbreeding unidentified (64.2%), common (3.4%), Pacific/Arctic (26.3%), yellow-billed (1.7%), and red-throated (4.4%) loons. The proportion of loons in nonbreeding plumage in harvest surveys and the average proportion of species and plumages in fall bird counts were used to adjust the harvest species composition. Loon harvest occurred mainly by boat and loons were taken with shotguns. Loons were used for food and were not used for crafts or ceremonial purposes. There is a preference to harvest young birds, including loons. The St. Lawrence Island Yupik naming of loons does not exactly match western biological taxonomy and identifies kinds of loons based on size and plumage. Identification of loon species, especially of nonbreeding plumages, is very difficult. As in western societies, a considerable proportion of St. Lawrence Island people could not tell loon species apart, and there were inconsistencies in uses of Native names. Common loons in harvest surveys most likely refer to the most common loon in the area, which in St. Lawrence Island is the Pacific loon. These results highlight the importance of testing and fine tuning harvest survey designs as new management issues emerge. This study also addressed some difficulties with previous harvest surveys and provided reliable harvest estimates representing usual bird and egg harvest levels in the study communities.

Key words: Saint Lawrence Island, Gambell, Savoonga, yellow-billed loon, *Gavia adamsii*, migratory birds, eggs, subsistence harvest, subsistence hunting, ducks, geese, swans, cranes, ptarmigan, grouse, seabirds, shorebirds, grebes, loons, Alaska Migratory Bird Co-Management Council.

EXECUTIVE SUMMARY

The yellow-billed loon *Gavia adamsii* was listed in 2009 under the Endangered Species Act as a candidate species, and subsistence harvest in Alaska was identified as a threat. Inconsistencies between harvest estimates and preliminary information on loon species composition and abundance on St. Lawrence Island raised potential issues with species identification and the magnitude of harvest estimates. In 2011 and 2012, fall bird counts, subsistence harvest surveys, ethnographic research, and outreach activities were conducted to address these conservation concerns.

Visual bird counts were conducted close to the communities of Gambell and Savoonga to assess the relative abundance of species in coastal waters from mid-September to mid-October, when most loon harvest occurs. Data were also collected on loon plumages (breeding, nonbreeding), age (adult, juvenile), group size, approximate distance from shore, and direction of flight. The observation effort was 168.3 hours in 2011 and 161.4 hours in 2012. The index of relative species abundance (ISA) was calculated by dividing numbers of birds counted by hours of observation.

For the harvest survey, all households in both communities were stratified as harvester or nonharvester and attempts were made to contact all households. On average, 94.9% of the households contacted agreed to participate in the survey. The average sampling rate was 89.8% for spring–summer and 82.0% for fall. To provide context to harvest data, local and traditional knowledge was collected on species identification, methods of harvest, and local uses of loons through field notes and 4 semidirective key respondent interviews. In 2012, harvest survey materials were modified to better represent loon species composition, identification by local residents, and harvest preference for young loons.

Sixty species were recorded in fall bird counts. The short-tailed shearwater was the species counted in the highest numbers (2011=95.4%, 2012=96.2%), followed by black-legged kittiwake (2011=3.0%, 2012=1.3%), spectacled eider (2011=0.5%, 2012=0.6%), and king eider (2011=0.2%, 2012= 0.4%). Loons represented up to 0.1% of the total number of birds. Four loon species were observed: Pacific (94.5% of total number of loons), yellow-billed (4.2%), red-throated (0.5%), and Arctic (0.4%) loons. The common loon was not recorded.

Loons occurred closer to shore at Gambell (56.5% of loons within 0–199 m from shore) than at Savoonga (74.1% of loons farther than 400 m from shore). The main directions of loon flight in Gambell (70.9% SW to NE, 29.1% NE to SW) and Savoonga (68.0% W to E, 31.9% E to W) support that loons stage around St. Lawrence Island during fall migration. Loons were observed as single birds (66.4%), pairs (18.7%), groups of 3–9 loons (13.8%), and groups of 10–182 loons (1.1%). Pacific/Arctic loons represented 94.0% of loons in breeding plumage and 96.9% of loons in nonbreeding plumage. Yellow-billed loons represented 5.6% of loons in breeding plumage and 1.6% of loons in nonbreeding plumage.

The 2011–2012 annual average bird harvest was 5,171 birds for Gambell and 4,038 birds for Savoonga. The main species harvested were (2011–2012 annual % average) murre (24.6% of the total harvest in Gambell and 52.2% in Savoonga), auklet (45.2% and 9.9%), cormorant (11.1% and 16.7%), common eider (6.0% and 4.2%), and large gull (4.3% and 3.3%). The 2011–2012 annual average egg harvest was 3,938 eggs for Gambell and 18,345 eggs for Savoonga. Murre eggs represented 93.2% of egg harvest for Gambell and 99.5% for Savoonga. Loons represented 0.3% of the total bird harvest in Gambell and 3.7% in Savoonga. Harvest of loon eggs was not reported.

In 2011, harvest estimates included 151 loons composed of common (53.6%), Pacific/Arctic (27.8%), yellow-billed (11.3%), and red-throated (7.3%) loons. In 2012, harvest estimates included 179 loons composed of nonbreeding unidentified (64.2%), common (3.4%), Pacific/Arctic (26.3%), yellow-billed (1.7%), and red-throated (4.4%) loons. The proportion of loons in nonbreeding plumage in harvest surveys and the average proportion of species and plumages in fall bird counts were used to adjust the harvest species composition.

Loon harvest occurred mainly by boat in conjunction with the fall seal hunt. Loons were taken with shotguns as most other birds. Loons were used only for food and were not used for crafts or ceremonial purposes. There is a preference to harvest young birds, including loons, because young birds are tender and have more fat. Entanglement of loons in subsistence fishing nets was reported as occasional (2 loons in the 2011–2012 surveys) and seemed to be uncommon. Loons were commonly harvested as single birds (17 out of 33 cases) although the occurrence of groups of loons may be related to increased harvest success. Dozens of loons may take part in feeding aggregations with other birds and marine mammals. Although feeding aggregations may be relatively common around St. Lawrence Island, it seems that they uncommonly include large loon numbers.

The St. Lawrence Island Yupik naming of loons does not exactly match western biological taxonomy. Local people recognize loons and grebes as a family of birds and identify kinds of loons based on size and plumage. *Yuwayu* is the name for loons in general (all species), although it may refer to small loons (Pacific, Arctic, and red-throated loons), or yet more specifically, to small loons in breeding plumage. *Yuwayaaghaq* refers to young loons in general (all species in nonbreeding plumage) or specifically to young, small loons. *Melqupak* is the name for Pacific and Arctic loons in breeding plumage and *eghqaaq* are red-throated loons in breeding plumage. *Nangqwalek* is the name for large loons, both yellow-billed and common loons, or specifically for large loons in breeding plumage. Large loons in nonbreeding plumage are named *nangqwalgaaghaq*. Loon identification requires advanced bird identification skills. As in western societies, a considerable proportion of people could not tell loon species apart and there were inconsistencies in uses of Native names. The dominant factor for loon identification in harvest surveys was the word "common" presented in survey materials rather than morphologic characteristics (size, plumage, and bill color). "Common loons" reported in harvest surveys most likely refer to the most common loon in the area, which is the Pacific loon.

In 2011, use of the historic survey materials in a context of increased sampling effort and dedicated expertise in harvest data collection and loon identification clarified harvest levels and highlighted difficulties in species identification. Modifications to the 2012 survey materials minimized species identification issues and allowed a quantification of harvest preference for young loons. These results highlight the importance of testing and fine tuning harvest survey designs as new management issues emerge.

A key goal of the project was to conduct the 2011–2012 St. Lawrence Island bird harvest surveys with scientific rigor. (1) Implementation of the sampling design included local expertise (local surveyors) and expertise in harvest data collection (anthropologists) and loon identification (avian biologists). (2) Outreach and education efforts informed and involved the communities. (3) Sampling coverage was maximized and only a small proportion of households was not surveyed (households that could not be contacted or that declined to participate in the survey). (4) Recall bias was minimized by collecting fall harvest data (when most loon harvest occurs) just at the end of the season. (5) Although we did not specifically assess potential biases in harvest reporting (under or over-reporting), there were no indications that potential biases could have significantly affected harvest estimates including loon estimates. (6) Limitations in loon species identification in harvest surveys were established with ethnographic information and bird counts and adjusted species-specific harvest estimates were based on fall bird counts. (7) Data review included extensive participation of the communities and staff from ADF&G, USFWS, and USGS. In this context, this study addressed some difficulties with previous harvest surveys and provided reliable harvest estimates representing usual bird and egg harvest levels in the study communities.

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We are grateful for the opportunity to work in close collaboration with the communities of Gambell and Savoonga. The tribal councils welcomed us to the communities, facilitated research work and data review, and were open to discuss sensitive topics such as harvest of species of conservation concern. We are grateful to all households that participated in the survey and provided comments and insights on harvest patterns and bird ecology. We thank Chester Noongwook, Sam Mokiyuk, Kenneth Iworrigan Sr., and Morgan Apatiki Sr. for sharing their knowledge in key respondent interviews. The bird count observers provided bird identification expertise and endured very harsh weather: Dennis Marks, Luke DeCicco, Elizabeth Labunski, Peter Scully, Andy Bankert, Garrett MacDonald, and David Pavlik. Paul Lehman contributed knowledge and insight on the local bird fauna. The local surveyors helped in the communication with the households and in many other aspects of the data collection work: Brenda Slwooko, Susan Apassingok, Daniel Apassingok, Dawnelle Apangalook, and Josh Slwooko (Gambell); Morgan Annogivuk, Dylan Iya, and Tristan Seppilu (Savoonga). For expertise in harvest data collection we relied on anthropologists and other staff from the ADF&G and USFWS: James Van Lanen, Meredith Marchioni, Kelly Gwynn, and Ernest Nageak. Steven Jacobson of the Alaska Native Language Center provided information on Native loon names. Christopher Koonooka translated key respondent interview from St. Lawrence Island Yupik to English. Roland Alowa, Sharon Alowa, Cheryl Koonooka, Della Campbell, and Hanson Irrigoo provided key logistic support. We thank the USFWS Region 7 Division of Migratory Bird Management Anchorage Office, especially Russ Oates and the AMBCC Program, and the USFWS Fisheries and Ecological Services Fairbanks Field Office for funding this study and providing technical support. Donna Dewhurst (USFWS–AMBCC Program) has provided continuous technical expertise to all research projects conducted by the AMBCC, including this one. Dave Koster and the Information Management Unit of ADF&G Division of Subsistence assisted in data management. We thank our peer-reviewers for their contributions, which much improved this report: Ted Swem and other staff from the USFWS Fisheries and Ecological Services, Kathy Kuletz and Bob Stehn (USFWS Division of Migratory Bird Management), Joel Schmutz (USGS Alaska Science Center), Dan Rosenberg (ADF&G Division of Wildlife Conservation), and Jim Fall and Hiroko Ikuta (ADF&G Division of Subsistence).

Photo by Tamara K. Zeller, USFWS

INTRODUCTION

The yellow-billed loon *Gavia adamsii* was listed in 2009 under the Endangered Species Act (ESA) as a candidate species (CFR vol. 75, No. 56, pp. 12932–12968). The subsistence harvest in Alaska was identified as a threat, primarily based on 2007 harvest estimates for the Bering Strait–Norton Sound region, in northwest Alaska (Naves 2010). In this region, yellow-billed loons occur in small numbers in the mainland, and at least in some years, relatively large numbers migrate across the Bering Sea nearing St. Lawrence Island (Figure 1) (Schmutz and Rizzolo 2012). Harvest estimates seemed inconsistent with information on loon species composition and abundance on St. Lawrence Island, raising concerns about the accuracy of estimated harvest amounts and issues with species identification (USFWS 2010). Following the yellow-billed loon listing, efforts directed to better understand loon abundance, distribution, and harvest in the Bering Strait–Norton Sound region included 1) a literature review on loon harvest in western and northern Alaska (Huntington 2009); 2) an ethnographic study on historic and current harvests and uses of loons on St. Lawrence Island (Omelak 2009); 3) 2009 and 2010 harvest surveys conducted in the context of the regular harvest monitoring program of the Alaska Migratory Bird Co-Management Council (AMBCC) (Naves 2011, 2012); and 4) 2010 community outreach, interviews, and fall bird counts to determine the relative abundance of loon species on St. Lawrence Island (Zeller et al. 2011).

Based on these previous efforts, this study conducted in 2011 and 2012 on St. Lawrence Island was designed 1) to continue building communication with the local communities about loon conservation; 2) to provide reliable information on the species and amounts of loons and other birds harvested; and 3) to better understand the context of the loon harvest. The U. S. Fish and Wildlife Service (USFWS) and the Alaska Department of Fish and Game (ADF&G) established direct collaboration with the Native communities of Gambell and Savoonga through their tribal councils to collect subsistence harvest data and to facilitate research and community meetings to discuss loon conservation issues. Harvest data were collected in the context of the AMBCC Harvest Assessment Program (Naves 2012), which was supplemented by efforts 1) to ensure accuracy and completeness of data collection; 2) to ensure extensive sampling coverage; 3) to minimize recall bias; 4) to address loon identification issues; and 5) to collect local and traditional knowledge (LTK). In addition, shore-based bird counts were conducted in fall (when most loon harvest occurs) to provide information on the local occurrence and abundance of loons and other birds. Preliminary results were reviewed and approaches for data release were discussed at community meetings (photo page 31, bottom left). An earlier version of this report was peer-reviewed by staff of USFWS, ADF&G, and the U. S. Geological Service (USGS). All comments and suggestions provided by the communities and other reviewers were formally addressed and incorporated in this report.

St. Lawrence is a large island (90 miles long, 8–22 miles wide) in the Bering Sea, surrounded by complex oceanographic conditions involving currents, upwellings, and polynyas. Highly productive waters support an abundance of marine mammals and seabirds. On the island, the communities of Gambell (63°46’ N 171°42’ W; human population of 681 in 2010) and Savoonga (63°41’ N 170°27’ W; human population of 671; U.S. Census Bureau 2011) are primarily engaged in subsistence fishing, hunting, and gathering. These communities harvest a diversity of wild animals and plants, although marine mammals compose most of their harvests. Subsistence harvests at Savoonga were estimated in 2009 at 948 edible lb/person and were composed of 45% walrus, 28% seals, 14% bowhead whale, 6% fish, 2% birds, 2% bird eggs, and 3% other resources (Tahbone and Trigg 2011). Birds and eggs are a small proportion of the total harvests but add diversity to the diet, and their harvesting and sharing are important cultural and social activities.

In Alaska, most of the yellow-billed loon breeding population is found between the Meade and Ikpikpuk rivers in the North Slope; sparse breeding also occur in other areas of the North Slope and Northwest Arctic, including St. Lawrence Island. Breeding areas in Arctic Canada and Russia are poorly known and the breeding range may include large areas with few or no birds (reviewed in Earnst 2004). The estimated yellow-billed loon global population is about 16,000–32,000 birds with 3,000–4,000 birds breeding in Alaska (74 FR 12932). The yellow-billed loon is a regular migrant along the north coastline of Canada and Alaska, tip of the Seward Peninsula, and St. Lawrence Island. Most yellow-billed loons that breed in Alaska and on the Canadian Arctic islands winter in the Sea of Japan and the Yellow Sea, whereas birds from eastern mainland Canada migrate inland to winter in Southeast Alaska and British Columbia (North 1993; Moores 2007). Satellite tracking revealed one postbreeding (fall) migration route for yellow-billed loons across the Chukchi Sea and another through the Bering Strait and St. Lawrence Island area. In the prebreeding (spring) migration, most detections of tracked birds were in the Bering Strait, especially near St. Lawrence Island (Schmutz and Rizzolo 2012). The yellow-billed loon is an uncommon to fairly common fall migrant at St. Lawrence Island; a few individuals have been recorded from mid-August to mid-September, with

increased abundance in late September and early October (high daily counts 20–40 birds, Lehman 2012). Productive waters north of St. Lawrence Island are likely a staging area during the fall migration (North 1993, J. Schmutz pers. comm. in Earnst 2004).

Records of common loons *Gavia immer* on St. Lawrence Island occur mostly in spring and only few records of single birds occur in fall (Lehman 2012, this study). The Pacific loon *Gavia pacifica* breeds on St. Lawrence Island and it is common during the spring and fall migrations (Fay and Cade 1959; Ehrlich et al. 1993). Fall migration of Pacific loons starts in early September, with high numbers of 100–125 birds/day counted between mid-September and early October (maximum 279–510 birds/day) (Lehman 2012). The Arctic loon *Gavia arctica* breeds in the Chukotka Peninsula and in small numbers in northwest Alaska. This species is a regular spring migrant and a rare fall migrant on St. Lawrence Island (occasional records of single birds from late August to mid-October, Lehman 2012, this study). The red-throated loon *Gavia stellata* is a common breeder on St. Lawrence Island (Fay and Cade 1959; Ehrlich et al. 1993) and fall migration has been recorded from late August to mid-October (maximum of 9 birds observed in 1 day, Lehman 2012).

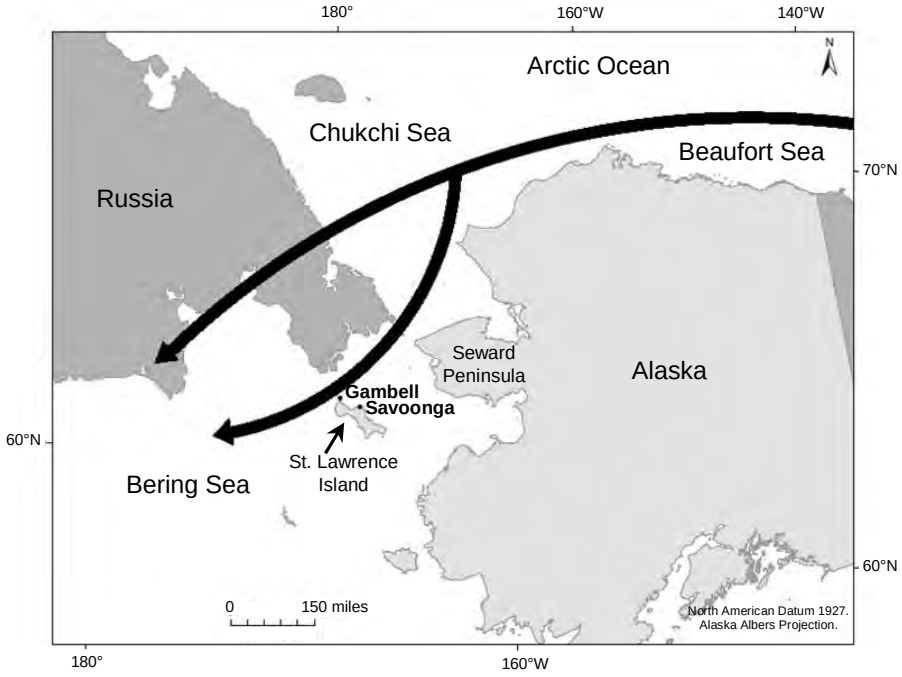

Figure 1.–Location of St. Lawrence Island and fall migration routes of yellow-billed loons.

Note: Yellow-billed loon migration routes based on Schmutz and Rizzolo (2012). Map prepared by ADF&G Division of Subsistence, July 2013.

METHODS

FALL BIRD COUNT

Relative Abundance of Species

Shore-based visual bird counts (seawatches) were conducted close to the communities of Gambell and Savoonga to assess the relative abundance of bird species, especially loons, in coastal waters in fall, when most loon harvests occur (Georgette and Iknokinok 1997; Kawerak 2004: 17, 20; Ahmasuk and Trigg 2008: 226; Naves 2010: 56, 94, 168; 2011: 44). Bird counts were conducted from mid-September to mid-October to cover the period of higher abundance of yellow-billed loons (late September to early October) during their fall migration (mid-August to early October) (Lehman 2012). A stationary observer facing seaward scanned the waters and the shoreline using binoculars and a spotting scope to record birds in flight and on the water (modified from Richardson and Johnson 1981; Byers and Dickson 2001; Day et al. 2003; Day et al. 2004). Observation sessions started with an instantaneous count of all species, and cumulative numbers built up as new birds moved through the observation range (photos on page 25, right). Data were also collected on loon plumages (breeding, nonbreeding), age (adult, juvenile), group size, distance from shore, and direction of flight. Identification of age categories in nonbreeding plumages was tentative because of the intrinsic difficulty in telling these plumages apart and because observation conditions were sometimes unfavorable (loons flying away from shore, rough seas, poor visibility).

Counts were distributed along daylight hours to account for circadian movements of birds (Figure 2). Count duration averaged 1.7 hours (SD=0.8, range=0.3–5.0 hours) and varied depending on weather conditions. Harsh weather (wind, fog, rain, snow) is common in fall on St. Lawrence Island. Visibility and the distance sampled varied depending on fog, precipitation, and sea conditions (in rough seas, low flying birds may not be detected in wave troughs). Counts were not made in strong winds, thick fog, and moderate to heavy precipitation, which can hinder detectability and species identification. For large birds such as loons, species identification was possible at distances up to 2 km offshore for birds on water, 3–5 km for birds flying just above sea level, and 10 km for birds flying higher. Recorded loon migration altitude in Alaska ranged 1–39 m above sea level although most records were below 20 m (Richardson et al. 1975; Day et al. 2003). Species that migrate at high altitude (such as shorebirds) and species that occur far from shore may be under-represented in counts. Attention was paid to not double-count birds, although sometimes it was difficult to track movements of individual birds. Bird numbers may be inflated by double-counting individuals during a count session (erratic flight, small scale movement) or different counts in the same day or different days (medium scale movement). Considering the time and resources available for this study, it was not possible to deploy the field effort and techniques necessary to correct for double-counting, detectability, and other sources of bias and error. Effects of these issues may be species-specific, and abundance of species with different behaviors and ecology may be measured at different rates (Dawson 1981).

Counting stations were selected to overlap hunting locations on the sea shore close to the communities and were identified by GPS coordinates (figures 3 and 4). Most counts were conducted at the stations closest to the communities because of difficulties accessing other stations. Subsistence activities occur in many areas close to and far from the communities. In summer and fall, hunting, fishing, and gathering also occur from traditional camp and

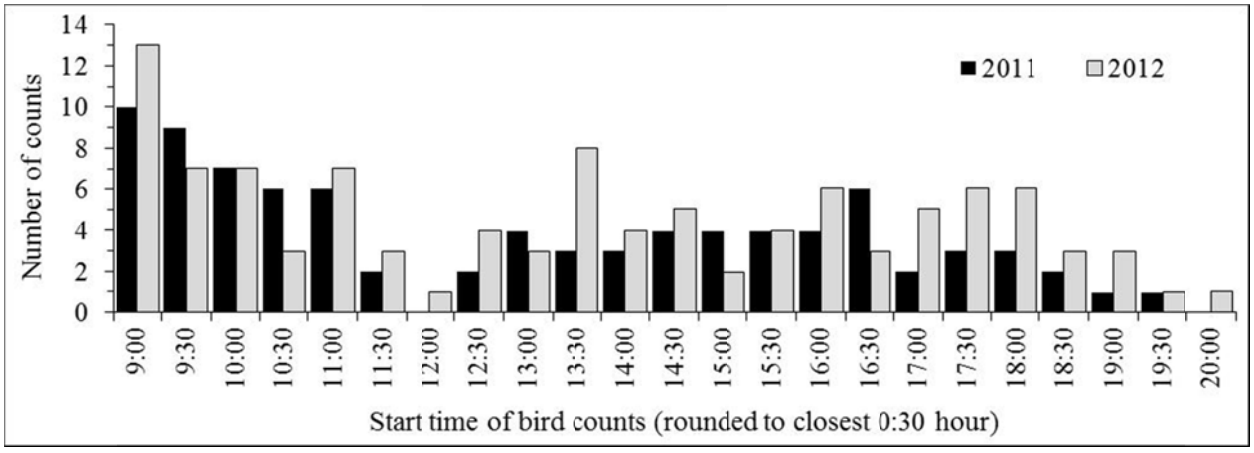

Figure 2.–Distribution of start time of bird counts along hours of daylight.

cabin sites and other remote areas (not shown in figures 3 and 4). Bird hunting frequently occurs in conjunction with other subsistence pursuits and may occur inland; on freshwater lakes, ponds, and streams; along the sea shore; and by boat away from shore. A complete representation of the relative abundance of bird species potentially available for harvest would require assessment of the temporal and spatial distribution of harvest efforts applied to a diversity of subsistence resources and was beyond the scope of this study.

Data Analysis

Indices of relative species abundance (ISA) were calculated by dividing numbers of birds counted by hours of observation. The ratio of the counts to the actual local species abundance or population sizes is unknown. Therefore, the ISA does not allow estimates of total bird abundance.

SUBSISTENCE HARVEST SURVEY

Ethical Standards

From a subsistence harvester's perspective, harvest surveys collect information that commonly is private and sensitive. Subsistence bird harvests are a sensitive topic because spring and summer hunting was illegal until recently. Subsistence users fear that information provided in harvest surveys may be used to direct law enforcement efforts and to limit harvest practices that are essential for their diet and culture. To meet survey objectives, it is necessary to develop and maintain trust and collaboration between subsistence users and resource management agencies.

This study observed the ethical "Principles for the conduct of research in the Arctic" (National Science Foundation, Office of Polar Programs, http://www.nsf.gov/geo/plr/arctic/conduct.jsp, accessed in August 2013), the "Alaska Federation of Natives guidelines for research" (http://ankn.uaf.edu/IKS/afnguide.html, accessed in August 2013), and ethical standards adopted by the AMBCC for data collection, management, and release (Naves 2012). Specific data release agreements were discussed for this study (appendices A–D). Formal requests to access AMBCC raw data are considered on a case-by-case basis by the AMBCC executive director following the cited ethical standards. Community and household participation in the survey were voluntary. Community consent was granted as tribal council resolutions. A tracking sheet was used to document whether households agreed or not to participate or could

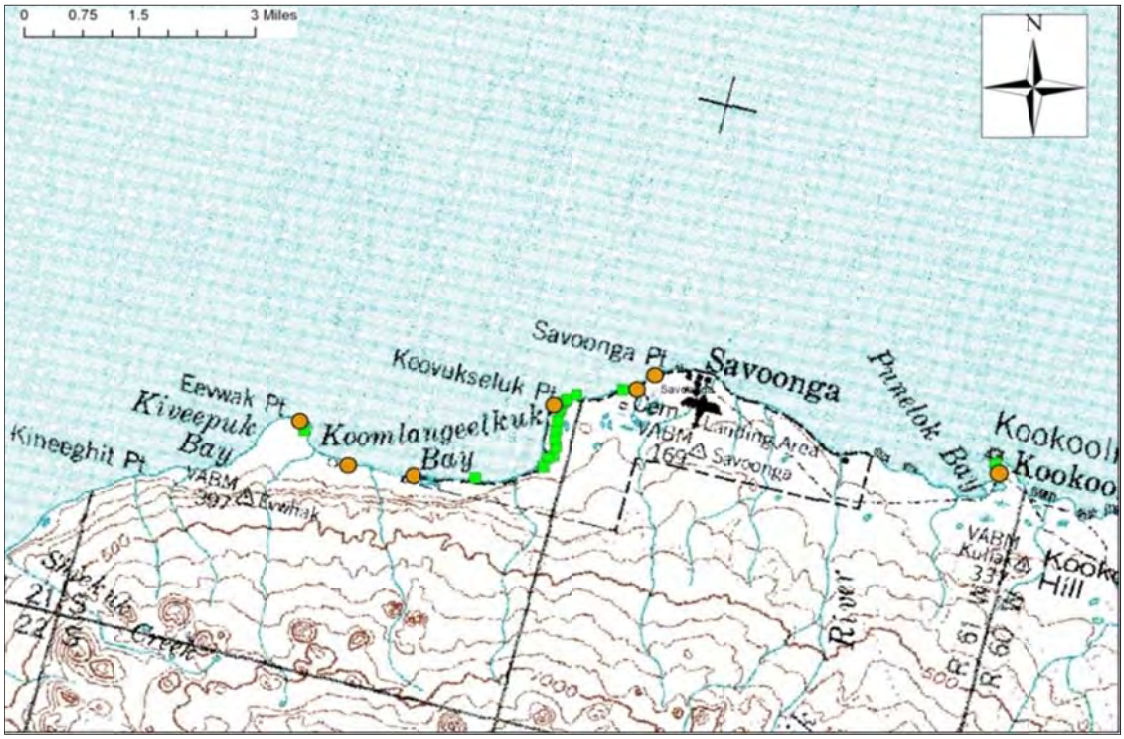

Figure 3.–Hunting blinds (green squares) and bird count stations (orange circles) close to Savoonga.

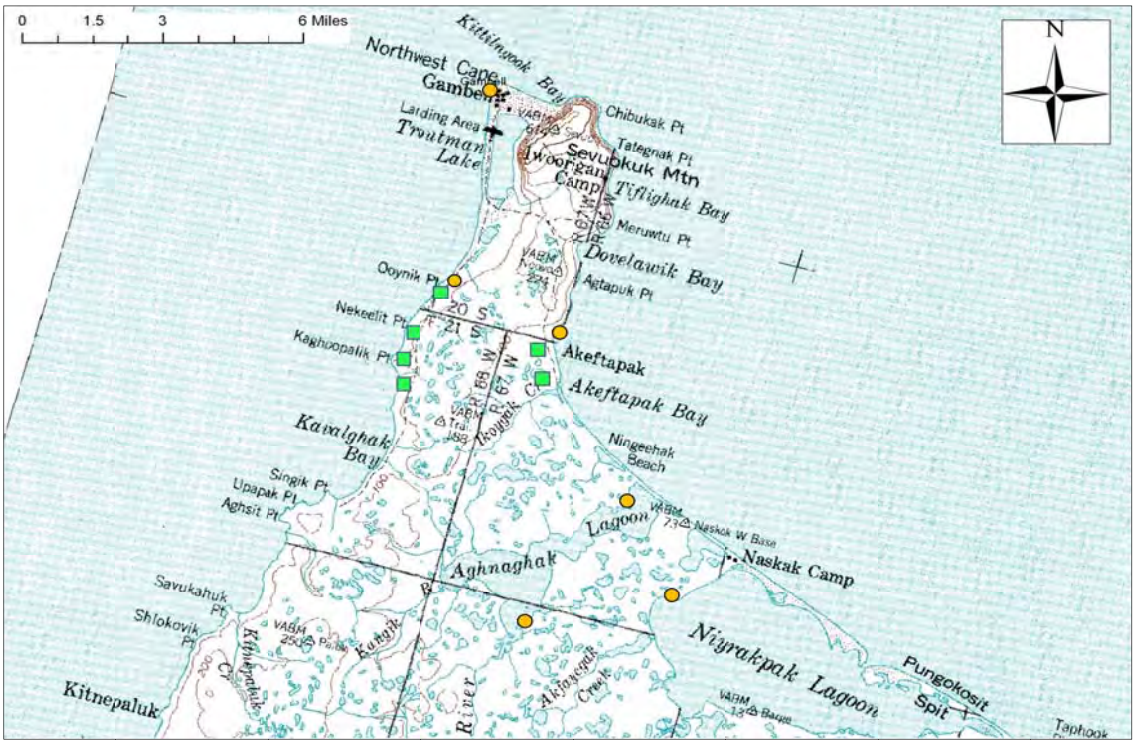

Figure 4.–Hunting blinds (green squares) and bird count stations (orange circles) close to Gambell.

not be contacted. Archived materials did not include household names or other personal information for anonymity of household harvest reports. A household list is necessary to conduct surveys, however household names were not used in harvest report forms and were not entered in the database (a numeric household identifier was used). Names on household lists were covered; lists not showing names were then photocopied and scanned for digital archiving together with other survey materials.

Accuracy and Completeness of Data Collection

Diverse fields of expertise were enlisted to ensure accuracy and completeness of data collection and to minimize potential sources of bias and random measurement error. Local research assistants worked together with anthropologists (ADF&G Division of Subsistence) and biologists (USFWS, ADF&G Division of Subsistence) so that data collection teams included local expertise, expertise in conducting harvest surveys, and in loon biology and identification. Data collection staff were Tamara K. Zeller and Ernest Nageak (USFWS); James Van Lanen, Meredith Marchioni, Kelly Gwynn, and Liliana Naves (ADF&G); Brenda Slwooko, Susan Apassingok, Daniel Apassingok, Dawnelle Apangalook, and Josh Slwooko (Native Village of Gambell); and Morgan Annogivuk, Dylan Iya, and Tristan Seppilu (Native Village of Savoonga).

Sampling Design and Coverage

The household was the basic sampling unit. The sampling frame encompassed all resident households (year-round residents that have lived in the community for at least the 12 previous months). The sampling goal was a census survey (all households), and contact was attempted with all households in Gambell and Savoonga. Because some households decline to participate or cannot be contacted, households were stratified a priori as harvester or nonharvester to properly account for nonsurveyed households when calculating harvest estimates. Harvester was defined as households that have harvested birds or eggs in any 1 of the 3 years preceding the study year.

Survey respondents were instructed to report all birds and eggs harvested by all hunters in the household, including birds and eggs that were given to other household(s). If birds or eggs were harvested by a crew, respondents were instructed to report the household's harvest share. Respondents were instructed not to report birds or eggs received from other household(s).

Timing of Data Collection

Two seasonal rounds of data collection were timed to minimize recall bias. Household visits occurred in September–October to collect spring (1 April–30 June) and summer (1 July–31 August) harvest data and in November–January to collect fall (1 September–31 October) harvest data, when most loon harvests occur. Harvest data collection dates were as follows:

- Gambell: 20–28 September 2011 (spring and summer); 28 November–4 December 2011 (fall); 26 September–5 October 2012 (spring and summer); 7–11 November 2012 (fall).
- Savoonga: 29 September–5 October 2011 (spring and summer); 16–20 January 2012 (2011 fall); 19–26 September 2012 (spring and summer); 31 October–7 November 2012 (fall).

Species Identification

The 2011 survey used the standard AMBCC harvest report form (Appendix E) and bird identification guide (Appendix F) for Western Alaska, which included species likely to be harvested and species of management priority. Some species closed to harvest were shown on survey materials as an attempt to collect harvest data for the sustainable management of all bird species; this was not an endorsement of or consent to engage in the harvest of closed species. Household harvest reports were kept anonymous. To elicit accurate answers to sensitive questions, harvest survey information must not be used for punitive law enforcement. Harvests of species not included in the form were reported in the "other bird" field. The harvest report form had a sheet for each survey season showing black and white drawings of birds in breeding plumage and fields to record numbers of birds and eggs harvested (Appendix E). The bird identification guide (appendices F and G, see below) had color drawings of birds; it was offered to all contacted households in all contact occasions and was used together with the harvest report form.

A 4-page "Bering Strait–Norton Sound loon identification guide" was developed as an additional communication and outreach tool for this study (Appendix H). The loon identification guide included breeding and nonbreeding plumages and focused on the relative species abundance on St. Lawrence Island. The Pacific and the Arctic loons were treated as "Pacific/Arctic loon" because these species are difficult to tell apart. Adults in nonbreeding plumage and juveniles were treated together as "nonbreeding" birds because their plumages are very similar (this terminology was also used in this report). The loon identification guide was widely distributed in the communities and offered to all households contacted, in all contact occasions.

A large poster with color photographs of all species included in the survey assisted in species identification and outreach related to the harvest survey (Appendix I). Close to each photograph appeared the species's English name and a blank field for survey staff and local people to write Native and local names. Another large poster specifically addressing loon identification and distribution produced by U.S. Fish and Wildlife Service in 2010 (Zeller et al. 2011) was also used in this study (Appendix J). Posters were displayed at public places (post office, general store, tribal council, and school) and distributed in the community.

Data collection teams also used bird identification guide books (Sibley 2003; Dunn and Alderfer 2011) for additional illustration of species, plumages, and distribution ranges. A compilation of St. Lawrence Island Yupik bird names facilitated communication with respondents and assisted in species identification (Appendix K). Information on loon conservation concerns and species identification was also emphasized during training of data collection staff and at community meetings.

Based on review of the 2011 preliminary survey results including recommendations by the communities, the harvest report form and bird identification guide (appendices E and F) were modified for the 2012 survey (Appendix G) as follows:

1) A drawing of a loon in nonbreeding plumage was added to better document harvests of "young" loons. A juvenile Pacific loon was used to represent nonbreeding plumages (juveniles and nonbreeding adults) because this was the species recorded in the largest numbers in 2010 (Zeller et al. 2011) and 2011 bird counts (this study). Species identification of loons in nonbreeding plumages (adults and juveniles) is very difficult and requires advanced bird identification skills and favorable observation conditions. Findings in Zeller et al. (2011) and in the 2011 study indicated that an attempt to obtain identification of loon species in nonbreeding plumage in harvest surveys was likely to produce unreliable data.

2) Loon species were presented in a row from the most abundant (at left) to the least abundant (at right) as documented in the 2010 and 2011 bird counts (Zeller et al. 2011; this study). However, the common loon was presented next to the yellow-billed loon to highlight similarities between these species. The sizing of the loon drawings attempted to depict size differences among species.

3) The harvest report form and bird identification guide did not show loon names because of difficulties in the use of both English and St. Lawrence Island Yupik loon names, especially the common loon. Loon identification was based primarily on drawings related to numbers: loon 1 (Pacific/Arctic loon), loon 2 (nonbreeding loon), loon 3 (yellow-billed loon), loon 4 (common loon), and loon 5 (red-throated loon). Data collection staff carried a list of loon names in St. Lawrence Island Yupik to help communicate with respondents. Other auxiliary survey materials such as the loon identification guide and the bird poster showed English names.

Local and Traditional Knowledge

Although the main objective of the regular AMBCC harvest survey is to document harvest numbers, communication between surveyors and respondents may relate to topics such as harvests methods, resource uses, and bird ecology. This communication is important to involve respondents in the study and to correctly report harvests. Also, towards the end of each survey, respondents are asked if they have comments or questions regarding the survey or other topic related to birds and eggs. The survey form includes a field for comments in each of its 3 seasonal sheets where the surveyor may document these exchanges. Ethnographic content offered in harvest surveys may describe aspects of the local culture, practices, and knowledge. However, this manner of documenting LTK requires data collection expertise to open opportunities for input and to properly record information offered.

In this study, surveyors were trained to document LTK during harvest surveys as field notes, especially those on loon identification and naming, harvests, and uses. A list of topics (below) was developed to train and guide surveyors on how to correctly record harvests (species and amounts) and to explore additional information that respondents might be willing to share. Although efforts focused on reported loon harvests, all households were encouraged to offer comments and ask questions on other species and aspects of the harvest. A script was developed to inform respondents on the need for additional information: *"Because of conservation concerns, the yellow-billed loon is a candidate to be listed as threatened or in danger of extinction under the Endangered Species Act. We are trying to better understand harvests and uses of loons by the communities of St. Lawrence Island and to have correct information to evaluate potential effects of harvest on the yellow-billed loon population. Loons are difficult to tell apart, so I would like to ask some questions that may help us to correctly report your birds and understand the numbers that result from this survey."*

- "*Please help me make sure that I got your loon(s) right*." Assess loon species identification using 2-page general bird identification guide (show kinds of loons, appendices F and G), 4-page loon guide (Appendix H), and if needed also use bird identification book and list of Native names (Appendix K). To introduce the list of Native bird names, you may say: "*So far, this is what we have learned about Native bird names. You are welcome to offer comments and corrections to this list*." As part of this process, document local loon identification system and naming;
- Harvest methods (from shore?, by boat?, shotgun or other means?, while doing other harvest?)
- Current loon uses (food?, Native craft?, other?)
- Harvest situation, loon grouping behavior (were loons caught single birds? from pairs? groups? If more than 1 loon was harvested, were these loons caught at the same time, together)?
- Other comments, observations, or questions about loons, other birds, or this survey?

Local and traditional knowledge was also compiled in 4 semidirective key respondent interviews conducted in 2012 with knowledgeable elders and hunters (2 interviews in Gambell and 2 in Savoonga, photo page 24, bottom right). The interviews were guided by a set of discussion topics (Appendix L), but the respondents were allowed to shape the discussion according to their worldview, relevance of, and connection among topics. The interviewer could intervene to keep the discussion on topic or to ask further detail (Huntington 1998; Bernard 2011). Detailed notes of key respondent interviews were generated from audiorecordings.

Notes from harvest surveys and key respondent interviews were kept anonymous and are presented together in this report without the intent of being literal transcriptions. These notes yielded a body of qualitative ethnographic information as well as quantitative information on loon naming, group size, harvest methods, and current uses.

Data Analysis

Harvest data were entered in Microsoft Office Access[1] forms designed to mimic survey forms. The raw data were stored in a Microsoft SQL Server relational database with metadata documentation. Double data entry and logic checks ensured data entry accuracy. Harvest estimates and confidence intervals were calculated based on Cochran (1977: 274) (Appendix M). Harvests reported by households sampled in each stratum (harvester, nonharvester) were expanded to all households in that stratum. Community-level harvest estimates were calculated as the sum of the estimates for each stratum. Annual harvest estimates were calculated as the sum of seasonal estimates. Fields to record egg harvests were not available in fall sheets because the nesting period of birds in Alaska extends only into July. Fall egg harvest is shown as zero in the survey results. In the case of wide confidence intervals, if the calculated low end of the range was less than the reported harvest, the reported harvest is presented instead. Household participation rates were calculated dividing the number of households that agreed to participate by the number of households contacted (households that agreed to participate and households that did not agree to participate). Sampling rates were calculated dividing the number of households sampled by the total number of resident households.

OUTREACH ACTIVITIES

Community involvement in this study occurred during harvest surveys, key respondent interviews, and a series of tribal council (n=7) and community meetings (n=7) conducted in both villages (photo page 31, bottom left) and listed below. Study skins of loons in breeding and nonbreeding plumages were available in almost all community meetings to facilitate discussions on loon identification (photo page 27, bottom right). Species identification materials (loon identification guide, general bird poster and loon identification poster, list of Native bird names, bird identification books) were available at all community and tribal council meetings and were largely distributed in the community. Several copies of bird identification books were distributed to tribal councils and other community bodies.

- **Spring 2011**: tribal council and community meetings at Savoonga (19 May, T. Zeller) and Gambell (20 May, T. Zeller) to discuss 2010 results (Zeller et al. 2011) and 2011 preliminary work plan.
- **Fall 2011**: tribal council and community meetings at Gambell (21 September, T. Zeller and J. Van Lanen) and Savoonga (30 September, T. Zeller and M. Marchioni) to discuss 2010 results (Zeller et al. 2011) and to present 2011 final work plan (T. Zeller and J. Van Lanen). Gambell community meeting (21 September) was canceled at suggestion of the tribal council.
- **Winter 2012**: Savoonga community and tribal council meetings (17 January, T. Zeller and K. Gwynn) to discuss 2012 preliminary work plan.
- **Spring 2012**: tribal council and community meetings at Gambell (22 May 2012, T. Zeller and L. Naves) and Savoonga (23 May 2012, T. Zeller and L. Naves) to discuss 2011 results and data release and 2012 preliminary work plan.
- **Fall 2012**: community meeting at Savoonga (9 September, T. Zeller and L. Naves) and tribal council meeting at Gambell (5 October, T. Zeller and J. Van Lanen) to present 2012 final work plan and to discuss 2011 results and data release. Scheduling conflict prevented Gambell community meeting. Loon identification guide and poster were available to participants.
- **Winter 2013**: community and tribal council meetings at Gambell (20 February, L. Naves) and Savoonga (21 February, L. Naves) to discuss 2011–2012 results and data release. Data review also included previous studies (1993–2010).

1. Product names are given for scientific completeness or because they are established standards for the State of Alaska; they do not constitute product endorsement.

RESULTS

FALL BIRD COUNT

Relative Proportion of Species

The bird counts included 168.3 hours of observation in 2011 and 161.4 hours in 2012 (Table 1). A total of 60 species was observed (Table 2, appendices N and O). The short-tailed shearwater was the species observed in the largest numbers (2011=95.4%, 2012=96.2%), followed by black-legged kittiwake (2011=3.0%, 2012=1.3%), spectacled eider (2011=0.5%, 2012=0.6%), and king eider (2011=0.2%, 2012=0.4%). Loons represented <0.1% of the total number of birds observed in 2011 and 0.1% in 2012 (Table 2). Four loon species were observed: Pacific loon (94.8% of total number of loons), yellow-billed loon (4.3%), red-throated loon (0.6%), and Arctic loon (0.3%) (Table 3). The common loon was not observed in the 2011 and 2012 bird counts.

There were no trends clearly differentiating the relative abundance of species at Gambell and Savoonga (appendices N and O). However, the data available may be insufficient to assess such fine-scale variations in species distribution across years. Short-tailed shearwaters were more abundant in 2011 at Gambell and in 2012 at Savoonga resulting in large annual variation in the total ISA of the communities (Gambell 2011=29,797.18; 2012=9,053.41. Savoonga 2011=6,739.54; 2012=23,349.35). Excluding short-tailed shearwaters, in both years a slightly higher relative abundance of birds was observed at Gambell (2011 ISA_B=934.29, 2012 ISA_B=677.54) than at Savoonga (2011 ISA_B=769.28, 2012 ISA_B=584.19) (Appendix O). In both years, some species had higher ISA at Gambell (common eider, king eider, common and thick-billed murres, least and crested auklets, Pacific and yellow-billed loons) while other species had higher ISA at Savoonga (spectacled eider and long-tailed duck).

Higher daily abundance of Pacific loons occurred between 26 September and 10 October in both years (Figure 5). In 2012, yellow-billed loons were first observed on 22 September and the daily relative abundance was low and regular throughout the observation period with occasional high daily ISA (Figure 6). For Pacific and yellow-billed loons, peak daily ISA were observed in 2012 but not in 2011.

Table 1.–Sampling effort (hours of observation) and periods covered by bird counts.

Sampling effort	2011	2012
Gambell	78.8 hours	84.4 hours
	(22 Sept–11 October)	(17 September–11 October)
Savoonga	89.5 hours	77.0 hours
	(21 Sept–10 October)	(19 September–10 October)
Total	168.3 hours	161.4 hours

Table 2.–Species composition in fall bird counts and in subsistence harvests (Gambell and Savoonga combined).

Species	ISA% (all species included)		ISA_B% (short-tailed shearwater excluded)		Fall harvest estimates%		(Fall harvest estimates%) - (ISA_B%)**	
	2011	2012	2011	2012	2011	2012	2011	2012
Ducks								
Eurasian wigeon	0.000873%	0.000113%	0.02%	<0.01%	–	–	-0.02%	<-0.01%
Northern pintail	0.002780%	0.001689%	0.06%	0.04%	0.11%	0.29%	0.05%	0.24%
Black scoter	0.000097%	–	0.00%	0.00%	0.19%	–	0.19%	–
Surf scoter	–	–	–	–	0.21%	–	0.21%	–
White-winged scoter	0.008695%	0.006118%	0.19%	0.16%	0.08%	1.11%	-0.11%	0.96%
Greater scaup	0.000097%	–	0.00%	–	–	–	<-0.01%	–
Common eider	0.044478%	0.087457%	0.97%	2.28%	7.90%	5.24%	6.93%	2.96%
King eider	0.228207%	0.359886%	4.96%	9.38%	1.42%	0.70%	-3.54%	-8.68%
Spectacled eider	0.536125%	0.550377%	11.64%	14.35%	0.56%	1.53%	-11.08%	-12.82%
Steller's eider	0.001034%	0.000038%	0.02%	0.00%	–	0.21%	-0.02%	0.21%
Unidentified eider	–	0.019368%	–	0.51%	–	–	–	-0.51%
Harlequin duck	0.019718%	0.023534%	0.43%	0.61%	0.13%	–	-0.29%	-0.61%
Long-tailed duck	0.026732%	0.039449%	0.58%	1.03%	0.83%	–	0.25%	-1.03%
Red-breasted merganser	0.001422%	0.001051%	0.03%	0.03%	–	–	-0.03%	-0.03%
Duck (unidentified)	–	–	–	–	0.13%	–	0.13%	–
Geese								
Black brant	0.004105%	0.001764%	0.09%	0.05%	1.42%	1.28%	1.33%	1.23%
Canada goose	–	–	–	–	0.43%	–	0.43%	–
Greater white-fronted goose	–	–	–	–	–	0.04%	–	0.04%
Emperor goose	0.000291%	0.000976%	0.01%	0.03%	1.07%	3.26%	1.06%	3.24%
Snow goose	0.036688%	–	0.80%	0.00%	5.01%	0.54%	4.21%	0.54%
Tundra swan	0.000129%	–	0.00%	0.00%	0.05%	0.21%	0.05%	0.21%
Sandhill crane	0.000808%	–	0.02%	0.00%	–	0.21%	-0.02%	0.21%
Seabirds								
Pelagic cormorant	0.090992%	0.095790%	1.98%	2.50%	21.15%	27.21%	19.18%	24.71%
Fork-tailed storm petrel	–	0.000038%	–	<0.01%	–	–	–	<0.01%
Short-tailed shearwater	95.394708%	96.165154%	excluded	excluded	0.46%	1.98%	excluded	excluded
Northern fulmar	0.031484%	0.000826%	0.68%	0.02%	–	–	-0.68%	-0.02%

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Table 2.–Page 2 of 4.

Species	ISA% (all species included) 2011	ISA% (all species included) 2012	ISA_B% (short-tailed shearwater excluded) 2011	ISA_B% (short-tailed shearwater excluded) 2012	Fall harvest estimates% 2011	Fall harvest estimates% 2012	(Fall harvest estimates%) - (ISA_B%)** 2011	(Fall harvest estimates%) - (ISA_B%)** 2012
Common murre	0.031193%	0.179155%	0.68%	4.67%	*	*	*	*
Thick-billed murre	0.068204%	0.060281%	1.48%	1.57%	*	*	*	*
Unidentified murre	0.018683%	0.015202%	0.41%	0.40%	*	*	*	*
Total murre	0.118079%	0.254638%	2.56%	6.64%	38.47%	7.60%	35.91%	0.96%
Pigeon guillemot	0.027702%	0.054088%	0.60%	1.41%	*	*	*	*
Black guillemot	0.000097%	–	0.00%	0.00%	*	*	*	*
Total guillemot	0.027799%	0.054088%	0.60%	1.41%	0.46%	0.54%	-0.15%	-0.87%
Ancient murrelet	0.011637%	0.001877%	0.25%	0.05%	–	–	-0.25%	-0.05%
Kittlitz's murrelet	0.000129%	0.000338%	0.00%	0.01%	–	–	<-0.01%	-0.01%
Parakeet auklet	0.001649%	0.020344%	0.04%	0.53%	*	*	*	*
Least auklet	0.056373%	0.168720%	1.22%	4.40%	*	*	*	*
Crested auklet	0.064422%	0.285191%	1.40%	7.44%	*	*	*	*
Total auklet	0.122443%	0.474256%	2.66%	12.37%	7.36%	31.50%	4.70%	19.14%
Tufted puffin	0.014837%	0.055702%	0.32%	1.45%	*	*	*	*
Horned puffin	0.059702%	0.169996%	1.30%	4.43%	*	*	*	*
Total puffin	0.074539%	0.225698%	1.62%	5.89%	–	–	-1.62%	-5.89%
Parasitic jaeger	0.000162%	0.000038%	0.00%	0.00%	–	–	<-0.01%	<-0.01%
Pomarine jaeger	0.003426%	0.000976%	0.07%	0.03%	–	–	-0.07%	-0.03%
Unidentified jaeger	0.000291%	0.000300%	0.01%	0.01%	–	–	-0.01%	-0.01%
Herring gull	0.008469%	0.006456%	0.18%	0.17%	*	*	*	*
Glaucous gull	0.126322%	0.103071%	2.74%	2.69%	*	*	*	*
Glaucous-winged gull	0.005657%	0.018542%	0.12%	0.48%	*	*	*	*
Slaty-backed gull	0.000097%	0.000113%	0.002%	0.003%	*	*	*	*
Total large gull	0.140545%	0.128182%	3.05%	3.34%	9.08%	8.34%	6.02%	5.00%
Sabine's gull	0.000646%	0.000038%	0.01%	0.00%	–	–	-0.01%	<-0.01%
Black-legged kittiwake	2.990355%	1.319583%	64.93%	34.41%	0.24%	1.03%	-64.69%	-33.38%
Arctic tern	–	0.000075%	0.00%	<0.01%	–	–	–	<0.01%
Shorebirds								
Red phalarope	0.013867%	0.050109%	0.30%	1.31%	–	–	-0.30%	-1.31%

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Table 2.–Page 3 of 4.

Species	ISA% (all species included) 2011	ISA% (all species included) 2012	ISA_B% (short-tailed shearwater excluded) 2011	ISA_B% (short-tailed shearwater excluded) 2012	Fall harvest estimates% 2011	Fall harvest estimates% 2012	(Fall harvest estimates%) - (ISA_B%)** 2011	(Fall harvest estimates%) - (ISA_B%)** 2012
Pacific-golden plover	0.002327%	0.000938%	0.05%	0.02%	–	–	-0.05%	-0.02%
Ruddy turnstone	–	0.000375%	–	0.01%	–	–	–	-0.01%
Rock sandpiper	0.002230%	0.002064%	0.05%	0.05%	*	*	*	*
Dunlin	0.000129%	0.000788%	<0.01%	0.02%	*	*	*	*
Pectoral sandpiper	0.000097%	–	<0.01%	–	*	*	*	*
Sharp-tailed sandpiper	0.000065%	–	<0.01%	–	*	*	*	*
Loons								
Red-throated loon	0.000097%	0.000901%	<0.01%	0.02%	0.27%	0.33%	0.27%	0.31%
Pacific loon	0.057504%	0.108664%	1.25%	2.83%	*	*	*	*
Arctic loon	0.000259%	0.000338%	0.01%	0.01%	*	*	*	*
Pacific/Arctic loon	0.057763%	0.109002%	1.25%	2.84%	0.46%	1.94%	-0.80%	-0.90%
Common loon	–	–	–	–	2.03%	0.21%	2.03%	0.21%
Yellow-billed loon	0.002263%	0.005405%	0.05%	0.14%	0.35%	0.12%	0.30%	-0.02%
Nonbreeding loon	–	–	–	–	a	4.38%	a	–
Unidentified loon	0.000582%	0.000113%	0.01%	0.00%	–	–	–	–
Total loons	0.060704%	0.115420%	1.32%	3.01%	0.35%	4.38%	-0.97%	1.37%
Grebes								
Horned grebe	0.000485%	0.000075%	0.01%	0.00%	*	*	*	*
Red-necked grebe	–	0.000413%	–	0.01%	*	*	*	*
Total grebes	0.000485%	0.000488%	0.01%	0.01%	0.13%	0.29%	0.12%	0.28%
Birds of prey								
Rough-legged hawk	0.000097%	0.000300%	<0.01%	0.01%	–	–	<-0.01%	-0.01%
Gyrfalcon	0.000194%	0.000300%	<0.01%	0.01%	–	–	<-0.01%	-0.01%
Peregrine falcon	–	0.000038%	–	<0.01%	–	–	–	<-0.01%
Short-eared owl	0.000129%	–	<0.01%	–	–	–	<-0.01%	–
Snowy owl	0.000162%	0.001126%	<0.01%	0.03%	–	–	<-0.01%	-0.03%
Corvids								
Common raven	–	0.014338%	–	0.37%	–	–	–	-0.37%

-continued-

Table 2.–Page 4 of 4.

Note: This table includes species reported as harvested in fall or observed in bird counts in at least 1 of 2 study years.
ISA=number of birds counted ÷hours of observation.
–: Species not observed in bird counts or reported as harvested.
*: Harvest survey did not ask identification at species level.
**: Positive values indicate tendency for positive harvest selectivity (species more represented in harvest estimates as compared to bird counts). Negative values indicate tendency for negative harvest selectivity (species more represented in bird counts as compared to harvest estimates).
a: Plumage not included in 2011 harvest survey.

Table 3.–Number of loons counted and index of relative species abundance, fall 2011 and 2012.

	Number of birds			Index of relative species abundance (ISA)			2011–2012 Average loon species composition %
	2011	2012	2011–2012 Average	2011	2012	2011–2012 Average	
Gambell							
Pacific loon	1,070	1,782	1,426	13.58	21.11	17.35	93.2%
Arctic loon	2	5	4	0.03	0.06	0.05	0.2%
Red-throated loon	2	23	13	0.03	0.27	0.15	0.8%
Yellow-billed loon	53	126	90	0.67	1.49	1.08	5.8%
Common loon	0	0	0	0.00	0.00	0.00	0.0%
Savoonga							
Pacific loon	709	1,113	911	7.92	14.45	11.19	97.5%
Arctic loon	6	4	5	0.07	0.05	0.06	0.5%
Red-throated loon	1	1	1	0.01	0.01	0.01	0.1%
Yellow-billed loon	17	18	18	0.19	0.23	0.21	1.9%
Common loon	0	0	0	0.00	0.00	0.00	0.0%
Both communities							
Pacific loon	1,779	2,895	2,337	10.57	17.94	14.25	94.8%
Arctic loon	8	9	9	0.05	0.06	0.05	0.3%
Red-throated loon	3	24	14	0.02	0.15	0.08	0.6%
Yellow-billed loon	70	144	107	0.42	0.89	0.65	4.3%
Common loon	0	0	0	0.00	0.00	0.00	0.0%

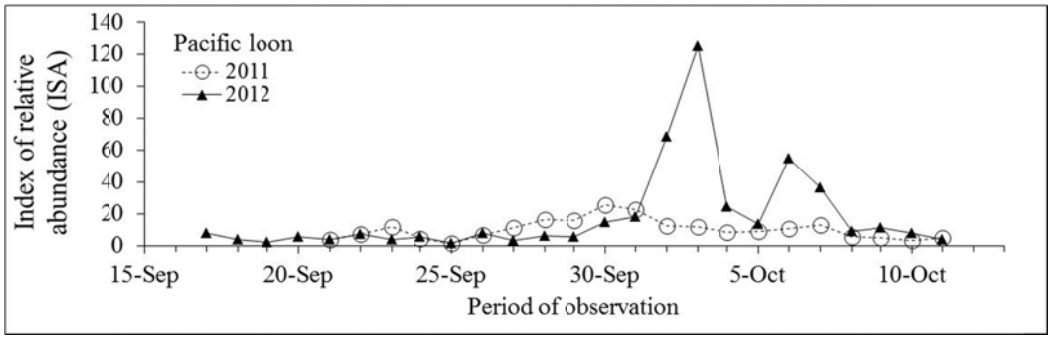


Figure 5.–Daily index of relative species abundance, Pacific loons.

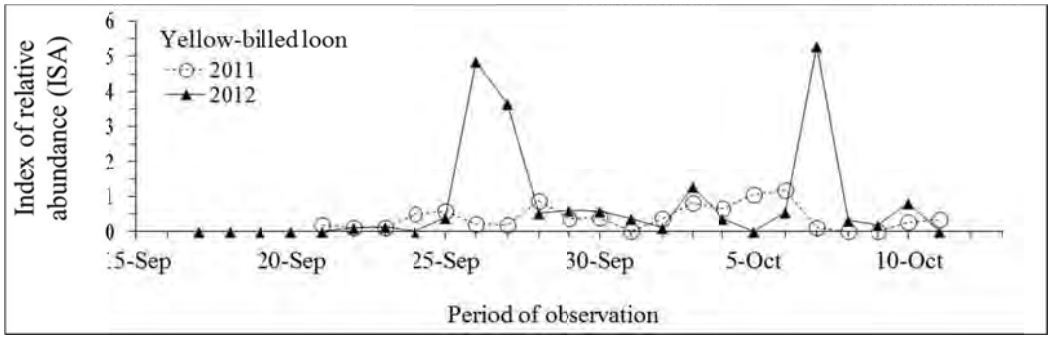


Figure 6.–Daily index of relative species abundance, yellow-billed loons.

Distance of Loons from Shore

Distinct patterns of loon distances from shore were not detected among species or between years (Table 4). Loons tended to occur closer to shore at Gambell (56.5% of loons within 0–199 m from shore) than at Savoonga (74.1% of loons farther than 400 m from shore) (Figure 7). Based on 2011 data for which more detail was available, the majority of loons observed from Savoonga were much farther than 400 m from shore (≤400 m=14.4%; 401–1,609 m=64.6%; and 1,610–8,000 m=21.0%; n=770 loons).

Table 4.–Distance of loons from shore near Gambell and Savoonga by year and species.

	Arctic loon	Pacific loon	Red-throated loon	Yellow-billed loon
Gambell, Fall 2011				
<100 m	2	332	2	18
100–199 m	–	337	–	24
200–299 m	–	270	–	7
300–399 m	–	33	–	3
≥400 m	–	–	–	–
Gambell, Fall 2012				
<100 m	1	210	8	14
100–199 m	3	680	8	32
200–299 m	1	475	3	24
300–399 m	–	267	2	23
≥400 m	–	144	5	32
Savoonga, Fall 2011				
<100 m	–	–	–	–
100–199 m	–	31	–	–
200–299 m	–	31	–	–
300–399 m	–	43	–	2
≥400 m	6	615	1	15
Savoonga, Fall 2012				
<100 m	–	25	1	–
100–199 m	–	53	–	2
200–299 m	2	74	–	2
300–399 m	1	216	–	3
≥400 m	–	715	–	11

–: Not observed. Range categories in meters.

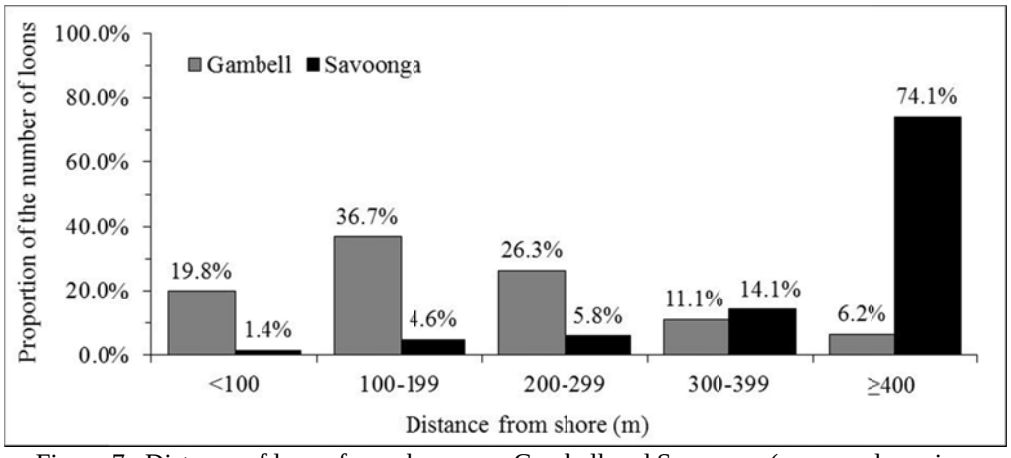


Figure 7.–Distance of loons from shore near Gambell and Savoonga (years and species combined).

Direction of Loon Flight

Almost all loons observed in Gambell (99.1%) and Savoonga (97.8%) were in flight (Table 5, Figure 8). At Gambell, directions of flight were SW to NE (70.9%) and NE to SW (29.1%). At Savoonga, directions of loon flight were W to E (68.0%), E to W (31.9%), and N to S (0.1%). Variations in this pattern were not detected among loon species and between years.

Table 5.–Direction of loon flight near Gambell and Savoonga by year and species.

	SW to NE	NE to SW	W to E	E to W	N to S	On water
Gambell, Fall 2011						
Arctic loon	1	1	–	–	–	–
Pacific loon	405	138	–	–	–	–
Red-throated loon	–	–	–	–	–	–
Yellow-billed loon	33	5	–	–	–	–
Gambell, Fall 2012						
Arctic loon	2	1	–	–	–	–
Pacific loon	465	241	–	–	–	11
Red-throated loon	7	11	–	–	–	2
Yellow-billed loon	73	7	–	–	–	–
Unknown loon	1	1	–	–	–	–
Savoonga, Fall 2011						
Arctic loon	–	–	4	1	–	–
Pacific loon	–	–	342	76	1	4
Red-throated loon	–	–	1	–	–	–
Yellow-billed loon	–	–	8	5	–	1
Unknown loon	–	–	5	12	–	–
Savoonga, Fall 2012						
Arctic loon	–	–	–	3	–	–
Pacific loon	–	–	416	264	–	20
Red-throated loon	–	–	–	–	–	1
Yellow-billed loon	–	–	9	8	–	–

Note: total numbers of loons observed as single birds, pairs, or groups.

–: Not observed.

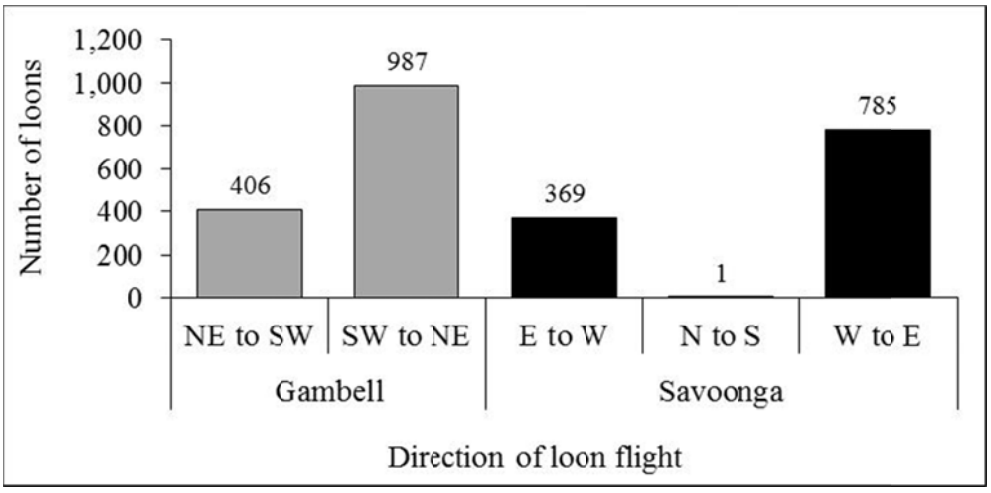


Figure 8.–Direction of loon flight near Gambell and Savoonga (years and species combined).

Loon Group Size

Most loons observed in fall bird counts occurred as single birds (66.4%), pairs (18.7%), or small groups of 3–9 birds (13.8%) (years combined, Table 6). The Pacific loon was the only species recorded in groups of more than 10 birds and groups with more than 20 loons were only observed in 2012. Quantitative information on loon group size was also obtained from harvest survey respondents in 2012. About half of the loons reported as harvested were single birds (51.5%) (Figure 9). The proportions of loons reported as harvested from pairs and from groups with up to 19 loons were slightly higher than the representation of these categories in fall bird counts suggesting that the occurrence of loons in groups is related to increased harvest success as compared to the occurrence of single birds.

Table 6.–Number of loons per group by year and species observed in bird counts.

	Number of groups				
Group size (number of loons)	Arctic loon	Pacific loon	Red-throated loon	Yellow-billed loon	Unknown loon
2011					
1 (single birds)	6	667	3	43	13
2 (pairs)	1	199	–	10	3
3–9	–	171	–	2	1
10–19	–	5	–	–	–
20–49	–	–	–	–	–
78	–	–	–	–	–
182	–	–	–	–	–
2012					
1 (single birds)	5	952	16	64	2
2 (pairs)	–	259	4	24	–
3–9	1	183	1	9	–
10–19	–	17	–	–	–
20–49	–	5	–	–	–
78	–	1	–	–	–
182	–	1	–	–	–

–: Not observed.

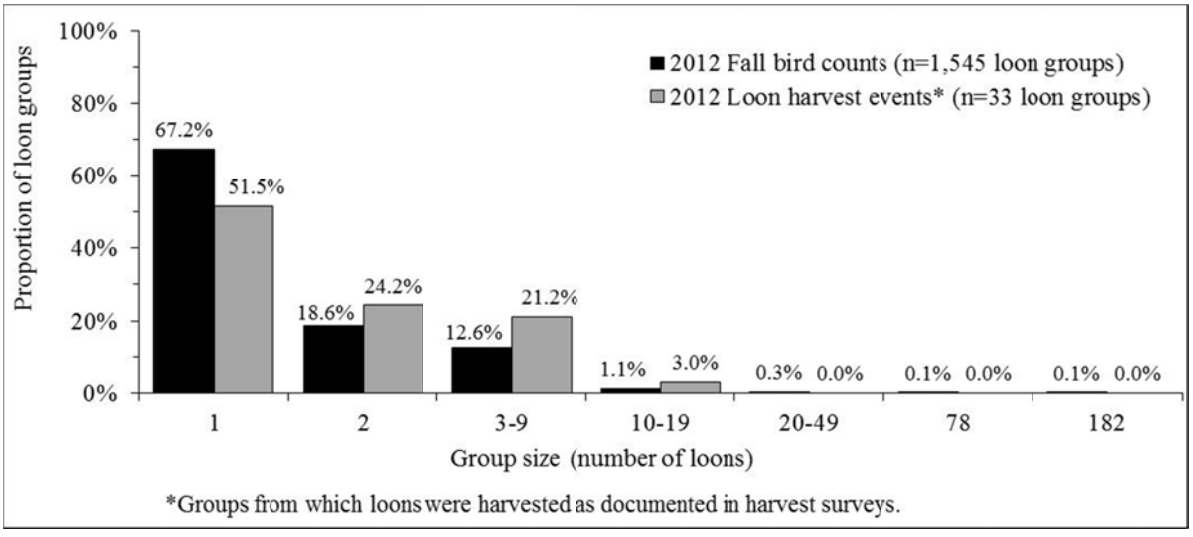


Figure 9.–Loon group size in 2012 bird counts and harvest events (species combined).

Loon Plumages

The proportion of individuals in breeding and nonbreeding plumages was very similar in fall 2011 and 2012 for the 4 loon species (Table 7). Loons in early molt stage were considered together with loons in breeding plumage because the former mostly still have breeding appearance. In both years, approximately 91.5% of yellow-billed loons were in breeding plumage. About three-fourths of Pacific loons (73.9% in 2011 and 76.0% in 2012) and Arctic loons (75.0% in 2011 and 77.8% in 2012) were in breeding plumage. A relatively lower proportion of red-throated loons were in breeding plumage: 66.7% in 2011 (n=3) and 40.0% in 2012 (n=25). On average, Pacific/Arctic loons represented 94.0% of all loons in breeding plumage and 96.9% of all loons in nonbreeding plumage (Figure 10). Yellow-billed loons represented 5.6% of all loons in breeding plumage and 1.6% of all loons in nonbreeding plumage. Considering all species together, 75.7% of loons observed in fall were in breeding plumage and 24.3% were in nonbreeding plumages. In 2011, 59.3% of Pacific loons in nonbreeding plumage were identified as adults while this proportion was 9.6% in 2012. The proportion of yellow-billed loons in nonbreeding plumage identified as adults was 50.0% in 2011 and 0.0% in 2012 (Table 7).

Table 7.–Occurrence of loons in breeding and nonbreeding plumages in fall bird counts.

Plumage and age categories	Arctic loon	Pacific loon	Red-throated loon	Yellow-billed loon
Fall 2011				
Breeding	6	1,310	2	64
Nonbreeding	2	462	1	6
Adult	1	274	–	3
Juvenile	1	94	–	2
Unknown age	–	94	1	1
Unknown	–	16	–	–
Fall 2012				
Breeding	7	1,884	10	129
Nonbreeding	2	595	15	12
Adult	–	57	–	–
Juvenile	–	379	15	5
Unknown age	2	159	–	7
Unknown	–	415	–	3

–: Not observed.

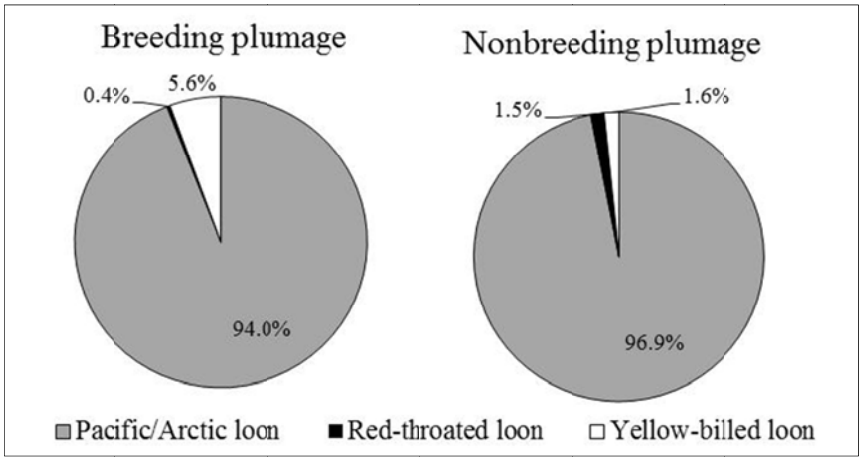


Figure 10.–Species composition of loons in breeding and nonbreeding plumages (2011–2012 average).

Gambell, late September.

Savoonga, late May.

Gambell, late February.

Subsistence hunters share their knowledge about the behavior of animals and their relationships in the ecosystem. Sam Mokiyuk (right) and Lili Naves (left, ADF&G) in key respondent interview. Savoonga, November 2012.

Some households still use *malliighusiq*, wings of large birds such as this one of a snow goose, to sweep and dust the house. Chester Noongwook, Savoonga, November 2012.

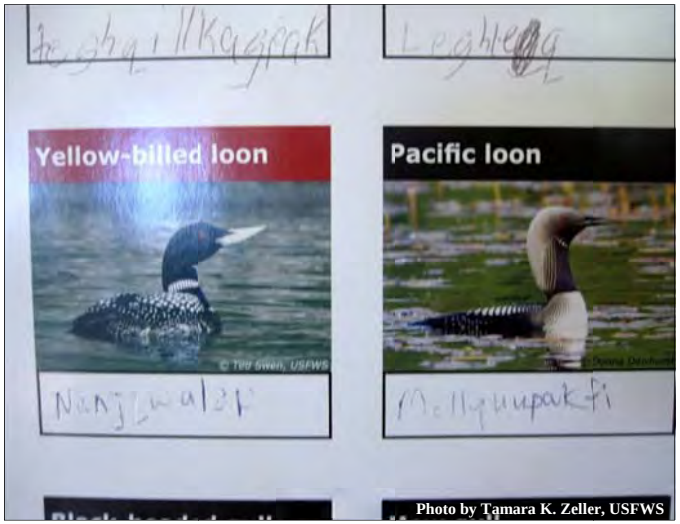
Fall bird counts were conducted to assess the relative abundance of birds near to Gambell and Savoonga.

Local research assistants help to communicate with households. Morgan Annogyiuk (right) and Meredith Marchioni (left, ADF&G), Savoonga, November 2012.

Bird count stations were selected to overlap hunting locations and many times observers used existing hunting blinds.

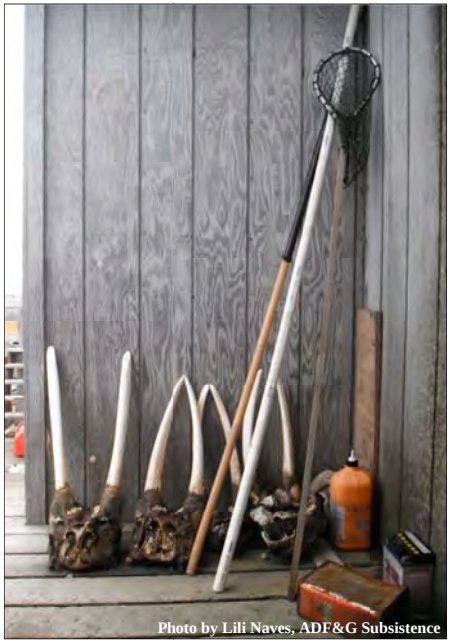
Tamara Zeller (USFWS) found a yellow-billed loon, *nangqwalek*. washed onshore Savoonga, November 2012.

Pacific loon, *melqupak*, represented 95% of the loons observed during fall. This bird started molting into nonbreeding plumage, 12 October 2010.



Different outreach materials helped to identify bird species. Posters had blank fields for writing local and Native bird names.

A fall sunset gives Gambell warm colors.



In 2009, subsistence harvests at Savoonga were estimated at 948 edible pounds per person and were composed of walrus (45%), seals (28%), bowhead whale (14%), fish (6%), birds (2%), bird eggs (2%), and other resources (3%) (Tahbone and Trigg 2011).

Sustained north winds bring marine debris to St. Lawrence Island beaches. Seabirds entangle in fishing nets, usually murres, young loons, and puffins.

A sunny evening at Koomlangeelkuk Bay, west of Savoonga. In the horizon, at left, the village of Gambell lies behind the Sevoukuk Mountain in the Northwest Cape. September, 2012.

Loon study skins in breeding and nonbreeding plumage draw attention at community meetings and school activities.

Whales, seals, and seabirds aggregate in large numbers to feed on concentrations of forage fish in summer and fall close to St. Lawrence Island.

Short-tailed shearwaters, *kaputaghaq*, are the most abundant birds in fall offshore St. Lawrence Island and it is sometimes harvested for food. Larry Kava, Savoonga, November 2012.

Dense schools of forage fish such as capelin, *sikaaq* (M*allotus villosus*) feed birds, marine mammals, and people. Gambell, November, 2012.

"We eat loons probably once or twice a month, other birds too once or twice a month. We eat mostly seals and walrus."

Seal butchering at Gambell beach.

Marine mammals, especially walrus and seals, are the main subsistence resources for St. Lawrence Island people.

Three young Pacific loons (right, top), 1 female spectacled eider (center), and 1 young murre (left) harvested in November.

Tepaq are tunicates, ascidians, and other groups harvested from the seashore, usually after storms, and are used for food by most households in Gambell and Savoonga.

Boat trip on a rare sunny day in late August. Rough weather and seas frequently preclude boating in fall.

Seal and bird hunting happens by boat and from onshore blinds, *nenki*, this one near Savoonga.

Subsistence hunters are always alert to harvest opportunities.

Hunters scout the sea for marine mammals and birds in early December as the icepack closes in. The boat will be launched if a harvest opportunity arises.

Dried meats from harvest seasons help getting through the winter.

Community meetings, this one at Gambell, are a main opportunity to share information.

Youth help organize harvest survey materials at the Savoonga Tribal Council.

St. Lawrence Island people anticipate the fall migration of snow goose, *kaanguq*. In some years, snow geese take a different route and are not locally available.

SUBSISTENCE HARVEST SURVEY

Sampling Effort and Participation Rates

On average 94.9% of the households contacted agreed to participate in the survey (Table 8). The average sampling rate was 89.8% in the spring–summer and 82.0% in the fall data collection. Some households that agreed to participate in the spring–summer data collection later declined to participate in the fall data collection (Gambell 2011=2 households, 2012=8 households; Savoonga 2011=12 households, 2012=7 households). On the other hand, some households that declined to participate in the spring–summer data collection later agreed to participate in the fall data collection (Gambell 2011=4 households, 2012=4 households; Savoonga 2011=5 households, 2012=11 households). A full set of harvest report forms (all seasons) was completed for households that agreed to participate in the fall data collection but that could not be contacted or declined to participate in the spring–summer data collection. Gambell household participation was higher in 2012 (spring–summer=95.2%, fall=91.9%) than in 2011 (spring–summer=85.9%, fall=87.3%) for both data collection seasons. Savoonga household participation was higher in 2011 (93.5%) than in 2012 (86.0%) for the spring–summer data collection and there was no difference in fall participation between years (2011=89.7%; 2012=89.8%). No other differences were detected in household participation relating to year or season. No factors were identified that could had affected household participation, such as interference with law enforcement action. Because of the high sampling rates, the harvest estimates (accounting for surveyed and nonsurveyed households) were very similar to the reported harvest (surveyed households only) (tables 9–16).

Table 8.–Harvest survey sampling effort.

	2011		2012		
	Gambell	Savoonga	Gambell	Savoonga	Average
Total resident households	135	151	138	148	
Harvester households[a]	83 (61.5%)	87 (57.6%)	84 (60.9%)	91 (61.5%)	60.4%
Nonharvester households	52 (38.5%)	64 (42.3%)	54 (39.1%)	57 (38.5%)	39.6%
Households contacted in spring–summer	128 (94.8%)	138 (91.4%)	125 (90.6%)	121 (81.8%)	89.6%
Households contacted in fall	126 (93.3%)	145 (96.0%)	123(89.1%)	128 (86.5%)	91.2%
Households contacted (overall)[b]	134 (99.3%)	149 (98.6%)	135 (97.8%)	137 (92.6%)	97.1%
Spring–summer participation rate[c]	110 (85.9%)	129 (93.5%)	119 (95.2%)	104 (86.0%)	90.1%
Fall participation rate[c]	110 (87.3%)	130 (89.7%)	113 (91.9%)	115 (89.8%)	89.7%
Overall participation rate[d]	120 (89.6%)	145 (97.3%)	133 (98.5%)	129 (94.2%)	94.9%
Spring–summer sampling rate[e]	120 (88.9%)	136 (90.1%)	132 (95.7%)	125 (84.5%)	89.8%
Fall sampling rate[e]	110 (81.5%)	130 (86.1%)	114 (82.6%)	115 (77.8%)	82.0%

a: "Harvester" households were those that harvested birds or eggs in any 1 of the 3 years preceding the study year.

b: Some households not contacted in spring–summer were contacted in fall and vice-versa.

c: Participation rate = households that agreed to participate ÷ households contacted.

d: Households that agreed to participate in at least 1 season.

e: Sampling rate = households surveyed ÷ total resident households.

Harvest Estimates

The 2011–2012 estimated annual average bird harvest was 5,171 birds for Gambell and 4,038 birds for Savoonga (tables 9, 11, 13, 15). The species harvested in the largest numbers (2011–2012 annual % average) were murre (24.6% of the total harvest in Gambell and 52.2% of the total harvest in Savoonga), auklet (45.2% and 9.9%), cormorant (11.1% and 16.7%), common eider (6.0% and 4.2%), and large gull (4.3% and 3.3%). Loons represented 0.3% of the total bird harvest in Gambell and 3.7% in Savoonga. The 2011–2012 annual average egg harvest was higher for Savoonga (18,345 eggs) than for Gambell (3,938 eggs) (tables 10, 12, 14, 16). Murre eggs represented 99.5% of the Savoonga egg harvest and 93.2% of the Gambell egg harvest. Harvests of loon eggs were not reported in the 2011 and 2012 surveys. Main differences between Gambell and Savoonga bird and egg harvests were a higher

proportion of auklets in Gambell bird harvests and higher average egg harvest at Savoonga. Human populations in Gambell and Savoonga are very similar (Gambell=681, Savoonga=671; U. S. Census Bureau 2011). Consistent differences in the amount and composition of subsistence harvests may represent local availability of bird species and patterns and distribution of harvest efforts.

On average, bird harvests (species and villages combined) occurred mainly in spring (53.0%) and fall (33.7%); summer harvests represented 13.3% of the annual harvests (tables 9, 11, 13, 15). However, harvests of individual bird categories may have a specific seasonal pattern. For instance, fall harvests accounted on average for 78.4% of the loon annual harvests in Gambell and Savoonga (Gambell 2011=13 loons, 2012=7 loons; Savoonga 2011=103 loons, 2012=162 loons; tables 9, 11, 13, 15).

The 2011 estimated loon harvest was 27 loons in Gambell and 124 in Savoonga composed of common (53.6%), Pacific/Arctic (27.8%), yellow-billed (11.3%), and red-throated (7.3%) loons. Following modifications to the harvest report form, the 2012 estimated loon harvest was 8 loons in Gambell and 171 loons in Savoonga composed of nonbreeding (unidentified) (64.2%), common (3.4%), Pacific/Arctic (26.3%), yellow-billed (1.7%), and red-throated (4.4%) loon.

Because of difficulties with loon species identification in harvest surveys, the proportion of nonbreeding loons in harvest surveys and the proportion of species and plumages in fall bird counts were used to adjust the harvest species composition. Assumptions underlying this approach are considered in the Discussion section “Loon Species Composition in the Subsistence Harvest.” First, the proportion of nonbreeding loons in the 2012 summer and fall harvests (64.2%, seasons combined) was applied to the 2011summer and fall harvests to account for selective harvest of young loons (the 2011 survey did not include nonbreeding loon). Second, the 2011–2012 average species and plumage composition in fall bird counts (Figure 10) was used to calculate species-specific harvest estimates (2011 breeding and nonbreeding plumages, 2012 nonbreeding plumages). Adjusted yellow-billed loon harvest estimates were 4 birds in 2011 and 5 birds in 2012 (Table 17). The average plumage composition from fall bird counts was not applied to spring harvests because species and plumage composition in the spring migration has not been investigated in detail. We also refrained from using this approach to adjust species-specific harvest estimates from previous harvest surveys. Although species and plumage proportions were very similar in the 2011 and 2012 bird counts, they may vary annually depending on loon productivity at different breeding areas and the proportion of birds staying in wintering areas. Also, because of uncertainty in the magnitude of previous harvest estimates (especially 2007), adjusted species-specific estimates would remain questionable (Discussion, Annual Variation of Harvest Estimates).

Table 9.–Reported and estimated bird harvest, Gambell 2011.

Species	Yearly bird harvest				Seasonal estimated bird harvest					
	Reported	**Estimated**	Confidence Interval		Spring		Summer		Fall	
	number	**number**	CIP	Low – High	Number	CIP	Number	CIP	Number	CIP
Ducks										
American wigeon	2	**2**	71%	2 – 4	2	71%	0	-	0	-
Teal	2	**2**	50%	2 – 4	2	50%	0	-	0	-
Mallard	5	**6**	42%	5 – 8	2	50%	4	41%	0	-
Northern pintail	52	**62**	35%	52 – 84	52	39%	6	59%	4	62%
Northern shoveler	0	**0**	-	-	0	-	0	-	0	-
Black scoter	0	**0**	-	-	0	-	0	-	0	-
Surf scoter	2	**2**	71%	2 – 4	2	71%	0	-	0	-
White-winged scoter	2	**3**	64%	2 – 4	0	-	0	-	3	84%
Bufflehead	0	**0**	-	-	0	-	0	-	0	-
Goldeneye	12	**14**	71%	12 – 24	14	71%	0	-	0	-
Canvasback	6	**7**	71%	6 – 12	7	71%	0	-	0	-
Scaup	0	**0**	-	-	0	-	0	-	0	-
Common eider	291	**360**	17%	298 – 421	131	22%	72	27%	156	26%
King eider	83	**101**	30%	83 – 132	38	54%	18	53%	46	30%
Spectacled eider	37	**45**	34%	37 – 61	6	36%	19	67%	21	58%
Steller's eider	3	**4**	71%	3 – 6	4	71%	0	-	0	-
Harlequin duck	3	**4**	71%	3 – 6	4	71%	0	-	0	-
Long-tailed duck	40	**50**	67%	40 – 84	24	71%	0	-	26	84%
Merganser	2	**2**	71%	2 – 4	0	-	2	71%	0	-
Duck (unidentified)	5	**6**	43%	5 – 9	1	71%	0	-	5	66%
Total ducks	547	**671**	15%	568 – 775	290	20%	121	24%	260	22%
Geese										
Black brant	37	**45**	23%	37 – 55	28	30%	6	37%	10	50%
Canada goose	34	**40**	50%	34 – 60	36	54%	4	71%	0	-
Greater white-fronted goose	6	**7**	60%	6 – 11	7	60%	0	-	0	-
Emperor goose	51	**60**	30%	51 – 78	40	35%	6	42%	14	40%
Snow goose	15	**18**	29%	15 – 23	8	45%	0	-	10	52%
Total geese	143	**169**	21%	143 – 205	120	25%	15	33%	34	35%
Tundra swan	10	**12**	27%	10 – 15	9	33%	1	71%	1	84%
Sandhill crane	4	**5**	43%	4 – 7	5	43%	0	-	0	-
Ptarmigans and grouses	0	**0**	-	-	0	-	0	-	0	-
Seabirds										
Cormorant	568	**690**	16%	583 – 797	228	24%	221	23%	241	21%
Tern	0	**0**	-	-	0	-	0	-	0	-
Black-legged kittiwake	0	**0**	-	-	0	-	0	-	0	-
Sabine's gull	0	**0**	-	-	0	-	0	-	0	-
Mew gull	10	**12**	71%	10 – 20	0	-	12	71%	0	-
Large gull	261	**314**	16%	262 – 365	70	36%	11	32%	233	26%
Auklet	1,802	**2,137**	15%	1,824 – 2,449	1,411	18%	581	32%	144	41%
Murre	1,373	**1,635**	23%	1,373 – 2,013	818	16%	663	52%	154	30%
Guillemot	10	**12**	71%	10 – 20	0	-	12	71%	0	-
Puffin	0	**0**	-	-	0	-	0	-	0	-
Total seabirds	4,024	**4,799**	13%	4,164 – 5,434	2,527	15%	1,499	27%	773	18%
Shorebirds										
Whimbrel/Curlew	0	**0**	-	-	0	-	0	-	0	-
Godwit	0	**0**	-	-	0	-	0	-	0	-
Golden/Black-bellied plover	0	**0**	-	-	0	-	0	-	0	-
Turnstone	0	**0**	-	-	0	-	0	-	0	-
Phalarope	0	**0**	-	-	0	-	0	-	0	-
Small shorebird	0	**0**	-	-	0	-	0	-	0	-
Total shorebirds	0	**0**	-	-	0	-	0	-	0	-
Loons and grebes										
Common loon	7	**9**	28%	7 – 11	1	71%	4	41%	4	62%
Pacific loon	8	**10**	34%	8 – 13	4	71%	2	71%	4	47%
Red-throated loon	0	**0**	-	-	0	-	0	-	0	-
Yellow-billed loon	6	**8**	34%	6 – 10	0	-	3	71%	5	51%
Grebe	0	**0**	-	-	0	-	0	-	0	-
Total loons and grebes	21	**27**	21%	21 – 31	5	56%	9	44%	13	33%
Total birds	4,749	**5,683**	12%	5,011 – 6,353	2,956	13%	1,646	25%	1,081	16%

Table 10.–Reported and estimated egg harvest, Gambell 2011.

Species	Yearly egg harvest				Seasonal estimated egg harvest					
	Reported number	**Estimated number**	Confidence Interval		Spring		Summer		Fall	
			CIP	Low – High	Number	CIP	Number	CIP	Number	CIP
Ducks										
American wigeon	0	**0**	-	-	0	-	0	-	0	-
Teal	0	**0**	-	-	0	-	0	-	0	-
Mallard	0	**0**	-	-	0	-	0	-	0	-
Northern pintail	0	**0**	-	-	0	-	0	-	0	-
Northern shoveler	0	**0**	-	-	0	-	0	-	0	-
Black scoter	0	**0**	-	-	0	-	0	-	0	-
Surf scoter	0	**0**	-	-	0	-	0	-	0	-
White-winged scoter	0	**0**	-	-	0	-	0	-	0	-
Bufflehead	0	**0**	-	-	0	-	0	-	0	-
Goldeneye	30	**36**	71%	30 – 61	36	71%	0	-	0	-
Canvasback	0	**0**	-	-	0	-	0	-	0	-
Scaup	0	**0**	-	-	0	-	0	-	0	-
Common eider	190	**225**	44%	190 – 325	225	44%	0	-	0	-
King eider	0	**0**	-	-	0	-	0	-	0	-
Spectacled eider	0	**0**	-	-	0	-	0	-	0	-
Steller's eider	0	**0**	-	-	0	-	0	-	0	-
Harlequin duck	0	**0**	-	-	0	-	0	-	0	-
Long-tailed duck	0	**0**	-	-	0	-	0	-	0	-
Merganser	0	**0**	-	-	0	-	0	-	0	-
Total ducks	220	**261**	39%	220 – 363	261	39%	0	-	0	-
Geese										
Black brant	20	**24**	71%	20 – 41	24	71%	0	-	0	-
Canada goose	70	**83**	71%	70 – 142	83	71%	0	-	0	-
Greater white-fronted goose	45	**53**	71%	45 – 91	53	71%	0	-	0	-
Emperor goose	20	**24**	71%	20 – 41	24	71%	0	-	0	-
Snow goose	0	**0**	-	-	0	-	0	-	0	-
Total geese	155	**184**	56%	155 – 286	184	56%	0	-	0	-
Tundra swan	0	**0**	-	-	0	-	0	-	0	-
Sandhill crane	4	**5**	71%	4 – 8	5	71%	0	-	0	-
Ptarmigans and grouses	0	**0**	-	-	0	-	0	-	0	-
Seabirds										
Cormorant	0	**0**	-	-	0	-	0	-	0	-
Tern	0	**0**	-	-	0	-	0	-	0	-
Black-legged kittiwake	0	**0**	-	-	0	-	0	-	0	-
Sabine's gull	0	**0**	-	-	0	-	0	-	0	-
Mew gull	0	**0**	-	-	0	-	0	-	0	-
Large gull	48	**57**	65%	48 – 94	57	65%	0	-	0	-
Auklet	0	**0**	-	-	0	-	0	-	0	-
Murre	1,846	**2,174**	42%	1,846 – 3,083	2,165	42%	9	52%	0	-
Guillemot	0	**0**	-	-	0	-	0	-	0	-
Puffin	0	**0**	-	-	0	-	0	-	0	-
Total seabirds	1,894	**2,231**	41%	1,894 – 3,144	2,222	41%	9	52%	0	-
Shorebirds										
Whimbrel/Curlew	0	**0**	-	-	0	-	0	-	0	-
Godwit	0	**0**	-	-	0	-	0	-	0	-
Golden/Black-bellied plover	0	**0**	-	-	0	-	0	-	0	-
Turnstone	0	**0**	-	-	0	-	0	-	0	-
Phalarope	0	**0**	-	-	0	-	0	-	0	-
Small shorebird	0	**0**	-	-	0	-	0	-	0	-
Total shorebirds	0	**0**	-	-	0	-	0	-	0	-
Loons and grebes										
Common loon	0	**0**	-	-	0	-	0	-	0	-
Pacific loon	0	**0**	-	-	0	-	0	-	0	-
Red-throated loon	0	**0**	-	-	0	-	0	-	0	-
Yellow-billed loon	0	**0**	-	-	0	-	0	-	0	-
Grebe	0	**0**	-	-	0	-	0	-	0	-
Total loons and grebes	0	**0**	-	-	0	-	0	-	0	-
Total eggs	2,273	**2,681**	35%	2,273 – 3,617	2,671	35%	9	52%	0	-

Table 11.–Reported and estimated bird harvest, Gambell 2012.

Species	Yearly bird harvest				Seasonal estimated bird harvest					
	Reported	**Estimated**	Confidence Interval		Spring		Summer		Fall	
	number	**number**	CIP	Low – High	Number	CIP	Number	CIP	Number	CIP
Ducks										
American wigeon	1	**1**	53%	1 – 2	1	53%	0	-	0	-
Teal	3	**3**	30%	3 – 4	3	30%	0	-	0	-
Mallard	3	**3**	30%	3 – 4	3	30%	0	-	0	-
Northern pintail	55	**58**	13%	55 – 66	44	15%	7	26%	7	56%
Northern shoveler	0	**0**	-	-	0	-	0	-	0	-
Black scoter	0	**0**	-	-	0	-	0	-	0	-
Surf scoter	0	**0**	-	-	0	-	0	-	0	-
White-winged scoter	2	**2**	25%	2 – 3	0	-	0	-	2	76%
Bufflehead	0	**0**	-	-	0	-	0	-	0	-
Goldeneye	0	**0**	-	-	0	-	0	-	0	-
Canvasback	0	**0**	-	-	0	-	0	-	0	-
Scaup	0	**0**	-	-	0	-	0	-	0	-
Common eider	246	**260**	7%	246 – 279	191	8%	20	25%	50	33%
King eider	52	**55**	18%	52 – 65	43	22%	2	30%	10	46%
Spectacled eider	17	**20**	37%	17 – 28	0	-	0	-	20	61%
Steller's eider	0	**0**	-	-	0	-	0	-	0	-
Harlequin duck	2	**2**	30%	2 – 3	2	30%	0	-	0	-
Long-tailed duck	0	**0**	-	-	0	-	0	-	0	-
Merganser	0	**0**	-	-	0	-	0	-	0	-
Total ducks	381	**406**	7%	381 – 433	287	8%	29	19%	90	27%
Geese										
Black brant	25	**27**	12%	25 – 30	21	13%	0	-	6	54%
Canada goose	6	**6**	25%	6 – 8	6	25%	0	-	0	-
Greater white-fronted goose	7	**7**	15%	7 – 8	6	17%	0	-	1	76%
Emperor goose	116	**128**	13%	116 – 144	53	13%	16	17%	58	41%
Snow goose	20	**21**	18%	20 – 25	15	21%	0	0%	6	50%
Total geese	174	**189**	11%	174 – 210	101	13%	16	17%	71	38%
Tundra swan	5	**6**	21%	5 – 7	1	30%	0	-	5	76%
Sandhill crane	1	**1**	30%	1 – 1	1	30%	0	-	0	-
Ptarmigans and grouses	0	**0**	-	-	0	-	0	-	0	-
Seabirds										
Cormorant	397	**458**	13%	398 – 518	49	19%	83	17%	326	29%
Tern	0	**0**	-	-	0	-	0	-	0	-
Black-legged kittiwake	14	**17**	22%	14 – 21	0	-	0	-	17	65%
Sabine's gull	0	**0**	-	-	0	-	0	-	0	-
Mew gull	0	**0**	-	-	0	-	0	-	0	-
Large gull	107	**128**	15%	108 – 148	0	-	10	30%	118	33%
Auklet	2,349	**2,537**	7%	2,369 – 2,706	1,679	7%	95	17%	763	40%
Murre	874	**908**	7%	874 – 970	807	7%	43	23%	58	52%
Guillemot	0	**0**	-	-	0	-	0	-	0	-
Puffin	0	**0**	-	-	0	-	0	-	0	-
Total seabirds	3,741	**4,048**	6%	3,816 – 4,281	2,535	7%	231	13%	1,282	27%
Shorebirds										
Whimbrel/Curlew	0	**0**	-	-	0	-	0	-	0	-
Godwit	0	**0**	-	-	0	-	0	-	0	-
Golden/Black-bellied plover	0	**0**	-	-	0	-	0	-	0	-
Turnstone	0	**0**	-	-	0	-	0	-	0	-
Phalarope	0	**0**	-	-	0	-	0	-	0	-
Small shorebird	0	**0**	-	-	0	-	0	-	0	-
Total shorebirds	0	**0**	-	-	0	-	0	-	0	-
Loons and grebes										
Common loon	0	**0**	-	-	0	-	0	-	0	-
Pacific loon	0	**0**	-	-	0	-	0	-	0	-
Red-throated loon	0	**0**	-	-	0	-	0	-	0	-
Nonbreeding loon	7	**8**	14%	7 – 10	0	-	1	30%	7	47%
Yellow-billed loon	0	**0**	-	-	0	-	0	-	0	-
Grebe	0	**0**	-	-	0	-	0	-	0	-
Total loons and grebes	7	**8**	14%	7 – 10	0	-	1	30%	7	47%
Total birds	4,309	**4,658**	5%	4,413 – 4,904	2,925	6%	278	11%	1,455	25%

Table 12.–Reported and estimated egg harvest, Gambell 2012.

Species	Yearly egg harvest				Seasonal estimated egg harvest					
	Reported	**Estimated**	Confidence Interval		Spring		Summer		Fall	
	number	**number**	CIP	Low – High	Number	CIP	Number	CIP	Number	CIP
Ducks										
American wigeon	0	**0**	-	-	0	-	0	-	0	-
Teal	0	**0**	-	-	0	-	0	-	0	-
Mallard	0	**0**	-	-	0	-	0	-	0	-
Northern pintail	0	**0**	-	-	0	-	0	-	0	-
Northern shoveler	0	**0**	-	-	0	-	0	-	0	-
Black scoter	0	**0**	-	-	0	-	0	-	0	-
Surf scoter	0	**0**	-	-	0	-	0	-	0	-
White-winged scoter	0	**0**	-	-	0	-	0	-	0	-
Bufflehead	0	**0**	-	-	0	-	0	-	0	-
Goldeneye	0	**0**	-	-	0	-	0	-	0	-
Canvasback	0	**0**	-	-	0	-	0	-	0	-
Scaup	0	**0**	-	-	0	-	0	-	0	-
Common eider	30	**31**	30%	30 – 40	31	30%	0	-	0	-
King eider	0	**0**	-	-	0	-	0	-	0	-
Spectacled eider	0	**0**	-	-	0	-	0	-	0	-
Steller's eider	0	**0**	-	-	0	-	0	-	0	-
Harlequin duck	0	**0**	-	-	0	-	0	-	0	-
Long-tailed duck	0	**0**	-	-	0	-	0	-	0	-
Merganser	0	**0**	-	-	0	-	0	-	0	-
Total ducks	30	**31**	30%	30 – 40	31	30%	0	-	0	-
Geese										
Black brant	0	**0**	-	-	0	-	0	-	0	-
Canada goose	0	**0**	-	-	0	-	0	-	0	-
Greater white-fronted goose	0	**0**	-	-	0	-	0	-	0	-
Emperor goose	0	**0**	-	-	0	-	0	-	0	-
Snow goose	0	**0**	-	-	0	-	0	-	0	-
Total geese	0	**0**	-	-	0	-	0	-	0	-
Tundra swan	0	**0**	-	-	0	-	0	-	0	-
Sandhill crane	0	**0**	-	-	0	-	0	-	0	-
Ptarmigans and grouses	0	**0**	-	-	0	-	0	-	0	-
Seabirds										
Cormorant	0	**0**	-	-	0	-	0	-	0	-
Tern	0	**0**	-	-	0	-	0	-	0	-
Black-legged kittiwake	0	**0**	-	-	0	-	0	-	0	-
Sabine's gull	0	**0**	-	-	0	-	0	-	0	-
Mew gull	0	**0**	-	-	0	-	0	-	0	-
Large gull	0	**0**	-	-	0	-	0	-	0	-
Auklet	0	**0**	-	-	0	-	0	-	0	-
Murre	4,970	**5,165**	11%	4,970 – 5,747	3,852	15%	1,312	12%	0	-
Guillemot	0	**0**	-	-	0	-	0	-	0	-
Puffin	0	**0**	-	-	0	-	0	-	0	-
Total seabirds	4,970	**5,165**	11%	4,970 – 5,747	3,852	15%	1,312	12%	0	-
Shorebirds										
Whimbrel/Curlew	0	**0**	-	-	0	-	0	-	0	-
Godwit	0	**0**	-	-	0	-	0	-	0	-
Golden/Black-bellied plover	0	**0**	-	-	0	-	0	-	0	-
Turnstone	0	**0**	-	-	0	-	0	-	0	-
Phalarope	0	**0**	-	-	0	-	0	-	0	-
Small shorebird	0	**0**	-	-	0	-	0	-	0	-
Total shorebirds	0	**0**	-	-	0	-	0	-	0	-
Loons and grebes										
Common loon	0	**0**	-	-	0	-	0	-	0	-
Pacific loon	0	**0**	-	-	0	-	0	-	0	-
Red-throated loon	0	**0**	-	-	0	-	0	-	0	-
Yellow-billed loon	0	**0**	-	-	0	-	0	-	0	-
Grebe	0	**0**	-	-	0	-	0	-	0	-
Total loons and grebes	0	**0**	-	-	0	-	0	-	0	-
Total eggs	5,000	**5,195**	11%	5,000 – 5,778	3,883	15%	1,312	12%	0	-

Table 13.–Reported and estimated bird harvest, Savoonga 2011.

Species	Yearly bird harvest				Seasonal estimated bird harvest					
	Reported number	**Estimated number**	Confidence Interval CIP	Low – High	Spring Number	Spring CIP	Summer Number	Summer CIP	Fall Number	Fall CIP
Ducks										
American wigeon	1	**1**	62%	1 – 2	0	-	1	65%	0	-
Teal	0	**0**	-	-	0	-	0	-	0	-
Mallard	0	**0**	-	-	0	-	0	-	0	-
Northern pintail	0	**0**	-	-	0	-	0	-	0	-
Northern shoveler	0	**0**	-	-	0	-	0	-	0	-
Black scoter	6	**7**	61%	6 – 11	0	-	0	-	7	68%
Surf scoter	7	**8**	46%	7 – 12	0	-	0	-	8	52%
White-winged scoter	8	**9**	43%	8 – 13	0	-	9	46%	0	-
Bufflehead	0	**0**	-	-	0	-	0	-	0	-
Goldeneye	0	**0**	-	-	0	-	0	-	0	-
Canvasback	0	**0**	-	-	0	-	0	-	0	-
Scaup	0	**0**	-	-	0	-	0	-	0	-
Common eider	159	**183**	16%	159 – 213	29	39%	15	33%	139	21%
King eider	33	**38**	23%	33 – 46	14	32%	17	39%	7	57%
Spectacled eider	13	**15**	49%	13 – 22	3	53%	11	65%	0	-
Steller's eider	12	**13**	53%	12 – 20	0	-	13	53%	0	-
Harlequin duck	4	**5**	61%	4 – 7	0	-	0	-	5	68%
Long-tailed duck	4	**5**	61%	4 – 7	0	-	0	-	5	68%
Merganser	0	**0**	-	-	0	-	0	-	0	-
Total ducks	247	**283**	13%	247 – 319	46	27%	66	23%	171	18%
Geese										
Black brant	46	**53**	29%	46 – 69	0	-	10	46%	43	34%
Canada goose	30	**34**	40%	30 – 47	17	53%	0	0%	16	68%
Greater white-fronted goose	1	**1**	63%	1 – 2	1	63%	0	0%	0	0%
Emperor goose	38	**44**	27%	38 – 56	0	-	18	47%	26	29%
Snow goose	156	**181**	21%	156 – 220	0	-	4	35%	177	29%
Total geese	271	**313**	19%	271 – 373	18	50%	33	41%	261	25%
Tundra swan	4	**5**	48%	4 – 7	0	-	3	65%	1	68%
Sandhill crane	5	**6**	51%	5 – 9	6	51%	0	-	0	-
Ptarmigans and grouses	0	**0**	-	-	0	-	0	-	0	-
Seabirds										
Short-tailed shearwater	15	**17**	61%	15 – 28	0	-	0	-	17	68%
Cormorant	782	**899**	12%	791 – 1,006	15	50%	335	16%	549	14%
Tern	0	**0**	0%	-	0	-	0	-	0	-
Black-legged kittiwake	8	**9**	48%	8 – 14	0	-	0	-	9	53%
Sabine's gull	0	**0**	-	-	0	-	0	-	0	-
Mew gull	0	**0**	-	-	0	-	0	-	0	-
Large gull	151	**171**	24%	151 – 211	65	53%	0	-	106	23%
Auklet	506	**567**	20%	506 – 683	391	21%	45	65%	131	31%
Murre	2,235	**2,541**	9%	2,308 – 2,773	1,246	14%	11	65%	1,283	14%
Guillemot	19	**22**	50%	19 – 33	0	-	5	65%	17	53%
Puffin	0	**0**	-	-	0	-	0	-	0	-
Total seabirds	3,716	**4,225**	8%	3,884 – 4,567	1,717	13%	396	15%	2,113	11%
Shorebirds										
Whimbrel/Curlew	0	**0**	-	-	0	-	0	-	0	-
Godwit	0	**0**	-	-	0	-	0	-	0	-
Golden/Black-bellied plover	0	**0**	-	-	0	-	0	-	0	-
Turnstone	0	**0**	-	-	0	-	0	-	0	-
Phalarope	0	**0**	-	-	0	-	0	-	0	-
Small shorebird	14	**16**	62%	14 – 26	0	-	16	65%	0	-
Total shorebirds	14	**16**	62%	14 – 26	0	-	16	65%	0	-
Loons and grebes										
Common loon	62	**72**	18%	62 – 85	0	-	0	-	72	20%
Pacific loon	28	**32**	33%	28 – 43	0	-	19	38%	13	43%
Red-throated loon	10	**11**	45%	10 – 17	0	-	1	65%	10	55%
Yellow-billed loon	8	**9**	41%	8 – 13	0	-	1	65%	8	50%
Grebe	7	**8**	33%	7 – 11	3	63%	0	-	5	41%
Total loons and grebes	115	**132**	16%	115 – 155	3	63%	21	36%	108	18%
Total birds	4,372	**4,980**	8%	4,588 – 5,374	1,791	12%	532	15%	2,654	11%

Table 14.–Reported and estimated egg harvest, Savoonga 2011.

Species	Yearly egg harvest				Seasonal estimated egg harvest					
	Reported	**Estimated**	Confidence Interval		Spring		Summer		Fall	
	number	**number**	CIP	Low – High	Number	CIP	Number	CIP	Number	CIP
Ducks										
American wigeon	0	**0**	-	-	0	-	0	-	0	-
Teal	0	**0**	-	-	0	-	0	-	0	-
Mallard	0	**0**	-	-	0	-	0	-	0	-
Northern pintail	0	**0**	-	-	0	-	0	-	0	-
Northern shoveler	0	**0**	-	-	0	-	0	-	0	-
Black scoter	0	**0**	-	-	0	-	0	-	0	-
Surf scoter	0	**0**	-	-	0	-	0	-	0	-
White-winged scoter	0	**0**	-	-	0	-	0	-	0	-
Bufflehead	0	**0**	-	-	0	-	0	-	0	-
Goldeneye	0	**0**	-	-	0	-	0	-	0	-
Canvasback	0	**0**	-	-	0	-	0	-	0	-
Scaup	0	**0**	-	-	0	-	0	-	0	-
Common eider	46	**52**	39%	46 – 72	52	39%	0	-	0	-
King eider	0	**0**	-	-	0	-	0	-	0	-
Spectacled eider	0	**0**	-	-	0	-	0	-	0	-
Steller's eider	0	**0**	-	-	0	-	0	-	0	-
Harlequin duck	0	**0**	-	-	0	-	0	-	0	-
Long-tailed duck	0	**0**	-	-	0	-	0	-	0	-
Merganser	0	**0**	-	-	0	-	0	-	0	-
Total ducks	46	**52**	39%	46 – 72	52	39%	0	-	0	-
Geese										
Black brant	0	**0**	-	-	0	-	0	-	0	-
Canada goose	0	**0**	-	-	0	-	0	-	0	-
Greater white-fronted goose	0	**0**	-	-	0	-	0	-	0	-
Emperor goose	0	**0**	-	-	0	-	0	-	0	-
Snow goose	0	**0**	-	-	0	-	0	-	0	-
Total geese	0	**0**	-	-	0	-	0	-	0	-
Tundra swan	0	**0**	-	-	0	-	0	-	0	-
Sandhill crane	0	**0**	-	-	0	-	0	-	0	-
Ptarmigans and grouses	0	**0**	-	-	0	-	0	-	0	-
Seabirds										
Cormorant	0	**0**	-	-	0	-	0	-	0	-
Tern	0	**0**	-	-	0	-	0	-	0	-
Black-legged kittiwake	0	**0**	-	-	0	-	0	-	0	-
Sabine's gull	0	**0**	-	-	0	-	0	-	0	-
Mew gull	0	**0**	-	-	0	-	0	-	0	-
Large gull	48	**54**	49%	48 – 81	54	49%	0	-	0	-
Auklet	0	**0**	-	-	0	-	0	-	0	-
Murre	14,093	**15,750**	13%	14,093 – 17,758	14,852	13%	898	46%	0	-
Guillemot	0	**0**	-	-	0	-	0	-	0	-
Puffin	0	**0**	-	-	0	-	0	-	0	-
Total seabirds	14,141	**15,804**	13%	14,141 – 17,812	14,906	13%	898	46%	0	-
Shorebirds										
Whimbrel/Curlew	0	**0**	-	-	0	-	0	-	0	-
Godwit	0	**0**	-	-	0	-	0	-	0	-
Golden/Black-bellied plover	0	**0**	-	-	0	-	0	-	0	-
Turnstone	0	**0**	-	-	0	-	0	-	0	-
Phalarope	0	**0**	-	-	0	-	0	-	0	-
Small shorebird	0	**0**	-	-	0	-	0	-	0	-
Total shorebirds	0	**0**	-	-	0	-	0	-	0	-
Loons and grebes										
Common loon	0	**0**	-	-	0	-	0	-	0	-
Pacific loon	0	**0**	-	-	0	-	0	-	0	-
Red-throated loon	0	**0**	-	-	0	-	0	-	0	-
Yellow-billed loon	0	**0**	-	-	0	-	0	-	0	-
Grebe	0	**0**	-	-	0	-	0	-	0	-
Total loons and grebes	0	**0**	-	-	0	-	0	-	0	-
Total eggs	14,187	**15,856**	13%	14,187 – 17,863	14,958	13%	898	46%	0	-

Table 15.–Reported and estimated bird harvest, Savoonga 2012.

Species	Yearly bird harvest				Seasonal estimated bird harvest					
	Reported	**Estimated**	Confidence Interval		Spring		Summer		Fall	
	number	**number**	CIP	Low – High	Number	CIP	Number	CIP	Number	CIP
Ducks										
American wigeon	0	**0**	-	-	0	-	0	-	0	-
Teal	0	**0**	-	-	0	-	0	-	0	-
Mallard	0	**0**	-	-	0	-	0	-	0	-
Northern pintail	6	**7**	80%	6 – 13	7	80%	0	-	0	-
Northern shoveler	0	**0**	-	-	0	-	0	-	0	-
Black scoter	0	**0**	-	-	0	-	0	-	0	-
Surf scoter	0	**0**	-	-	0	-	0	-	0	-
White-winged scoter	19	**25**	67%	19 – 41	0	-	0	-	25	80%
Bufflehead	0	**0**	-	-	0	-	0	-	0	-
Goldeneye	0	**0**	-	-	0	-	0	-	0	-
Canvasback	0	**0**	-	-	0	-	0	-	0	-
Scaup	0	**0**	-	-	0	-	0	-	0	-
Common eider	125	**157**	21%	125 – 190	47	32%	33	39%	77	33%
King eider	21	**26**	51%	21 – 39	15	80%	5	80%	7	89%
Spectacled eider	20	**25**	39%	20 – 35	6	66%	2	80%	17	61%
Steller's eider	14	**17**	78%	14 – 31	0	-	12	80%	5	89%
Harlequin duck	3	**4**	80%	3 – 7	4	80%	0	-	0	-
Long-tailed duck	0	**0**	-	-	0	-	0	-	0	-
Merganser	0	**0**	-	-	0	-	0	-	0	-
Total ducks	208	**261**	19%	212 – 310	79	29%	52	31%	130	28%
Geese										
Black brant	39	**49**	34%	39 – 65	12	80%	12	80%	25	47%
Canada goose	0	**0**	-	-	0	-	0	-	0	-
Greater white-fronted goose	0	**0**	-	-	0	-	0	-	0	-
Emperor goose	50	**62**	28%	50 – 79	8	69%	33	41%	21	46%
Snow goose	5	**7**	54%	5 – 10	0	-	0	-	7	64%
Total geese	94	**117**	24%	94 – 146	21	55%	45	46%	52	35%
Tundra swan	0	**0**	-	-	0	-	0	-	0	-
Sandhill crane	7	**9**	67%	7 – 15	1	80%	2	80%	5	89%
Ptarmigans and grouses	0	**0**	-	-	0	-	0	-	0	-
Seabirds										
Short-tailed shearwater	37	**48**	52%	37 – 73	0	-	0	-	48	62%
Cormorant	354	**452**	16%	380 – 524	35	58%	84	35%	333	21%
Tern	0	**0**	-	-	0	-	0	-	0	-
Black-legged kittiwake	6	**8**	63%	6 – 13	0	-	0	-	8	75%
Sabine's gull	0	**0**	-	-	0	-	0	-	0	-
Mew gull	0	**0**	-	-	0	-	0	-	0	-
Large gull	77	**99**	27%	77 – 126	0	-	15	55%	84	34%
Auklet	195	**233**	31%	195 – 305	207	33%	25	76%	0	-
Murre	1,382	**1,676**	20%	1,382 – 2,015	1,549	21%	0	-	126	33%
Guillemot	10	**13**	75%	10 – 23	0	-	0	-	13	89%
Puffin	0	**0**	-	-	0	-	0	-	0	-
Total seabirds	2,061	**2,528**	16%	2,115 – 2,940	1,792	20%	124	33%	612	22%
Shorebirds										
Whimbrel/Curlew	0	**0**	-	-	0	-	0	-	0	-
Godwit	0	**0**	-	-	0	-	0	-	0	-
Golden/Black-bellied plover	0	**0**	-	-	0	-	0	-	0	-
Turnstone	0	**0**	-	-	0	-	0	-	0	-
Phalarope	0	**0**	-	-	0	-	0	-	0	-
Small shorebird	0	**0**	-	-	0	-	0	-	0	-
Total shorebirds	0	**0**	-	-	0	-	0	-	0	-
Loons and grebes										
Common loon	5	**6**	50%	5 – 10	1	80%	0	-	5	70%
Pacific loon	36	**47**	44%	36 – 67	0	-	0	-	47	52%
Red-throated loon	6	**8**	55%	6 – 12	0	-	0	-	8	66%
Nonbreeding loon	83	**107**	27%	83 – 136	0	-	8	80%	99	30%
Yellow-billed loon	2	**3**	75%	2 – 5	0	-	0	-	3	89%
Grebe	7	**8**	49%	7 – 13	2	80%	0	-	6	73%
Total loons and grebes	139	**180**	20%	144 – 216	4	59%	8	80%	168	23%
Total birds	2,509	**3,095**	15%	2,625 – 3,564	1,896	20%	232	23%	967	19%

Table 16.–Reported and estimated egg harvest, Savoonga 2012.

Species	Yearly egg harvest				Seasonal estimated egg harvest					
	Reported	**Estimated**	Confidence Interval		Spring		Summer		Fall	
	number	**number**	CIP	Low – High	Number	CIP	Number	CIP	Number	CIP
Ducks										
American wigeon	0	**0**	-	-	0	-	0	-	0	-
Teal	0	**0**	-	-	0	-	0	-	0	-
Mallard	0	**0**	-	-	0	-	0	-	0	-
Northern pintail	0	**0**	-	-	0	-	0	-	0	-
Northern shoveler	0	**0**	-	-	0	-	0	-	0	-
Black scoter	0	**0**	-	-	0	-	0	-	0	-
Surf scoter	0	**0**	-	-	0	-	0	-	0	-
White-winged scoter	0	**0**	-	-	0	-	0	-	0	-
Bufflehead	0	**0**	-	-	0	-	0	-	0	-
Goldeneye	0	**0**	-	-	0	-	0	-	0	-
Canvasback	0	**0**	-	-	0	-	0	-	0	-
Scaup	0	**0**	-	-	0	-	0	-	0	-
Common eider	1	**1**	69%	1 – 2	1	69%	0	-	0	-
King eider	0	**0**	-	-	0	-	0	-	0	-
Spectacled eider	0	**0**	-	-	0	-	0	-	0	-
Steller's eider	0	**0**	-	-	0	-	0	-	0	-
Harlequin duck	0	**0**	-	-	0	-	0	-	0	-
Long-tailed duck	0	**0**	-	-	0	-	0	-	0	-
Merganser	0	**0**	-	-	0	-	0	-	0	-
Total ducks	1	**1**	69%	1 – 2	1	69%	0	-	0	-
Geese										
Black brant	0	**0**	-	-	0	-	0	-	0	-
Canada goose	0	**0**	-	-	0	-	0	-	0	-
Greater white-fronted goose	0	**0**	-	-	0	-	0	-	0	-
Emperor goose	0	**0**	-	-	0	-	0	-	0	-
Snow goose	0	**0**	-	-	0	-	0	-	0	-
Total geese	0	**0**	-	-	0	-	0	-	0	-
Tundra swan	8	**10**	80%	8 – 17	10	80%	0	-	0	-
Sandhill crane	0	**0**	-	-	0	-	0	-	0	-
Ptarmigans and grouses	0	**0**	-	-	0	-	0	-	0	-
Seabirds										
Cormorant	0	**0**	-	-	0	-	0	-	0	-
Tern	0	**0**	-	-	0	-	0	-	0	-
Black-legged kittiwake	0	**0**	-	-	0	-	0	-	0	-
Sabine's gull	0	**0**	-	-	0	-	0	-	0	-
Mew gull	30	**34**	69%	30 – 58	0	-	34	69%	0	-
Large gull	26	**32**	64%	26 – 52	32	64%	0	-	0	-
Auklet	10	**12**	80%	10 – 22	12	80%	0	-	0	-
Murre	17,159	**20,746**	20%	17,159 – 24,804	16,802	23%	3,944	36%	0	-
Guillemot	0	**0**	-	-	0	-	0	-	0	-
Puffin	0	**0**	-	-	0	-	0	-	0	-
Total seabirds	17,225	**20,824**	19%	17,225 – 24,883	16,846	23%	3,979	36%	0	-
Shorebirds										
Whimbrel/Curlew	0	**0**	-	-	0	-	0	-	0	-
Godwit	0	**0**	-	-	0	-	0	-	0	-
Golden/Black-bellied plover	0	**0**	-	-	0	-	0	-	0	-
Turnstone	0	**0**	-	-	0	-	0	-	0	-
Phalarope	0	**0**	-	-	0	-	0	-	0	-
Small shorebird	0	**0**	-	-	0	-	0	-	0	-
Total shorebirds	0	**0**	-	-	0	-	0	-	0	-
Loons and grebes										
Common loon	0	**0**	-	-	0	-	0	-	0	-
Pacific loon	0	**0**	-	-	0	-	0	-	0	-
Red-throated loon	0	**0**	-	-	0	-	0	-	0	-
Yellow-billed loon	0	**0**	-	-	0	-	0	-	0	-
Grebe	0	**0**	-	-	0	-	0	-	0	-
Total loons and grebes	0	**0**	-	-	0	-	0	-	0	-
Total eggs	17,234	**20,835**	19%	17,234 – 24,896	16,856	23%	3,979	36%	0	-

Table 17.–Original loon harvest estimates and adjusted species-specific estimates based on fall bird counts.

	Original harvest estimates				Adjusted harvest estimates			
	Spring	Summer	Fall	Total	Spring	Summer	Fall	Total
2011 Harvest								
Breeding plumage	a	a	a	a	**5**	**11****	**41****	**57****
Pacific/Arctic loon	a	a	a	a	4	10*	39*	53*
Red-throated loon	a	a	a	a	0	0*	0*	0*
Yellow-billed loon	a	a	a	a	0	1*	2*	3*
Common loon	a	a	a	a	1	0*	0*	1*
Nonbreeding plumage	a	a	a	a	**0**	**19****	**75****	**94****
Pacific/Arctic loon	a	a	a	a	0	18*	73*	91*
Red-throated loon	a	a	a	a	0	0*	1*	1*
Yellow-billed loon	a	a	a	a	0	1*	1*	2*
Common loon	a	a	a	a	0	0*	0*	0*
Plumages combined	**5**	**30**	**116**	**151**	**5**	**30**	**116**	**151**
Pacific/Arctic loon	4	21	17	42	4	29	111	144
Red-throated loon	0	1	10	11	0	0	1	1
Yellow-billed loon	0	4	13	17	0	1	4	5
Common loon	1	4	76	81	1	0	0	1
2012 Harvest								
Breeding plumage	**1**	**0**	**63**	**64**	**1**	**0**	**63**	**64**
Pacific/Arctic loon	0	0	47	47	0	0	47	47
Red-throated loon	0	0	8	8	0	0	8	8
Yellow-billed loon	0	0	3	3	0	0	3	3
Common loon	1	0	5	6	1	0	5	6
Nonbreeding plumage	**0**	**9**	**106**	**115**	**0**	**9**	**106**	**115**
Pacific/Arctic loon	a	a	a	a	0	9*	103*	112*
Red-throated loon	a	a	a	a	0	0*	1*	1*
Yellow-billed loon	a	a	a	a	0	0*	2*	2*
Common loon	a	a	a	a	0	0*	0*	0*
Plumages combined	**1**	**9**	**169**	**179**	**1**	**9**	**169**	**179**
Pacific/Arctic loon	a	a	a	a	0	9	150	159
Red-throated loon	a	a	a	a	0	0	9	9
Yellow-billed loon	a	a	a	a	0	0	5	5
Common loon	a	a	a	a	1	0	5	6

Note: Adjusted spring harvest estimates not calculated because species and plumage composition in the spring migration has not been investigated in detail.

**: Adjusted values based on 2012 proportion of loons in nonbreeding plumage in summer and fall harvest (seasons combined).

*: Adjusted values based on 2011–2012 average composition of species and plumages in fall bird counts.

a: Plumage or species break down not included in survey.

Harvest Selectivity

In the context of this study, we define harvest selectivity as considerable differences in the relative composition of the harvest and of the set of resources potentially available. Selective harvest may result from (1) harvest preference; (2) harvest avoidance; (3) harvest regulations; (4) access to resources; (5) interference of other subsistence or socio-

economic activities affecting harvest effort; and (6) other factors affecting spatial and temporal distribution of resources and harvest effort. Bird harvest selectivity may involve species, age categories, plumages, and sex. We define "positive selectivity" when the relative proportion of a category in the harvest is considerably higher than in the bird fauna (as measured by bird counts) and "negative selectivity" when the relative proportion of a category in the harvest is considerably lower than in the bird fauna.

Local and traditional knowledge documented in this study did not indicate harvest preferences for bird species including loon species (see photo page 29, bottom right). On the other hand, many respondents reported to prefer young birds (babies or juveniles) over adults (parents) of species such as kittiwake, puffin, cormorant, guillemot, gulls, and loons because young birds are tender and have more fat. The comments reproduced below illustrate this harvest preference. Accordingly, some species have different Native names for adult and young birds, for instance guillemot (adult: *samseghhaghaq*, young: *sipelaaghhaq*) and auklets (adult: crested auklet *sukilpaq*, least auklet *akmaliighaq*, parakeet auklet *suklugraq*; young auklet: *amaaghaq*). In the early 1980s, thousands of young seabirds (mostly cormorant, kittiwake, auklet, and gull) were taken annually from nests before fledging. At that time, Savoonga had 35 nestling gathering crews and Gambell had 24 crews (each crew with about 4 people) (Little and Robbins 1984). Unfortunately, harvest surveys (including this study) have not specifically documented nestling gathering, and estimated bird harvests include both adults and nestlings. Young birds harvested just before or after fledging are likely easy to tell apart from other age categories. However, in late fall and winter, "young" may also include adults in nonbreeding plumage.

> We catch anything, as much as we need to eat. But we do not catch much of the parents because they are tough. Except for murres and crested auklets, for which there is not much difference in the meat, they are both soft. When they become big we do not like to catch them, they become tough, all birds.
>
> Only eat young loons, older ones are too tough, like trying to chew on leather, maybe in survival situation they are edible.
>
> Only the young guillemot sticks around in the winter, have red feet. It is a rock bird, lays its eggs like auklets under the rock (auklet 1 egg, guillemot 2 eggs). Do not see the black parent in winter time, do not know where they go, maybe fly somewhere where it is warmer. Do not really go for guillemot eggs, maybe only when we were kids, get 6 of them, boil them. People get young guillemots when they are ready to jump out [fledge], get them in the cliffs.

We compared the relative species composition in fall harvests and in bird counts to assess harvest selectivity (Table 2). Considering both communities together, the short-tailed shearwater was by far the species most represented in the bird counts (2011=95.4%, 2012=96.2%), which makes it difficult to assess the relative abundance of all other bird species. Therefore, we calculated ISA_B% excluding short-tailed shearwater and assessed harvest selectivity by subtracting ISA_B% from the percent contribution of each species to fall harvest estimates. Positive values indicate a tendency for positive harvest selectivity (species more represented in harvest estimates than in bird counts). Negative values indicate a tendency for negative harvest selectivity (species more represented in bird counts than in harvest estimates). Species showing considerable tendency for positive harvest selectivity were cormorants (2011=19.2%, 2012=24.7%), murres (2011=35.9%, 2012=1.0%), auklets (2011=4.7%, 2012=19.1%), large gulls (2011=6.0%, 2012=5.0%), and common eider (2011=6.9%, 2012=3.0%). Species showing considerable tendency for negative harvest selectivity were short-tailed shearwater (ISA_B% not calculated), black-legged kittiwake (2011=-64.7%, 2012=-33.4%), spectacled eider (2011=-11.1%, 2012=-12.8%), and king eider (2011=-3.5%, 2012=-8.7%). The proportion of loons (species combined) in fall harvests (2011=0.4%, 2012=4.4%) was similar to that in bird counts (2011=1.3%, 2012=3.0%; short-tailed shearwaters excluded), which does not indicate selective harvest of loons. However, higher proportion of nonbreeding loons in 2012 fall harvest estimates (62.7%, tables 11 and 15) compared to the proportion of loons in nonbreeding plumage in the 2012 bird count (23.5%, Table 7) suggest positive harvest selectivity of loons in nonbreeding plumage, in accordance with harvest preference for young birds in general. Difficulties in loon species identification precluded an assessment of harvest selectivity for individual loon species, especially in 2011 when misidentification of common loons was prominent.

Local and Traditional Knowledge on Loon Harvest and Ecology

This section summarizes ethnographic information collected during harvest surveys and key respondent interviews and presents a few field notes to illustrate findings. Appendix P is a complete compilation of these notes. The information was kept anonymous and is presented in this report without the intent of being literal transcriptions.

Subsistence Harvest Methods and Uses

Loon harvests occurred mainly by boat, frequently in combination with seal hunting. Rough sea and weather conditions in fall appear to limit opportunities for boat trips. Loons were also harvested from onshore blinds or otherwise as opportunities arose (e.g., while traveling along the beach or hiking, Table 18). Loons, as other birds, were taken with shotguns.

> I probably went out by boat a couple of trips last month [October, 2012] and have not gone this month yet [at 5 November]. I probably went out 4 or 5 times since September.
>
> People use shotguns to hunt birds, some people still use nets for auklets. Only a few people use slingshots, mostly teenagers.
>
> People hunt birds with 12, 20, 28, .410, and 16 gauge shotguns.

All households in Gambell and Savoonga that reported loon harvests explained that loons were used for food only and that loons are not used for crafts or other purposes. Loons were usually prepared as a stew, soup, or roast.

> I use birds of all kinds just mainly for food. Once in a while I get birds for dog food, no more sled dogs, just pets.
>
> Some people use loons for soup, roast, and usually boiled.

Table 18.–Number of loons reported by harvest activity and season.

	Spring	Summer	Fall	Total
By boat	2	21	199	222
From onshore blind	–	1	10	11
Entangled in fishing net	–	2	–	2
Inland while hiking	–	–	1	1
Traveling along the beach	–	–	1	1

Note: Information provided during 2011–2012 harvest surveys conducted in Gambell and Savoonga.

–: No reported harvest.

Entanglement in Fishing Nets

During the 2011–2012 surveys, 2 loons were reported as harvested after entangling in subsistence fishing nets (Table 18). Harvesters sometimes referred to a loon entanglement that occurred years ago. Entangled birds are released alive or used for food. When asked about entanglement of loons in fishing nets, a key respondent commented on birds entangled in marine debris washed onshore. We had the opportunity of documenting a puffin entangled in a fishing net washed onshore close to Savoonga (photo page 27, top right), although there was no attempt to quantify bird entanglement in debris. Most marine debris in Alaska is derelict fishing gear such as trawl nets, gillnets, lines, and floats (King 2008). Campaigns for cleanup of marine debris have been conducted close to Gambell and Savoonga in recent years (http://www.alaskamsf.org/marine-debris/md-database-and-maps/ak-marine-database-g-earth/, accessed 23 October 2013). Fishing gear composed 87% of debris collected in a Savoonga cleanup (Ivanoff and Jones 2012). Shoreline monitoring could provide information on mortality of birds, including loons, not related to subsistence activities.

> Loons that get tangled in fishing nets may be less than 1% of the total, usually loons and pintails [long-tailed ducks] get tangled.
>
> Most loons caught in nets are in the month of August, maybe 1 or 2. Usually they are alive; people let them get tired out before they let loons go [because they are aggressive and difficult to handle].
>
> When there are sustained north winds, lots of debris wash up with birds entangled on them, usually murres, young loons, puffins.

Loon Group Size

The spatial distribution and behaviors of animals may affect their susceptibility to hunting. Previous high harvest estimates for loons on St. Lawrence Island raised concerns that large migratory concentrations of loons could be exposed to hunting effort in the area. To address this question, in the 2012 survey we asked if loons reported as harvested were single birds, pairs, or groups of individuals. In 17 out of 33 cases (51.5%), loons were harvested as single birds (Figure 9). Comments suggest that loons usually occur as single birds and pairs, and sometimes in fall as feeding groups of a few birds. Larger numbers of loons may occur as part of feeding aggregations on particularly abundant bait fish, such as capelin. Harvesters commented on recent observations of 2 large groups of 14 and 60 loons. Several hunters recounted the occurrence in fall 2012 of the biggest loon aggregation seen in many years close to Savoonga. Feeding aggregations may be relatively common around St. Lawrence Island, but they do not always include large loon numbers. Comments on others aspects of loon ecology and behavior are presented in Appendix P.

> In spring time I see mostly [loon] couples, flying. In fall time I see groups of up to 5, swimming.
>
> This fall there were 60–100 young loons, 500–1,000 feet from the shoreline, feeding on a large concentration of bait fish. There were other birds, shearwaters, murres, the sky was black, seals, and whales all together with birds eating fish.

Identification of Loons by Local Residents

This section is based on findings of this study and literature review. Additional research could further clarify the St. Lawrence Island Yupik taxonomy of loons. Local people recognize loons and grebes as a family of birds and identify kinds of loons based on size (large and small) and plumage (breeding and nonbreeding) (Table 19, Figure 11).

Table 19.–St. Lawrence Island Yupik ethnotaxonomy of loons and grebes.

Yuwayu: (1) loon in general, all loon species and plumages[2, 4]; (2) small loons (Pacific, Arctic, and red-throated loon) in any plumage[4]; (3) small loons in breeding plumage[4].
Yuwayaaghaq: (1) all loons in nonbreeding plumage (juvenile or nonbreeding adult)[4]; (2) small loon in nonbreeding plumage[4].
Melqupak: Pacific or Arctic loon[1, 2] in breeding plumage[4].
Eghqaaq: Red-throated loon[1, 2] in breeding plumage[4].
Nangqwalek: (1) yellow-billed loon[1, 2] and common loon in any plumage[4]; (2) yellow-billed loon and common loon in breeding plumage[4].
Nangqwalgaaghaq: yellow-billed and common loon in nonbreeding plumage[4] (juvenile or nonbreeding adult).
Aqfasuget: red-necked grebe and horned grebe[1, 2]. Aqfasuk has been translated as red-breasted merganser *Mergus serrator*[1], although it seems aqfasuk is sometimes used for grebes[4].

Source: [1] Romanenko et al. (1997), [2] Badten et al. (2008), [3] Paige et al. (1996), [4] this study, information from comments provided during harvest surveys.

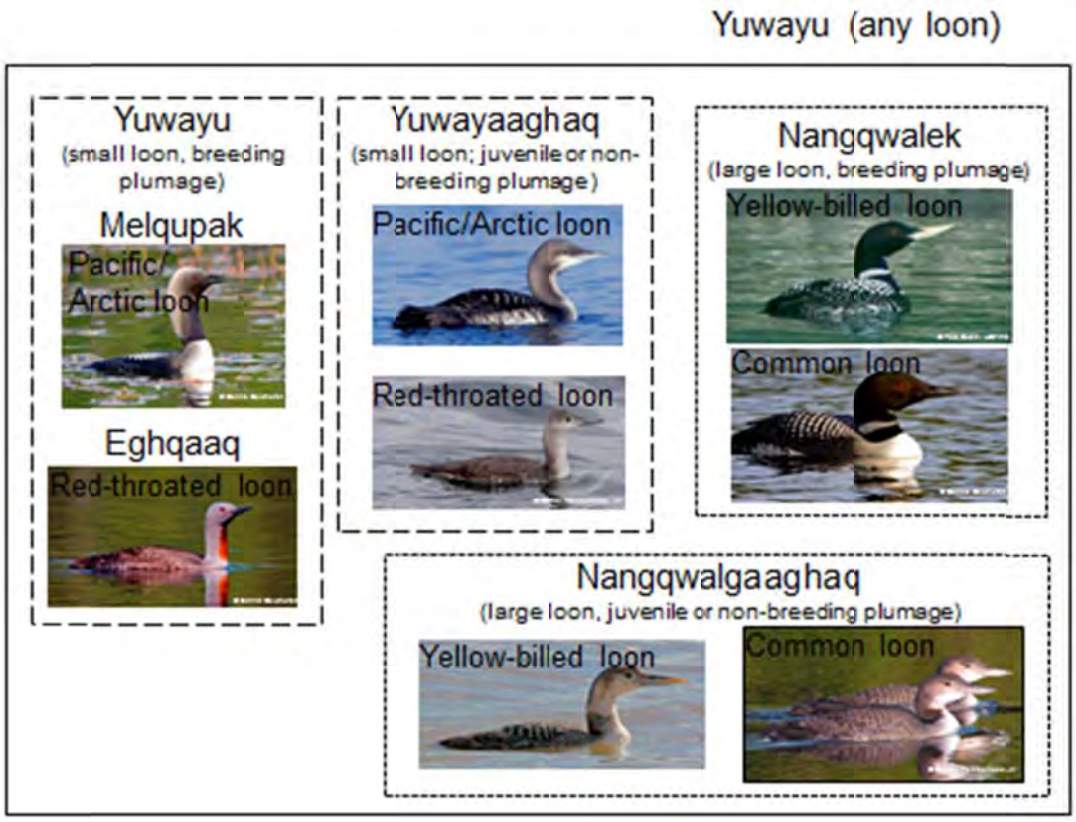


Figure 11.–Loon names in St. Lawrence Island Yupik.

Although *nangqwalek* is used for both common and yellow-billed loons, some people recognize 2 kinds of large loons, one with a yellow bill and another with a black bill. A couple of respondents specifically reported harvests of a "large loon with black bill." Due to difficulties in translation from St. Lawrence Island Yupik, we were unable to appreciate the information offered by a key respondent on differences in bill shape between the 2 large loons. Bill morphology allows telling apart yellow-billed and common loons and also differs between at least hatch-year and older birds in both species (Binford and Remsen 1974; Burn and Mather 1974).

The postbase a*ghaq* indicates the young of a species, for instance *kukupak* (ribbon seal) and *kukupagaghaq* (ribbon seal pup), *nanuq* (polar bear) and *nanaaghaq* (polar bear cub) (Badten et al. 2008). Use of yuwayaaghaq and nangqwalgaaghaq for loons in nonbreeding plumage follows this construction. Yuwayaaghaq and nangqwalgaaghaq were only mentioned in key respondent interviews and community meetings when specific questions were asked about loon names and it is unknown whether this distinction is commonly made by subsistence users. In harvest surveys, people described young loons as "yuwayu, the young one." It is unlikely that juveniles of the 3 small loons and adults in nonbreeding plumage are identified and named at the species level.

There were inconsistencies in the use of Native loon names (Table 20). For instance, yuwayaaghaq (juvenile) was sometimes used for breeding plumages and nangqwalek was used for all loons or the Pacific/Arctic loon. To illustrate difficulties in loon species identification, Zeller et al. (2011) reported that a loon identified as "yellow-billed loon, juvenile, male" by the harvester was later confirmed to be a Pacific loon. Although the Pacific loon was the most abundant loon species in fall bird counts, melqupak was not commonly mentioned in harvest surveys.

> All loons—yuwayu, yuwayaaghaq, melqupak, eghqaaq, nangqwalek, are almost the same family, they use the lakes. Nangqwalek is the biggest in the loon family. Smallest loon is aqfasuk [or aqfasuget, grebe], they are small and have a small head, they are also in the loon family.

I wonder which of those 2 species, yellow and black-billed, are the exact nangqwalek, we call them nangqwalek, the largest of the loons. Probably both of them are really nangqwalek. Maybe 1 term [for both species], same thing with the murres, murres are also divided in two.

Got the small ones, not the big ones. September–October have loons out here, mostly young ones, no adults, mostly small ones. Small ones are yuwayu. Nangqwalek [showing yellow-billed loon on loon identification guide]; mostly young ones [showing nonbreeding plumage on loon identification guide].

Yuwayaaghaq and nangqwalek, just these 2 names, young people nowadays just call them these two. Yuwayaaghaq is for juveniles.

Melqupak's neck is white, adults. Their feathers (*melquq*) are also longer, from their neck here to the tail.

Table 20.–Use of English and St. Lawrence Island Yupik loon names in harvest surveys.

	Yuwayu	Yuwaya-aghaq	Nangqwalek	Nangqwal-gaaghaq	Melqupak	Eghqaaq	Aqfasuget
2011							
Loon	8	–	1	–	–	–	–
Pacific/Arctic loon		1	1	–	–	–	–
Yellow-billed loon	1	–	7	–	–	–	–
Common loon	7	–	1	–	–	–	–
Red-throated loon	2	–	–	–	–	–	–
"Juvenile loon"	-	5	–	–	–	–	–
2012							
Loon	1	–	–	–	–	–	–
Loon "1" (Pacific/Arctic loon)	3	2	–	–	–	–	–
Loon "2" (juvenile loon)	11	3	–	–	–	–	–
Loon "3" (yellow-billed loon)	–	–	7	–	–	–	–
Loon "4" (common loon)	1	–	1	–	–	–	–
Loon "5" (red-throated loon)	2	–	–	–	–	–	–

Note: Numbers of times harvest survey respondents related a loon name in St. Lawrence Island Yupik to an English name and or a loon drawing. The 2012 harvest report form and bird identification guide did not show loon names, loon drawings were identified by a number.

DISCUSSION

RELATIVE ABUNDANCE OF SPECIES IN FALL BIRD COUNTS

In 2011 and 2012, the observation period (mid-September to mid-October) was likely long enough to document the main part of the fall migration of yellow-billed and Pacific loons (Lehman 2012) and adequately represent the fall relative abundance of species. The proportion of loon species was very similar in both years of this study, but Zeller et al. (2011) reported a higher relative proportion of yellow-billed loons in fall 2010 (Figure 12). This difference may be related to annual variation in the use of different migration routes, in the timing of migration of the yellow-billed loon or other loon species, and sampling differences between the two studies. Results in Zeller et al. (2011) were based on lower sampling effort (52.5 hours) and the sampling period covered (26 September–14 October) also differed from this study. Clear migratory waves or peaks were not detected for the yellow-billed loon. In 2012, a wave or peak of Pacific loon migration occurred about a week later and higher ISA values were recorded than in 2011. Environmental conditions may delay migration and birds may collect at staging areas waiting for favorable migration conditions. Annual variation in the timing of migration may also result from annual variation in breeding success because failed breeders tend to leave breeding areas earlier than successful breeders.

Main loon directions of flight in Gambell (SW to NE, NE to SW) and Savoonga (W to E, E to W) observed in this study support that loons stage around St. Lawrence Island in their fall migration. This aspect of the migration ecology may affect bird counts because of an increased likelihood of double-counting.

Satellite telemetry of 13 yellow-billed loons that migrated by St. Lawrence Island showed that 19% of 254 detections were within 10 km from shore with the remaining detections farther offshore (J. Schmutz, USGS, unpublished data). It is possible that the detection rate of yellow-billed loons in shore-based counts is depressed causing yellow-billed loons' ISA% to be underestimated compared to species that occur closer to shore. The spatial distribution of individual loon species may also affect their vulnerability to harvest. Species occurring far offshore may have lower harvest probability because increased travel distances imply increased costs and safety concerns for harvesters. Detailed information on the spatial and temporal distribution of loons and harvest effort is not available.

Information provided by local residents and fall bird counts supports that loons typically occur as single birds or pairs and only sporadically occur in groups of dozens of birds. In fall bird counts, only 5 groups with 20–49 loons were observed, 1 group with 78 loons, and 1 group with 182 loons. Day et al. (2003) reported loon average group size of 1.4 birds close to Gambell (range=1–3, n=12 groups; 47 hours of observation in 23 October–3 November 2002). Large loon groups may be related to migration waves (environmental conditions cause migration to be compressed in time, as it may have been the case in 2012) and local feeding aggregations on high concentrations of forage fish. These feeding aggregations occur more frequently at a few locations, such as 20 mi north of Eevwak Point (5–6 mi west of Savoonga) and off the Stolbi Rocks (1–2 mi east of Savoonga) (Huntington et al. 2013).

The proportion of Pacific and yellow-billed loons in nonbreeding plumage identified as adults varied greatly between years. Ecological conditions may affect the onset and progress of the fall molt in adults. However, our efforts to determine age were likely tentative considering the difficulty in telling apart adults in nonbreeding plumage and juveniles. The fall molt of adult yellow-billed loons may start in late September with replacement of neck feathers and extend into December involving also flight feathers, lesser wing coverts, back, head, and scapulars (reviewed in North 1994). Adult Pacific loons may retain breeding plumage into October or November (reviewed in Russel 2002). The yellow-billed loon adult plumage is acquired through a succession of molts in the first 3 years of life. The first plumage of hatch-year yellow-billed loons is worn during the first fall and winter (reviewed in North 1994). However, juvenile yellow-billed loons and some nonbreeding adults may remain at wintering grounds throughout the year. Therefore it is likely that most yellow-billed and Pacific loons reported as juvenile in summer and fall harvest surveys on St. Lawrence Island are hatch-year birds.

SEASONALITY OF HARVESTS

Bird harvests on Saint Lawrence Island occur mostly in spring and fall. Most loon harvest occurs in fall, and harvests of only a few loons have been reported in spring. Different reasons may explain low spring loon harvest: 1) the loon spring migration may not usually pass close to St. Lawrence Island or involve a smaller number of birds than the fall migration; 2) ice conditions or harvest focused on other resources may preclude loon harvest; and 3) little or no harvest effort is directed to loons in spring because of a preference for young loons in fall.

Winter harvest of migratory birds is minor or nonexistent in much of Alaska because at this season birds usually are at southerly wintering grounds. Therefore, some Native partners have asked the AMBCC harvest monitoring to cover spring–summer–fall or spring–summer only. Winter harvest monitoring by the AMBCC has occurred in the Alaska Peninsula, Aleutian Islands, and Kodiak Archipelago where birds winter. This study at St. Lawrence Island covered April–October harvests. However, during fall data collection, some respondents commented that they were still hunting birds in November and that eiders, long-tailed ducks, and murres occur on St. Lawrence Island in November–December. Comprehensive harvest surveys (all resources) in selected years and locations have covered the full calendar year. Winter harvests in November 1995–February 1996 corresponded to 12.5% of the annual harvest in Gambell and 19.4% in Savoonga. These harvests were composed largely of long-tailed duck, common eider, murre, and cormorant, but also included 113 loons (estimated fall loon harvest was 301 birds; Georgette and Iknokinok 1997). Estimated 2006 winter harvest (January–April) in Gambell and Savoonga totaled 151 birds, including 3 loons (Ahmasuk and Trigg 2008). Estimated 2009 Savoonga winter harvest (November–March) was 1 common eider (Tahbone and Trigg 2011). Most documented loon migration happens in fall from mid-August to mid-October (Lehman 2012), and therefore potential winter loon harvest is likely lower than fall harvest, as reported by Georgette and Iknokinok (1997). Also, winter harvests are likely subject to strong annual variation depending on conditions affecting bird availability and hunting opportunities, such as inclement weather and timing of fall migration and freeze up. Future bird harvest surveys on St. Lawrence Island should include at least the months of November–December to fully document subsistence harvests and efforts should be made to standardize season definition across studies.

CURRENT SUBSISTENCE USES OF LOONS AND OTHER BIRDS

All households that reported harvest of loons said that loons are only used for food and that loons are not currently used for Native crafts, traditional regalia, or other uses. Birds are mostly eaten fresh, although some are frozen or air-dried. In the past, birds also provided raw materials for clothing and utensils, especially bird skin parkas (Hughes 1984). Skins of loons in breeding plumage were used for decoration of functional items such as bags and parkas (Omelak 2009). Pacific loon skins were used for infant bedding and clothing (Ehrlich et al. 1993). Today, with few exceptions, birds (mostly gulls) are used only for food and sometimes to feed pet dogs. A few households still use dried wings of large birds such as the snow goose for brooms.

Current cultural, religious, and ceremonial uses of loons by the communities of St. Lawrence Island were not identified. In this regard, St. Lawrence Island differs from the cultural setting of the Iñupiaq people of the North Slope and Northwest Arctic where *suluktaq* (a headdress) made with the skin and bill of a yellow-billed loon symbolizes aspects of the traditional worldview during *Sivigiq* (Messenger Feast) (Spencer 1984: 333; Ikuta 2007).

IDENTIFICATION OF LOONS BY LOCAL RESIDENTS

Our findings clarified differences between the St. Lawrence Island Yupik loon identification system based on size and plumage and western taxonomy. Entries in Badten et al. (2008) for loon names (1) list yuwayu as "common loon or any loon;" (2) do not distinguish between large and small loons (nangqwalek is only related to yellow-billed loon); and (3) do not refer to nonbreeding plumages. Other references on loon names and harvests on St. Lawrence Island used common loon for the most common loon (Little and Robbins 1984: 28; Georgette and Iknokinok 1997; Romanenko et al. 1997; Kawerak 2004: 35; Ahmasuk and Trigg 2008: 226; Naves 2010: 168). Naming of loons based on size seems to occur in different cultural groups. A word for small loon (*quiriiq*) was documented in East Chugach Alutiiq (Prince William Sound) (Preikshot and Leer 1999). In Iñupiaq (Northwest Alaska), *tuutlik* means common or yellow-billed loons (Uhl and Uhl 1977), similarly to nangqwalek in St. Lawrence Island Yupik. However, different names have been recorded for common (*dodzina*) and yellow-billed loon (*dodibeeya*) in Koyukon Athabascan (Jules and Jones 2000). Ethnotaxonomy may have biological units based on categories such as plumage, age, and habitat used differing from the species-based western biology taxonomy (Tideman and Gosler 2010). The documentation of nuances in the identification and naming of species by cultural groups usually require dedicated studies including local people, linguists, and biologists and is commonly overlooked in general dictionaries and compilations of Native species names.

Previous common loon harvest estimates seemed excessively high compared to numbers known to occur on St. Lawrence Island (figures 12 and 13). This led biologists to consider that yellow-billed loons could have been misidentified as common loons based on body size and that yellow-billed loon harvests could be underestimated because common loon harvest estimates were high (USFWS 2010: 23). It is now established that the Pacific loon is by far the most abundant loon on St. Lawrence Island. Although there are occasional summer and fall records of

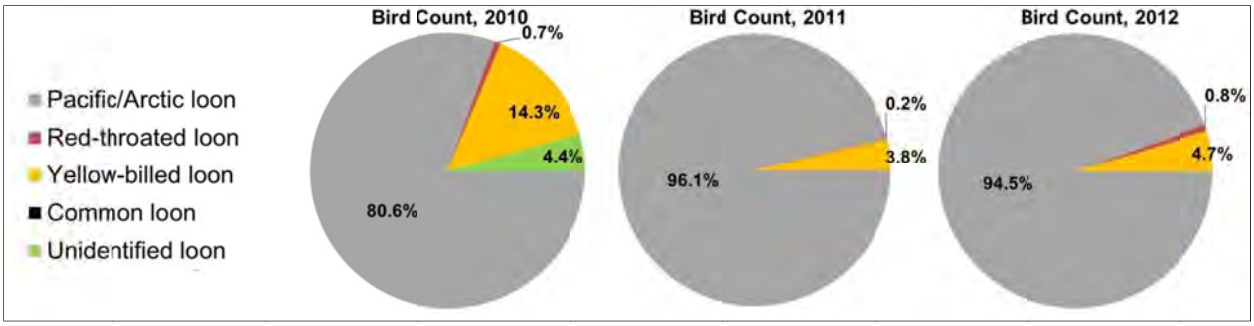


Figure 12.–Loon species composition in fall bird counts.
Source: 2010: Zeller et al. (2011), 2010–2011: this study.

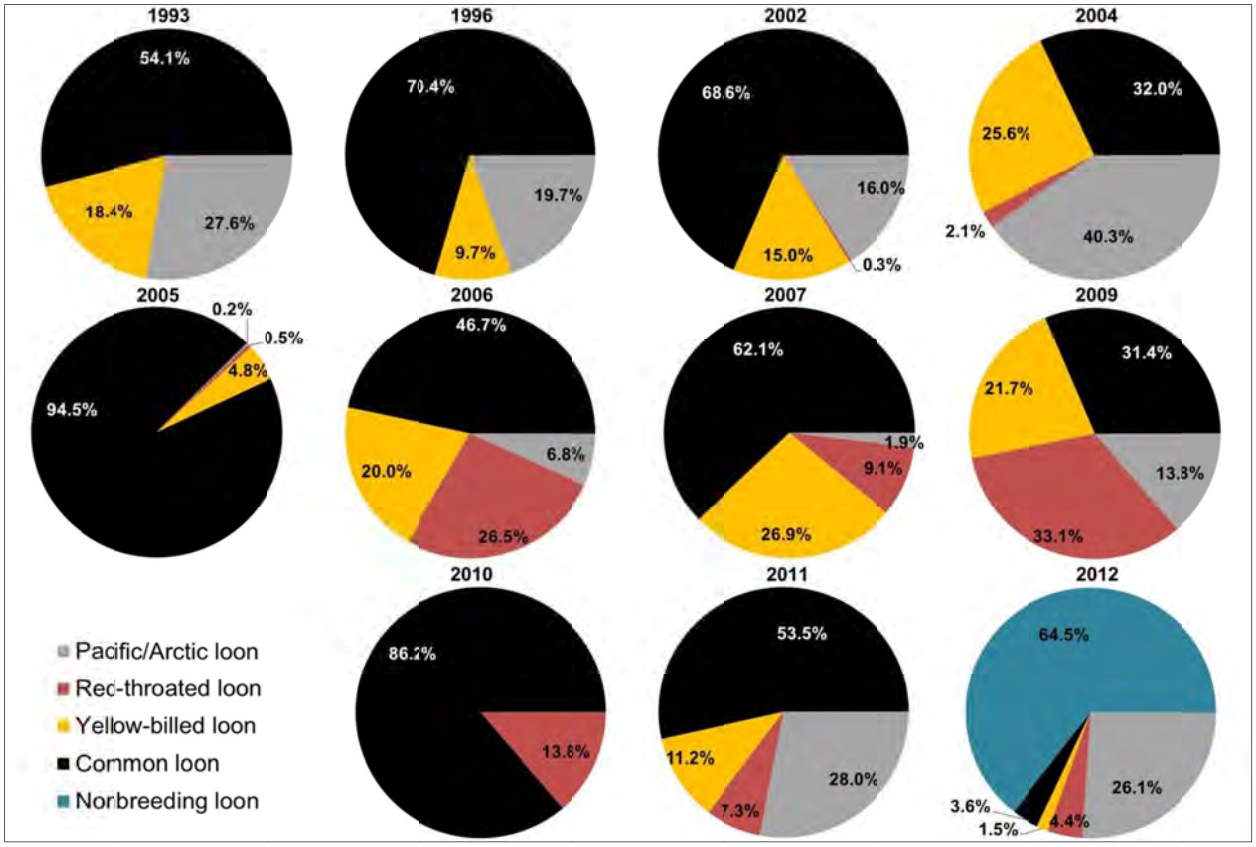


Figure 13.–Loon species composition in harvest surveys (spring, summer, and fall).
Source: 1993: Paige et al. (1996); 1996: Georgette and Iknokinok (1997); 2002: Kawerak (2004); 2004, 2005, 2007, 2009, 2010: Naves (In prep.); 2006: Ahmasuk and Trigg (2008); 2011–2012: this study.

common loons (Lehman 2012), this species was not observed in this study. Changes to survey materials in 2012 resulted in great reduction of common loon harvest reports. These results support that the main factor for loon identification in harvest surveys prior to 2012 was the word "common" presented in survey materials rather than morphologic characteristics such as size, plumage, or bill color and that reports of common loons most likely referred to Pacific loons.

Identification of loon species requires advanced skills whether following western biology taxonomy or St. Lawrence Island Yupik ethnotaxonomy. In western and Native cultures, likely a small proportion of people have such skills. For most people, it may not be relevant to know loon identification. We found that in St. Lawrence Island Yupik specific loon names are not frequently used and sometimes are used incorrectly. For instance, melqupak (Pacific

loon) and eghqaaq (red-throated loon) were not mentioned by respondents reporting loon harvest. Similarly, Zeller et al. (2011) found that the St. Lawrence Island Yupik name for red-throated loons was rarely remembered. Omelak (2009) did not document use of eghqaaq and reports that a respondent used aqfasuk (grebe or merganser) for red-throated loon.

Loss of vocabulary may also contribute to the prevalent use of general names (yuwayu) and incorrect use of specific names (melqupak, nangqwalgaaghaq, etc.). The introduction of English names may also generate confusion in species identification. English names including the word "common" (common loon, common eider, common goldeneye, common merganser, common murre) are particularly problematic and must be carefully considered in the design of harvest surveys. The integration of western culture has caused decline in the use of St. Lawrence Island Yupik language (Krauss 2007; Morgounova 2007). In the 1980s, most St. Lawrence Island children were Yupik dominant, but in 2007 the majority was English dominant and a significant part of the vocabulary was not frequently used (Morgounova 2007). In language contact situations, vocabulary is the linguistic domain where changes may first appear as words from the dominant language progressively replace words in the minority language. As use of a language retracts, its speakers become less proficient in the use of specialized vocabulary (Appel and Muysken 1987). Languages convey knowledge and language shift is a main threat to LTK preservation (Crystal 2000: 44–54). In harvest surveys, interviews, and meetings conducted in this study, local people expressed concern about loss of their Native language and were vividly interested in contributing to the list of Native bird names as a material that could help preserve their culture and teach their children.

In 2011, use of the historic harvest survey materials in a context of dedicated efforts clarified harvest levels and highlighted difficulties in species identification. In 2012, modifications to survey materials to better reflect the local composition of species and species identification minimized species identification issues and documented harvest preference for young loons. This study highlighted the importance of testing and fine tuning harvest survey materials especially when dealing with species of management concern. The 2012 materials can be adapted to reflect local loon identification in other areas of Alaska.

LOON SPECIES COMPOSITION IN THE SUBSISTENCE HARVEST

Harvest surveys, bird counts, and ethnographic information indicated that identification of loon species in harvest surveys is possible (but not perfect) for breeding plumages and likely not possible for nonbreeding plumages. Efforts to obtain more detailed loon species identification in harvest surveys may lead to unreliable data. Considering these limitations, we used the proportions of species and plumage from fall bird counts to generate species-specific harvest estimates. Below we discuss assumptions underlying this approach.

Assumption 1: Bird counts and harvest surveys are accurate. Bird counts and harvest surveys are approximate methods and are subject to their own potential biases and measurement errors. The measurement rate of individual species may differ in bird counts and in harvest surveys. Satellite telemetry suggests that yellow-billed loons occur farther offshore than red-throated loons (J. Schmutz, USGS, unpublished data). Therefore, yellow-billed loons may have lower detection probability in shore-based bird counts and their relative abundance may be underestimated. Accuracy of harvest estimates is subject to measurement errors, recall bias, and other potential sources of bias that may lead to under-reporting or over-reporting harvests. Communication and outreach efforts implemented since 2010 conveyed that yellow-billed loons are birds of conservation concern and are closed to harvest. It is possible that the outreach efforts and the dedicated harvest surveys affected 2011–2012 loon harvests and attitudes and perceptions regarding harvest surveys. However, there are no data to assess these potential interactions, and it is difficult to meaningfully hypothesize on potential effects that outreach efforts focusing on yellow-billed loons could have on harvests of other loon species. In this study, harvest data collection teams included local expertise as well as expertise in harvest data collection and loon identification to minimize measurement errors. Fall harvest data collection was timed to occur just at the end of the season to minimize recall bias. Participation of households in the fall survey was similar to that in the spring–summer survey which does not support reluctance to report fall harvests (when most loon harvest occurred). In the experience of the Division of Subsistence, households unwilling to provide accurate data usually decline to participate in voluntary harvest surveys. We have no indication of a tendency to under-report or over-report loon harvest. Interactions with survey respondents suggested an honest intent to report harvests to their best knowledge. Respondents appeared knowledgeable of and remembered details of their harvests activities.

Assumption 2: Harvest of loons is not selective regarding individual species. This study identified preference for harvest of young birds including loons. Harvest surveys documented higher proportion of loons in nonbreeding plumage as compared to bird counts. Adjusted species-specific harvest estimates represented the harvest proportion

of loons in nonbreeding plumage. We did not find evidence from LTK suggesting selective harvest of individual loon species. Difficulties in species identification precluded an in-depth assessment of harvest selectivity for individual loon species based on harvest data. Harvest preference or avoidance (choice) of individual loon species (regardless of plumage) is unlikely because of intrinsic difficulties with species identification. Harvest selectivity for individual loon species could result from differences in spatial and temporal distribution of loon species and overlap with harvest effort. Most loons were harvested from boats in conjunction with the fall seal hunt. Seal hunting occurs up to 75 miles from St. Lawrence's shoreline (Bering Sea Elders Advisory Group 2011: 18–27). However, weather, sea, and ice conditions in fall likely determine much shorter travel distances as well as the ability to launch boats because of safety concerns. Fall seal hunting occurs from ice, onshore using blinds and boats (see photo page 30, bottom right), and from boats away from shore. Annual variation in fall weather and in the conditions and timing of the ice approach makes it difficult to infer spatial and temporal patterns for distribution of harvest effort in relation to the distribution of different loon species.

Assumption 3: The proportion of loons in nonbreeding plumages harvested in 2011 was similar to the proportion reported in the 2012 survey. We used the proportion of loons in nonbreeding plumage in the 2012 harvest estimates to infer plumage composition in the 2011 harvest estimates (loons in nonbreeding plumage were not included in the 2011 survey). Annual variation in the relative availability of loons in breeding and nonbreeding plumages could affect the proportion of nonbreeding plumages in the loon harvest. However, bird counts indicated that proportions of loons in breeding and nonbreeding plumages were very similar in 2011 and 2012. We did not identify other processes that could affect availability and harvest selectivity of loon plumages.

Assumption 4: Local species and plumage composition is similar in summer and fall. Bird counts were only conducted in fall. Therefore local summer loon composition of species and plumages were not available to calculate species-specific harvest estimates for loons reported in nonbreeding plumages. Loon harvest occurred mostly in fall, although small numbers were reported as harvested in summer, and only a few in spring. Harvest reports of loons in nonbreeding plumages in summer 2012 support application of summer–fall average plumage composition to 2011 summer harvest data.

Assumption 5: Harvest of common loon was zero. Common loons occur in the St. Lawrence Island area as a casual visitor, but this species was not detected in the fall bird counts conducted in 2010 (Zeller et al. 2011), 2011, and 2012 (this study). Our adjusted species-specific harvest estimates did not include common loon harvest although it is possible that a few birds are harvested annually.

ANNUAL VARIATION OF HARVEST ESTIMATES

Data review of 2011–2012 results in tribal council and community meetings included discussions related to surveys conducted between 1993 and 2010. The community of Savoonga considered 2007 harvest estimates in general (78,993 birds, 118,360 eggs; Naves 2010) "excessively high, incorrect, and do not represent bird harvests by the village" (Appendix D). Similarly, the community of Gambell considered 2010 estimates for their village excessively low (781 birds, 388 eggs; Naves 2012) and considered that 2009 and 2010 estimates were based on insufficient sampling coverage (Appendix B). Both communities supported release of 2004–2010 AMBCC harvest data at the community level (Naves in prep.; appendices Q–T) to promote effective data review and clarify potential issues with previous surveys. The AMBCC has released only region and subregion harvest estimates because of concerns of Native partners regarding use of community-level data for law enforcement purposes. The AMBCC recognizes the importance of effective annual data review and is working to improve this process.

Annual bird harvest estimates for Gambell and Savoonga (all species combined) varied usually between 3,000 and 17,000 birds in the 1993–2012 period, although an estimate of 78,993 birds is available for Savoonga in 2007 and an estimate of 781 birds is available for Gambell in 2010 (Figure 14; appendices Q–T). Loon harvest estimates for the Bering Strait–Norton Sound region (4,042 loons, all species, Naves 2010) were largely associated with unusually high estimates for the community of Savoonga (3,748 loons, all species). Annual variation in harvest estimates may reflect actual variation of resources availability and harvest effort or the use of different sampling methods, sampling coverage, and potential issues with implementation of sampling designs among studies. Actual variability in harvest effort and resource availability may have resulted in the unusual 2007 and 2010 harvest estimates. However, during implementation of this study and its data review process we found no evidence of unusual ecological or socio-economic events that could have affected bird and egg harvests in 2007 and 2010.

St. Lawrence Island communities largely rely on subsistence harvests. Sharing of information and gear, organization of hunting-gathering parties, and uses and sharing of subsistence harvests are imbedded in daily activities. The

success of subsistence pursuits rely on the understanding of temporal and spatial variability of harvest conditions and its relationships with the outcome of harvest efforts. In this context, large annual variations in harvest levels are most likely noticeable and memorable events. In data review meetings conducted in Savoonga, local residents could not recollect unusually high bird and egg harvests anytime around 2007, when harvest estimates peaked. Gambell 2009 bird harvest estimates (21,039 birds, 12,934 eggs) were relatively high compared to other years while 2010 estimates (781 birds, 388 eggs) were the lowest on record. However, Gambell residents could not recollect low bird and egg harvests in recent years nor large differences in bird and egg harvest levels between years. The data review process did not reveal ecological or socio-economic factors that could be associated with unusual estimates.

Gambell and Savoonga have very similar human population sizes, are geographically and culturally close, and also do not significantly differ in their subsistence practices and socio-economic context. It is likely that both communities similarly experience unusual events that affect harvest effort and availability of subsistence resources. Therefore, unusual bird harvest amounts are expected to simultaneously occur in both communities. Unusually high harvest estimates for Savoonga in 2007 did not find a counterpart in 2007 Gambell estimates. Similarly, unusually low harvest estimates for Gambell in 2010 did not find a counterpart in 2010 Savoonga estimates. These facts do not support that unusual 2007 and 2010 harvest estimates were associated with actual variation in resource availability or harvest effort.

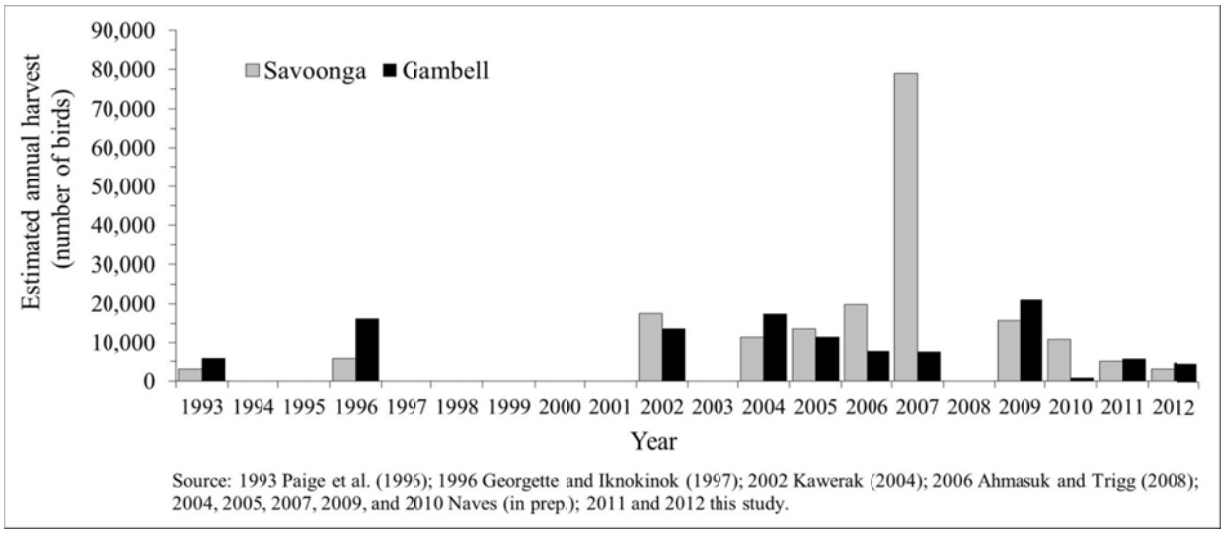


Figure 14.–Annual bird harvest estimates for Gambell and Savoonga (species combined), 1993–2012.

Potential issues with 2007 Savoonga harvest estimates were not associated with data entry, analysis, and expansion of reported numbers to nonsurveyed households. These procedures were independently reviewed multiple times by ADF&G and USFWS staff. Reported numbers per se were unusually high (1,401 loons, all species). Potential issues with 2007 harvest estimates may be related to issues in the implementation of the sampling design including failure (a) to properly assign households to strata (harvester, nonharvester); (b) to randomly sample households; (c) to achieve the sampling goal; (d) to correctly instruct and assist households about how to report harvests and complete the harvest report; and (e) to properly document, organize, review, and revise data collection work. These issues may simultaneously occur and are difficult to detect and then to correct for once data collection is completed and survey forms are sent for data analysis. It is impossible to reconstruct the exact circumstances that led to unusually high 2007 Savoonga harvest estimates.

For 2011–2012, care was taken to assure that the St. Lawrence Island bird harvest surveys were conducted with scientific rigor. (1) Implementation of the sampling design included local expertise (local surveyors) and expertise in harvest data collection (anthropologists) and loon identification (avian biologists). (2) Outreach and education efforts informed and involved the communities. (3) Sampling coverage was maximized and only a small proportion of households was not surveyed (households that could not be contacted or that declined to participate in the survey). (4) Recall bias was minimized by collecting fall harvest data (when most loon harvest occurs) just at the end of the season. (5) Although we did not specifically assess potential biases in harvest reporting (under or over-reporting), there were no indications that potential biases could have significantly affected harvest estimates

including loon estimates. (6) Limitations in loon species identification in harvest surveys were established by ethnographic information and bird counts and adjusted species-specific harvest estimates were based on fall bird counts. (7) Data review included extensive participation of the communities and staff from ADF&G, USFWS, and USGS. In this context, this study addressed some difficulties with previous harvest surveys and provided reliable harvest estimates representing usual bird and egg harvest levels at the study communities.

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APPENDICES

Appendix A.–Letter from the Native Village of Gambell in support of 2011 data release.

Gambell, September 26, 2012

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Dear Ms. Brown-Schwalenberg,

In 2011 the Native Village of Gambell partnered with the Division of Subsistence of the Alaska Department of Fish and Game (ADF&G) and the U.S. Fish and Wildlife Service (USFWS) to conduct the 2011 Loon Dedicated Survey in response to conservation concerns regarding the yellow-billed loon. This survey had the following objectives:

- To continue building communication among the local community and resource management agencies regarding loon conservation concerns;
- To provide accurate information on the species and number of loons and other birds harvested for subsistence uses;
- To improve understanding by resource management agencies of local systems for identification and naming of loons and therefore improve communication between local harvesters, biologists, and resource managers; and
- To obtain information on the composition and abundance of loons and other birds potentially available as subsistence resources in the St. Lawrence Island area.

On 23 May 2012, Liliana Naves (ADF&G) and Tamara Zeller (USFWS) met with the Gambell Tribal Council and community members to discuss 2011 survey results and options to release the harvest data. A written draft report was provided and the results were also presented at the meeting. Tribal Council and community members reviewed survey results, asked questions, and offered comments to (a) further improve survey methods in upcoming surveys, (b) clarify data presentation in the written report, and (c) clarify the local identification and naming of loons. We also discussed the need to expedite release of these data and the pros and cons of reporting harvest data at the village, island, and sub-regional level. The options discussed are explained below.

1. Timing for release of 2011 Gambell bird harvest estimates
   Option A. Expedite data release in relation to AMBCC 2-year regular process for data release: this will enable managers, agency staff, and villages to use the data in a timelier manner, especially the loon harvest data. Accurate loon harvest data are currently much needed in the ongoing processes of the yellow-billed loon listing evaluation and revision. It is important to ensure that the most recent and accurate information is available, which may help alleviate conservation concerns based on older, unreliable data. Under this option, 2011 data could be released in summer 2012.

   Option B. Release the data under the regular AMBCC process, according to which adoption of 2011 harvest estimates is scheduled to occur in the spring of 2013.

2. Geographical level of harvest estimates
   Option A. Report the data at the village level. AMBCC harvest data have been reported at the regional and subregional level because Native Partners, at least in the past, had concerns that village harvest data could be used to focus law enforcement efforts or to limit harvest. However, the main objective and goal for collecting harvest data is to document and protect subsistence uses and to ensure that resources will be available in the long-term. Village-level data make it easier to obtain effective data reviews from knowledgeable local residents. Also, village-level data are more useful for local communities than subregional or regional data.

   Option B. Report the data at the St. Lawrence Island level (Gambell and Savoonga together).

   Option C. Report data under the regular AMBCC survey sub-region, including Savoonga, Gambell, and Diomede (not surveyed in 2011).

The Tribal Council of the Native Village of Gambell met again on Oct 2, 2012 to discuss 2011 bird harvest data release options, this time without the participation of agency staff. At this meeting, the Tribal Council decided to:

1) Support reporting data at the village level for our community (Option 2.A). We agree that data reported at the village level can be more effective in alleviating yellow-billed loon conservation concerns caused by past unreliable harvest estimates at the regional level, which could not be properly reviewed at that level. Harvest estimates presented at the village level for all kinds of birds are more useful for our community because it is easier for us to understand and review results at the local level. Also, we will have the bird harvest data for our community readily available for use in other situations. We understand past concerns that bird harvest data at the village level data could be used to focus law enforcement efforts or to limit harvest. However, over the years, village-level data from other surveys have not been used for this purpose in our community. Data reported at the appropriate geographic scale are more effective for protecting and managing subsistence uses and harvests.

2) Support the immediate release of data from the 2011 Loon Dedicated Survey (Option 1.A) based on the fact that our community has already reviewed the survey results. We are looking forward to the publication of the final report in the short term including modifications to account for the comments and suggestions offered by our community.

It is our understanding that the Native Village of Savoonga also has made a decision to support immediate release of their 2011 Loon Dedicated Survey at the village level and you will hear from them on this matter.

Recently, the Gambell Tribal Council partnered again with ADF&G and USFWS to conduct a second year of the Loon Dedicated Survey in 2012. We hope that the detailed information provided by these efforts will help clarify and alleviate conservation concerns regarding loons and will help to protect our subsistence culture and harvests in the short and long term. Please contact me if you have comments or questions.

Sincerely,

Eddie Ungott

Native Village of Gambell, President
P.O. Box 90, Gambell AK 99742
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Appendix B.–Letter from the Native Village of Gambell in support of 2012 data release.

Gambell, 20 February, 2013

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Dear Ms. Brown-Schwalenberg,

In 2012 the Native Village of Gambell partnered again with the Division of Subsistence of the Alaska Department of Fish and Game (ADF&G) and the U.S. Fish and Wildlife Service (USFWS) to conduct the 2012 Loon Dedicated Survey in response to conservation concerns regarding the yellow-billed loon. This survey had the following objectives:

- To continue building communication among the local community and resource management agencies regarding loon conservation concerns;
- To provide accurate information on the species and number of loons and other birds harvested for subsistence uses;
- To improve understanding by resource management agencies of local systems for identification and naming of loons and therefore improve communication between local harvesters, biologists, and resource managers; and
- To obtain information on the composition and abundance of loons and other birds potentially available as subsistence resources in the St. Lawrence Island area.

On 20 February 2013, Liliana Naves (ADF&G) met with the Gambell Tribal Council and community members to discuss 2012 survey results and options to release the harvest data. A written draft report was provided and the results were presented at the meeting. Tribal Council and community members reviewed survey results, asked questions, and offered comments. We also discussed the need to expedite release of these data and the pros and cons of reporting harvest data at the village, island, and sub-regional level. The options discussed are explained below.

1. Timing for release of 2012 Gambell bird harvest estimates

Option A. Expedite data release in relation to AMBCC 2-year regular process for data release: this will enable managers, agency staff, and villages to use the data in a timelier manner, especially the loon harvest data. Accurate loon harvest data are currently much needed in the ongoing processes of the yellow-billed loon listing evaluation and revision. It is important to ensure that the most recent and accurate information is available, which may help alleviate conservation concerns based on older, unreliable data. Under this option, 2012 data could be released in winter 2013.

Option B. Release the data under the regular AMBCC process, according to which adoption of 2012 harvest estimates is scheduled to occur in the spring of 2014.

2. Geographical level of harvest estimates

Option A. Report the data at the village level. AMBCC harvest data have been reported at the regional and subregional level because Native Partners, at least in the past, had concerns that village harvest data could be mis-used to focus law enforcement efforts. However, the main objective and goal for collecting harvest data is to document and protect subsistence uses and to ensure that resources will be available in the long-term. Village-level data make it easier to obtain effective data reviews from knowledgeable local residents. Also, village-level data are more useful for local communities than subregional or regional data.

Option B. Report the data at the St. Lawrence Island level (Gambell and Savoonga together).

Option C. Report data under the regular AMBCC survey sub-region, including Savoonga, Gambell, and Diomede (not surveyed in 2012).

The Tribal Council of the Native Village of Gambell decided to:

1) Support reporting data at the village level for our community (Option 2.A). We agree that data reported at the village level can be more effective in alleviating yellow-billed loon conservation concerns caused by past unreliable harvest estimates at the regional level, which could not be properly reviewed at that level. Harvest estimates presented at the village level for all kinds of birds are more useful for our community because it is easier for us to understand and review results at the local level. Also, we will have the bird harvest data for our community readily available for use in other situations. We understand past concerns that bird harvest data at the village level data could be used to focus law enforcement efforts. However, over the years, village-level data from other surveys have not been used for this purpose in our community. Data reported at the appropriate geographic scale are more effective for protecting and managing subsistence uses and harvests.

2) Support the immediate release of data from the 2012 Loon Dedicated Survey (Option 1.A) based on the fact that we have already reviewed the survey results. We are looking forward to the publication of the final report in the short term including modifications to account for the comments and suggestions offered by our community.

3) Support re-consideration of harvest estimates for years prior to 2011, especially 2009 and 2010. On the 20 Feb, 2013 meeting we also discussed results of previous AMBCC harvest surveys. 2009 Harvest estimates are excessively high and 2010 are excessively low; these years are incorrect and do not represent bird harvests in our village.

4) Support 2011 and 2012 as the most representative harvest estimates for our village. These surveys included a very high proportion of households and data was collected in collaboration among local surveyors, biologists, and anthropologists.

5) Support reporting data at the village level for our community in all surveys done by the AMBCC including previous years. We would like a report with previous years of the AMBCC survey to be produced for our village.

6) Request that all harvest surveys are done with adequate training of local surveyors and survey materials to help correctly identifying bird species and reporting of harvest.

We hope that the detailed information provided by these efforts will help clarify and alleviate conservation concerns regarding loons and will help to protect our subsistence culture and harvests in the short and long term. Please contact me if you have comments or questions.

Sincerely,

Eddie Ungott

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Appendix C.–Letter from the Native Village of Savoonga in support of 2011 data release.

Savoonga, August 20, 2012

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Dear Ms. Brown-Schwalenberg,

In 2011 the Native Village of Savoonga partnered with the Division of Subsistence of the Alaska Department of Fish and Game (ADF&G) and the U.S. Fish and Wildlife Service (USFWS) to conduct the 2011 Loon Dedicated Survey in response to conservation concerns regarding the yellow-billed loon. This survey had the following objectives:

- To continue building communication among the local community and resource management agencies regarding loon conservation concerns;
- To provide accurate information on the species and number of loons and other birds harvested for subsistence uses;
- To improve understanding by resource management agencies of local systems for identification and naming of loons and therefore improve communication between local harvesters, biologists, and resource managers; and
- To obtain information on the composition and abundance of loons and other birds potentially available as subsistence resources in the St. Lawrence Island area.

On 23 May, 2012, Liliana Naves (ADF&G) and Tamara Zeller (USFWS) met with the Savoonga Tribal Council and community members to discuss 2011 survey results and options to release the harvest data. A written draft report was provided and the results were also presented at the meeting. Tribal Council and community members reviewed survey results, asked questions, and offered comments to (a) further improve survey methods in upcoming surveys, (b) clarify data presentation in the written report, and (c) clarify the local identification and naming of loons. We also discussed the need to expedite release of these data and the pros and cons of reporting harvest data at the village, island, and sub-regional level. The options discussed are explained below.

1. Timing for release of 2011 Savoonga bird harvest estimates

   Option A. Expedite data release in relation to AMBCC 2-year regular process for data release: this will enable managers, agency staff, and villages to use the data in a timelier manner, especially the loon harvest data. Accurate loon harvest data are currently much needed in the ongoing processes of the yellow-billed loon listing evaluation and revision. It is important to ensure that the most recent and accurate information is available, which may help alleviate conservation concerns based on older, unreliable data. Under this option, 2011 data would be released in summer 2012.

   Option B. Release the data under the regular AMBCC process, according to which adoption of 2011 harvest estimates is scheduled to occur in the spring of 2013.

2. Geographical level of harvest estimates

   Option A. Report the data at the village level. AMBCC harvest data have been reported at the regional and subregional level because Native partners, at least in the past, had concerns that village harvest data could be used to focus law enforcement efforts or to limit harvest. However, the main objective and goal for collecting harvest data is to document and protect subsistence uses and to ensure that resources will be available in the long-term. Village-level data make it easier to obtain effective data reviews from knowledgeable local residents. Also, village-level data are more useful for local communities than subregional or regional data.

   Option B. Report the data at the St. Lawrence Island level (Gambell and Savoonga together).

   Option C. Report data under the regular AMBCC survey sub-region, including Savoonga, Gambell, and Diomede (not surveyed in 2011).

The Tribal Council of the Native Village of Savoonga met again on 8 August, 2012 to discuss 2011 bird harvest data release options, this time without the participation of agency staff. At this meeting, the Tribal Council decided to:

1) Support reporting data at the village level for our community (Option 2.A). We agree that data reported at the village level can be more effective in alleviating yellow-billed loon conservation concerns caused by past unreliable harvest estimates at the regional level, which could not be properly reviewed at that level. Harvest estimates presented at the village level for all kinds of birds are more useful for our community because it is easier for us to understand and review results at the local level. Also, we will have the bird harvest data for our community readily available for use in other situations. We understand past concerns that bird harvest data at the village level data could be used to focus law enforcement efforts or to limit harvest. However, over the years, village-level data from other surveys have not been used for this purpose in our community. Data reported at the appropriate geographic scale are more effective for protecting and managing subsistence uses and harvests.

2) Support the immediate release of data from the 2011 Loon Dedicated Survey (Option 1.A) based on the fact that our community has already reviewed the survey results. We are looking forward to the publication of the final report in the short term including modifications to account for the comments and suggestions offered by our community.

It is our understanding that the Native Village of Gambell also has made a decision to support immediate release of their 2011 Loon Dedicated Survey at the village level and you will hear from them on this topic.

Recently, the Savoonga Tribal Council partnered again with ADF&G and USFWS to conduct a second year of the Loon Dedicated Survey in 2012. We hope that the detailed information provided by these efforts will help clarify and alleviate conservation concerns regarding loons and will help to protect our subsistence culture and harvests in the short and long term. Please contact me if you have comments or questions.

Sincerely,

Mitchell Kiyukiook
Native Village of Savoonga, President
P.O. Box 120, Savoonga AK 99769
907-984-2334 (phone), 907-984-6156 (fax)
tcsva@kawerak.org

Appendix D.–Letter from the Native Village of Savoonga in support of 2012 data release.

Savoonga, 21 February, 2013

Patty Brown-Schwalenberg
Alaska Migratory Bird Co-Management Council (AMBCC), Acting Executive Director
6200 Lake Otis Parkway, Suite 201, Anchorage, Alaska 99507
907-562-6647 (office), 907-227-8537 (cell), 907-562-6939 (fax)
alutiiqpride1@crcalaska.org

cc:

Joel Saccheus
Kawerak, Inc. Representative for the AMBCC
P.O. Box 72, Elim, AK 99739
907-880-1001 (phone)
eli.tc@kawerak.org (attn: Joel Saccheus)

Dale Rabe
Alaska Department of Fish and Game, Div. of Wildlife Conservation
P.O Box 115526, Juneau AK 99811
907-465-4190 (phone), 907-465-6145 (fax)
dale.rabe@alaska.gov

Rose Fosdick
Natural Resources Division, Kawerak, Inc.
P.O. Box 948, Nome, AK 99762
907-443-4377 (phone)
rfosdick@kawerak.org

Pete Probasco
U.S. Fish and Wildlife Service, Migratory Birds and State Programs
1011 E. Tudor Road, Anchorage AK 99503
907-786-3375 (phone), 907-786-3641 (fax)
pete_probasco@fws.gov

Dear Ms. Brown-Schwalenberg,

In 2012 the Native Village of Savoonga partnered again with the Division of Subsistence of the Alaska Department of Fish and Game (ADF&G) and the U.S. Fish and Wildlife Service (USFWS) to conduct the 2012 Loon Dedicated Survey in response to conservation concerns regarding the yellow-billed loon. This survey had the following objectives:

- To continue building communication among the local community and resource management agencies regarding loon conservation concerns;
- To provide accurate information on the species and number of loons and other birds harvested for subsistence uses;
- To improve understanding by resource management agencies of local systems for identification and naming of loons and therefore improve communication between local harvesters, biologists, and resource managers; and
- To obtain information on the composition and abundance of loons and other birds potentially available as subsistence resources in the St. Lawrence Island area.

On 21 February 2013, Liliana Naves (ADF&G) met with the Savoonga Tribal Council and community members to discuss 2012 survey results and options to release the harvest data. A written draft report was provided and the results were presented at the meeting. Tribal Council and community members reviewed survey results, asked questions, and offered comments. We also discussed the need to expedite release of these data and the pros and cons of reporting harvest data at the village, island, and sub-regional level. The options discussed are explained below.

1. Timing for release of 2012 Savoonga bird harvest estimates

Option A. Expedite data release in relation to the AMBCC 2-year regular process for data release: this will enable managers, agency staff, and villages to use the data in a timelier manner, especially the loon harvest data. Accurate loon harvest data are currently much needed in the ongoing processes of the yellow-billed loon listing evaluation and revision. It is important to ensure that the most recent and accurate information is available, which may help alleviate conservation concerns based on older, unreliable data. Under this option, 2012 data could be released in winter 2013.

Option B. Release the data under the regular AMBCC process, according to which adoption of 2012 harvest estimates is scheduled to occur in the spring of 2014.

2. Geographical level of harvest estimates

Option A. Report the data at the village level. AMBCC harvest data have been reported at the regional and subregional level because Native Partners, at least in the past, had concerns that village harvest data could be mis-used to focus law enforcement efforts. However, the main objective and goal for collecting harvest data is to document and protect subsistence uses and to ensure that resources will be available in the long-term. Village-level data make it easier to obtain effective data reviews from knowledgeable local residents. Also, village-level data are more useful for local communities than subregional or regional data.

Option B. Report the data at the St Lawrence Island level (Gambell and Savoonga together).

Option C. Report data under the regular AMBCC survey sub-region, including Savoonga, Gambell, and Diomede (not surveyed in 2012).

The Tribal Council of the Native Village of Savoonga decided to:

1) Support reporting data at the village level for our community (Option 2.A). We agree that data reported at the village level can be more effective in alleviating yellow-billed loon conservation concerns caused by past unreliable harvest estimates at the regional level, which could not be properly reviewed at that level. Harvest estimates presented at the village level for all kinds of birds are more useful for our community because it is easier for us to understand and review results at the local level. Also, we will have the bird harvest data for our community readily available for use in other situations. We understand past concerns that bird harvest data at the village level data could be used to focus law enforcement efforts. However, over the years, village-level data from other surveys have not been used for this purpose in our community. Data reported at the appropriate geographic scale are more effective for protecting and managing subsistence uses and harvests.

2) Support the immediate release of data from the 2012 Loon Dedicated Survey (Option 1.A) based on the fact that we have already reviewed the survey results. We are looking forward to the publication of the final report in the short term including modifications to account for the comments and suggestions offered by our community.

3) Support re-consideration of 2007 harvest estimates. On the 21 Feb, 2013 meeting we also discussed results of previous AMBCC harvest surveys. 2007 Harvest estimates are excessively high, incorrect, and do not represent bird harvests in our village.

4) Support 2011 and 2012 as the most representative harvest estimates for our village. These surveys included a very high proportion of households and data was collected in collaboration among local surveyors, biologists, and anthropologists.

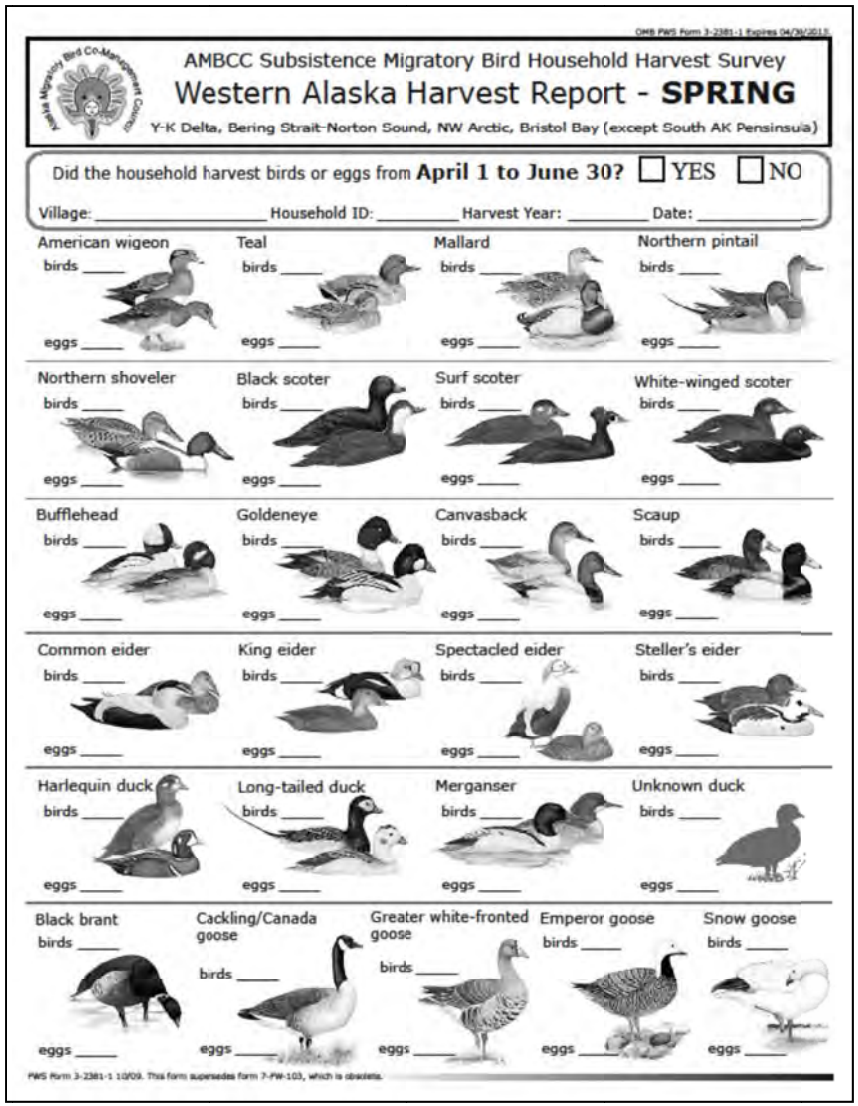
4) Support reporting data at the village level for our community in all surveys done by the AMBCC including previous years. We would like a report with previous years of the AMBCC survey to be produced for our village.

We hope that the detailed information provided by these efforts will help clarify and alleviate conservation concerns regarding loons and will help to protect our subsistence culture and harvests in the short and long term. Please contact me if you have comments or questions.

Sincerely,

Mitchell Kiyuklook
Native Village of Savoonga, President
P.O. Box 120, Savoonga AK 99769
907-984-6414 (phone), 907-984-6150 (fax)
tc.sva@kawerak.org

Appendix E.–Harvest report form used in 2011 harvest survey, Western Alaska (spring sheet, original size 8.5x11 inches).



OMB FWS Form 3-2381-1 Expires 04/30/2013

AMBCC Subsistence Migratory Bird Household Harvest Survey

Western Alaska Harvest Report - **SPRING**

Y-K Delta, Bering Strait-Norton Sound, NW Arctic, Bristol Bay (except South AK Pensinsula)

Did the household harvest birds or eggs from **April 1 to June 30?** ☐ YES ☐ NO

Village: _____ Household ID: _____ Harvest Year: _____ Date: _____

American wigeon — birds ____ eggs ____

Teal — birds ____ eggs ____

Mallard — birds ____ eggs ____

Northern pintail — birds ____ eggs ____

Northern shoveler — birds ____ eggs ____

Black scoter — birds ____ eggs ____

Surf scoter — birds ____ eggs ____

White-winged scoter — birds ____ eggs ____

Bufflehead — birds ____ eggs ____

Goldeneye — birds ____ eggs ____

Canvasback — birds ____ eggs ____

Scaup — birds ____ eggs ____

Common eider — birds ____ eggs ____

King eider — birds ____ eggs ____

Spectacled eider — birds ____ eggs ____

Steller's eider — birds ____ eggs ____

Harlequin duck — birds ____ eggs ____

Long-tailed duck — birds ____ eggs ____

Merganser — birds ____ eggs ____

Unknown duck — birds ____ eggs ____

Black brant — birds ____ eggs ____

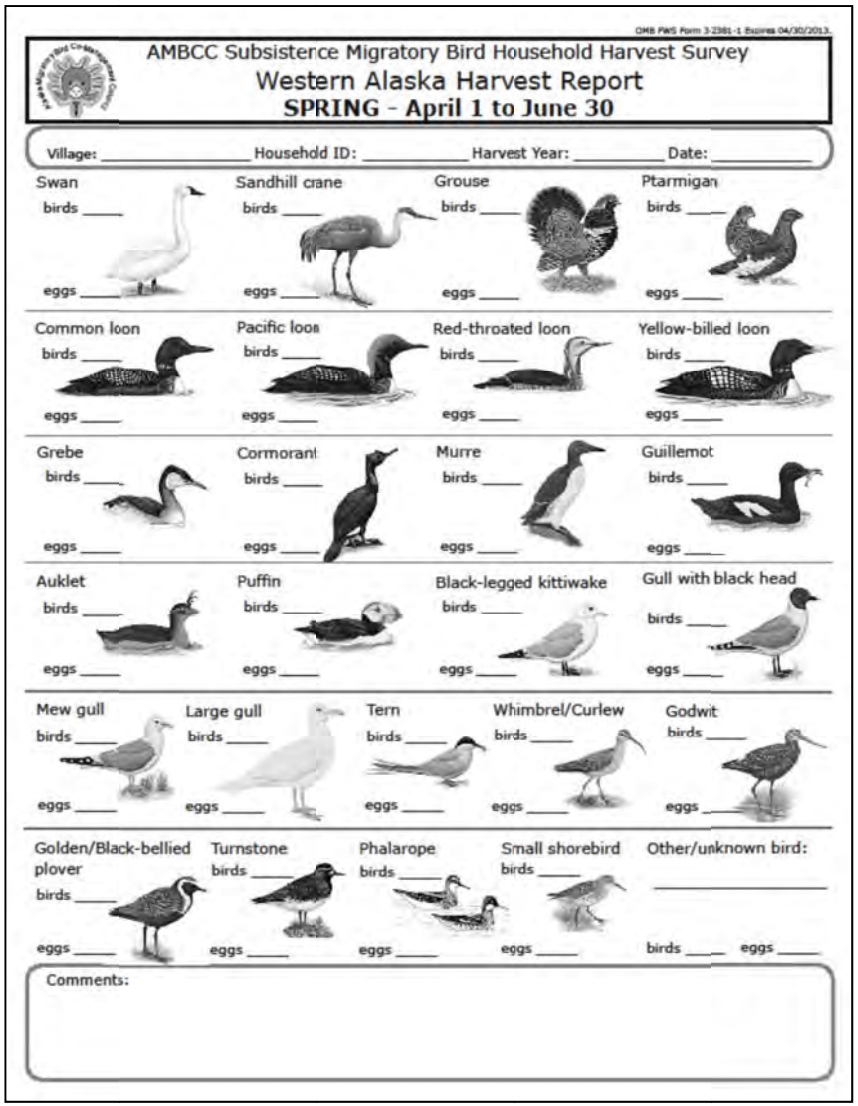
Cackling/Canada goose — birds ____ eggs ____

Greater white-fronted goose — birds ____ eggs ____

Emperor goose — birds ____ eggs ____

Snow goose — birds ____ eggs ____

FWS Form 3-2381-1 10/09. This form supersedes form 7-FW-103, which is obsolete.



OMB FWS Form 3-2381-1 Expires 04/30/2013

AMBCC Subsisterce Migratory Bird Household Harvest Survey

Western Alaska Harvest Report

SPRING - April 1 to June 30

Village: _____ Household ID: _____ Harvest Year: _____ Date: _____

Swan — birds ____ eggs ____

Sandhill crane — birds ____ eggs ____

Grouse — birds ____ eggs ____

Ptarmigan — birds ____ eggs ____

Common loon — birds ____ eggs ____

Pacific loon — birds ____ eggs ____

Red-throated loon — birds ____ eggs ____

Yellow-billed loon — birds ____ eggs ____

Grebe — birds ____ eggs ____

Cormorant — birds ____ eggs ____

Murre — birds ____ eggs ____

Guillemot — birds ____ eggs ____

Auklet — birds ____ eggs ____

Puffin — birds ____ eggs ____

Black-legged kittiwake — birds ____ eggs ____

Gull with black head — birds ____ eggs ____

Mew gull — birds ____ eggs ____

Large gull — birds ____ eggs ____

Tern — birds ____ eggs ____

Whimbrel/Curlew — birds ____ eggs ____

Godwit — birds ____ eggs ____

Golden/Black-bellied plover — birds ____ eggs ____

Turnstone — birds ____ eggs ____

Phalarope — birds ____ eggs ____

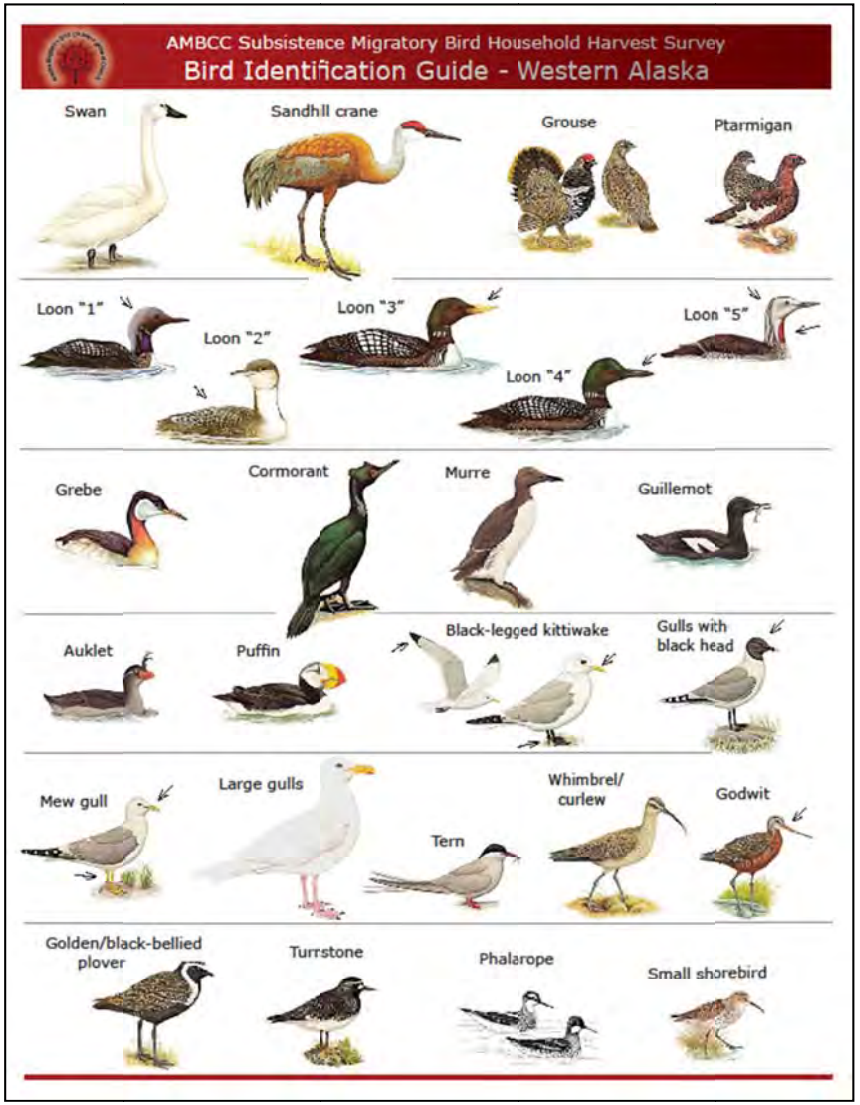
Small shorebird — birds ____ eggs ____

Other/unknown bird: _____ birds ____ eggs ____

Comments:

Appendix F.–Bird identification guide used in 2011 harvest survey (original size 8.5x11 inches).

Appendix G.–Bird identification guide used in 2012 harvest survey (original size 8.5x11 inches).



Appendix H.–Bering Strait–Norton Sound loon identification guide (original size 8.5x11 inches).

Alaska Migratory Bird Co-Management Council
Bering Strait-Norton Sound Loon Identification Guide

Yellow-billed loons need your help!

- Learn how to tell loons apart.
- Give Yellow-billed loons a break, they are closed to harvest.
- Participate in the bird harvest survey.

Harvest surveys show the importance of subsistence bird hunting to the culture and food resources of St. Lawrence Island.

St. Lawrence communities are unique in their harvest and use of loons for food, especially in the fall.

Because of conservation concerns, the Yellow-billed loon was placed on the "candidate list" for "threatened status" under the Endangered Species Act.

Be honest when reporting which species and how many birds you've harvested to the best of your memory and ability to identify the birds.

Under-reporting the number of birds harvested hurts the communities by not giving enough importance to the need for birds for subsistence.

Over-reporting the number of birds harvested or misidentifying what you've harvested may create unnecessary management concerns.

Working together we can keep the subsistence tradition long into the future!

Loons can be tough to tell apart!

Five loon species occur in the Bering Strait-Norton Sound Region. The Arctic loon and the Pacific loon look very much alike, so let's lump them together… this leaves 4 kinds of loons:

- Pacific/Arctic loon
- Red-throated loon
- Yellow-billed loon
- Common loon

In summer, breeding adults show sharp and contrasting colors. In fall, adults molt into their non-breeding plumage and chicks have grown up into juveniles.

Non-breeding birds (adults in fall-winter plumage and juveniles) of the same species are very similar and they are grouped together in this guide.

Large loons (32–35 inches from bill tip to tail tip)

Yellow-billed loon

The largest loon. Bill large and upturned.
Head peaked at front and rear, giving a slight double-bump look. Sometimes called "King loon."

Common loon

Bill always dark, at least at the midway point to the tip.
Despite their English name, these birds are not commonly seen in the St. Lawrence Island area.

*Non-breeding birds are sometimes collecively called "juveniles" and include adults in fall-winter plumage and juveniles.

Small loons (25–27 inches from bill tip to tail tip)

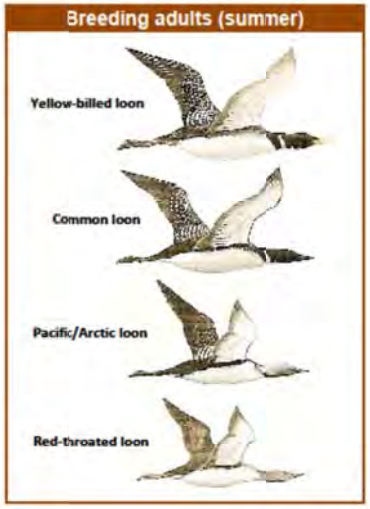
Pacific/Arctic loon

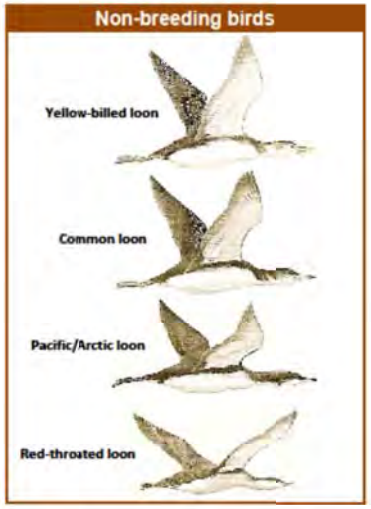
Bill straight, head and neck smoothly rounded.
This is the most common loon in the Saint Lawrence Island area.

Red-throated loon

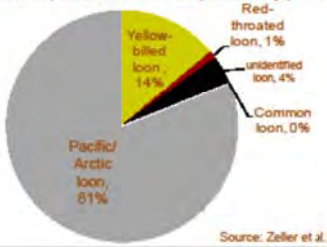
The most slender loon. Thin bill, may be slightly upturned. Head rounded.

*Non-breeding birds are sometimes collectively called "juveniles" and include adults in fall-winter plumage and juveniles.





The most common loon in the Bering Strait-Norton Sound Region is the Pacific/Arctic loon, but this is not the one whose English name is "Common loon."



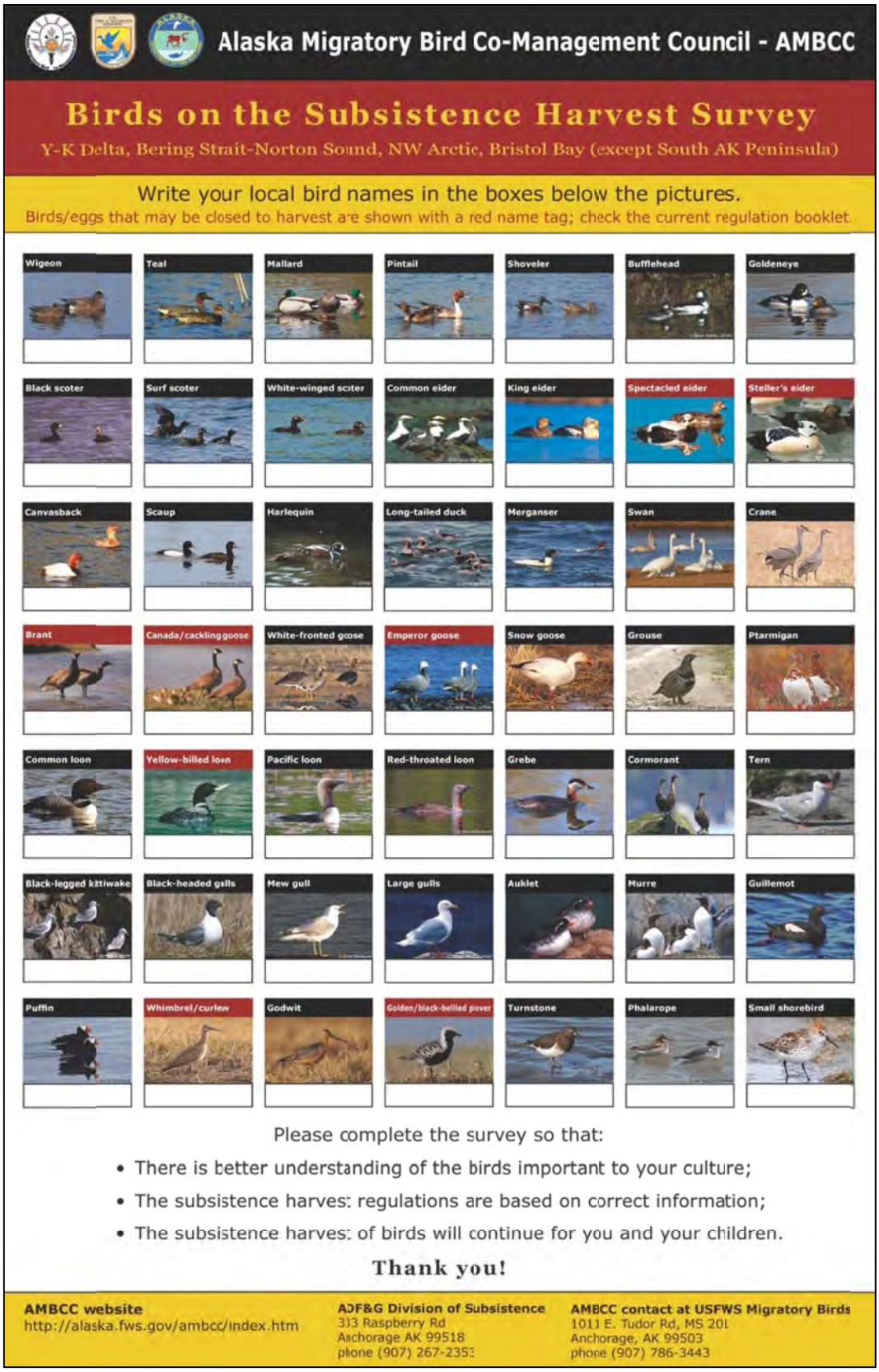
For more information, please contact:

ADF&G Division of Subsistence
333 Raspberry Road
Anchorage, AK 99518
(907) 267-2353

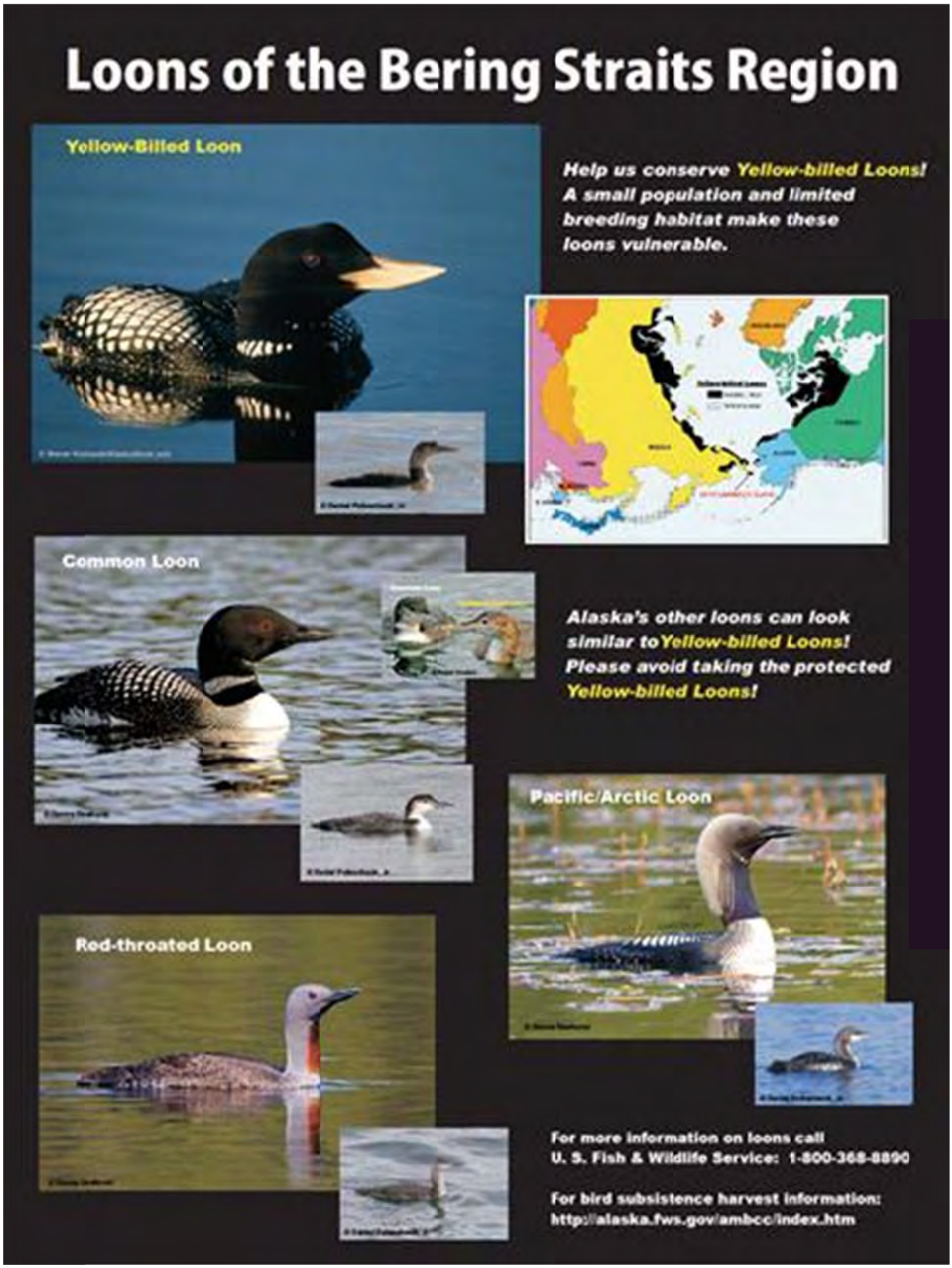
AMBCC Program, USFWS Migratory Birds
1011 East Tudor Road, MS 201
Anchorage, AK 99503
(907) 786-3443

Drawings from the National Geographic Field Guide to Birds of North America, used with permission.

Appendix I.–Bird poster, Western Alaska (original size 23 x 36 inches).



Appendix J.–Loon poster (original size 18 x 24 inches).



Appendix K.–Bird names in Latin, English, and St. Lawrence Island Yupik.

Latin	English	St. Lawrence Island Yupik
Ducks		
Anas penelope	Eurasian wigeon	
A. americana	American wigeon	
A. crecca	Green-winged teal	
A. platyrhynchos	Mallard	
A. acuta	Northern pintail	Ngiikaq[2], nqiikaaq[1, 2], quulvekesiiq[2]
A. clypeata	Northern shoveler	Pekutaghraak[1, 2]
Melanitta nigra	Black scoter	Metghasaak[1], whistlers[3], butterballs[3]
M. perspicillata	Surf scoter	
M. fusca	White-winged scoter	
Bucephala albeola	Bufflehead	
Bucephala clangula	Common goldeneye	
Aythya valisineria	Canvasback	
Aythya marila	Greater scaup	
Somateria mollissima	Common eider	Metghaq[1, 2], metghaqpik[2], gatepak[2], tagrapak[2], uskulla[2]
S. spectabilis	King eider	Qengalek[1, 2]
S. fischeri	Spectacled eider	Iyegaatelek[2], livghaan[1, 2]
Polysticta stelleri	Steller's eider	Aglekeseqaq[1, 2]
Histrionicus histrionicus	Harlequin duck	Qagingik[1, 2]
Clangula hyemalis	Long-tailed duck	Aahaangwliq[2], kangghwaak (female)[1, 2], uyangsaq[2], ugeyiighaq(male)[2]
Mergus serrator	Red-breasted merganser	Aqfasuk[1, 2], iikaaq[2]
Geese		
Branta bernicla	Black brant	Teghqillkak[1, 2], qefteq[1]
Branta hutcnhinsii taverneri	Taverner's Canada goose	Qefteq[1, 2], teghqilkagpak[7]
Anser albifrons	Greater white-fronted goose	Wilwitu[7]
Chen canagica	Emperor goose	Leghlleq[1, 2]
C. caerulescens	Snow goose	Kaanguq[2], kaangu[1], white goose[3]
Swan		
Cygnus columbianus	Tundra swan	Quuk[1, 2]
Crane		
Grus canadensis	Sandhill crane	Satelgaq[1, 2]
Ptarmigan		
Lagopus muta	Rock ptarmigan	Aqergiiq[1, 2]
Seabirds		
Fulmarus glacialis	Northern fulmar	Aghqulluk[1]
Puffinus tenuirostris	Short-tailed shearwater	Kaputaghaq[1]
Oceanodroma furcata	Fork-tailed storm petrel	
Phalacrocorax pelagicus	Pelagic cormorant	Ngelqaq[1, 2]
Sterna paradisea	Arctic tern	Tekeyiighaq[1, 2]
Rissa tridactyla	Black-legged kittiwake	Qaqsungiq[1, 2]
Xema sabini	Sabine's gull	Nasallenguq[1, 2]

-continued-

Latin	English	St. Lawrence Island Yupik
Rhodostethia rosea	Ross's gull	Kulusim qawaaga[1] (iceberg, polar ice bird)
Larus canus	Mew gull	Naghuya[2], ungazim naghuyangi[7] (different gull species)
Large gull *Larus hyperboreus* (1) *L. argentatus* (2) *L. glaucescens* (3)	Large gull Glaucous gull (1) Herring gull (2) Glaucous-winged gull (3)	 (1) Naghuyapik[1, 2] (2) Ugraaq[5, 6]
Auklet *Aethia cristatella* (1) *A. pusilla* (2) *A. psittacula* (3) *Cerorhinca monocerata* (4)	Auklet Crested auklet (1) Least auklet (2) Parakeet auklet (3) Rhinoceros auklet (4)	 (1): Sukilpaq[1, 2] (2): Akmaliighaq[1, 2] (3): Suklugraq[1, 2] Amaaghaq (auklet chick)
Murre *Uria aalge* (1) *U. lomvia* (2)	Murre Common murre (1) Thick-billed murre (2)	Alpa[1, 2] (1): Kuwaaq[1, 2] (2): Aqevgaghnak[1, 2], alpapiget[1], alpapik[7], quwaaghet[7]
Guillemot *Cephus columba* (1) *C. grille* (2)	Guillemot Pigeon guillemot (1) Black guillemot (2)	Samseghhaghaq[1, 2] (adult)[5], sipelaaghhaq[2] (young)[5]
Alle alle	Dovekie	Quqiiq[1,6]
Synthliboramphus antiquus	Ancient murrelet	
Brachyramphus brevirostris	Kittlitz's murrelet	
Puffin *Fratercula. cirrhata* (1) *F. corniculata* (2)	Puffin Tufted puffin (1) Horned puffin (2)	 (1): Pagrugaq[1, 2] (2): Quprughaq[2]
Stercorarius parasiticus	Parasitic jaeger	
S. pomarinus	Pomarine jaeger	
Shorebirds		Turiik[5] (all shorebirds)
Whimbrel/curlew *Numenius phaeopus* (1) *N. tahitiensis* (2)	Whimbrel/curlew Whimbrel (1) Bristle-thighed curlew (2)	Sugtuvak[1, 2, 5] [5]: any shorebird with long beak and larger than sandpipers.
Godwit *Limosa lapponica* (1) *L. limosa* (1)	Godwit Bar-tailed godwit (1) Black-tailed godwit (2)	Sugtuvak[5]
Golden/black-bellied plover *Pluvialis squatarola* (1) *P. fulva* (2) *P. dominica* (3)	Golden/black-bellied plover Pacific golden plover (1) Black-bellied plover (2) American golden plover (3)	Turiighpak[5] (large shorebird)
Turnstone *Arenaria interpres* (1) *A. melanocephala* (2)	Turnstone Ruddy turnstone (1) Black turnstone (2)	 (1): Sagelmak[1, 2]
Phalarope *Phalaropus fulicaria* (1) *P. lobatus* (2)	Phalarope Red phalarope (1) Red-necked phalarope (2)	Qulighyak[2], sughmeghaq[1, 2]

Latin	English	St. Lawrence Island Yupik
Small shorebird[a] *Calidris alpina* (1) *C. melanotos* (2) *C. ptilocnemis* (3) *C. mauri* (4) *C. acuminata* (5) *Charadrius semipalmatus* (6) *Tringa breviceps* (7) *Limnodromus scolopaceus* (8)	Small shorebird[a] Dunlin (1) Pectoral sandpiper (2) Rock sandpiper (3) Western sandpiper (4) Sharp-tailed sandpiper (5) Semipalmated plover (6) Gray-tailed tatler (7) Long-billed dowitcher (8)	Turiighaq[5] (1, 2): Teraateriiq[1, 2] (3): Qalmesam teraateriiq[5] (4): Iglagllengiiq[1, 2] (7): Qalmesam qawaaga[1, 2]
Loons and grebes	**Loons and grebes**	
Gavia sp.	Loon	Yuwayu[2, 4]: any loon species, breeding plumages. May also be used for any plumage (loon in general). Yuwayaaghaq[4]: juvenile or nonbreeding adult of any loon.
G. stellata	Red-throated loon	Eghqaaq[1, 2]: breeding plumage
G. pacifica	Pacific loon	Melqupak[1, 2]: breeding plumage
G. arctica	Arctic loon	Melqupak[1, 2]: breeding plumage
G. immer	Common loon	Nangqwalek[4]: breeding plumage Nangqwalgaaghaq[4]: juvenile or nonbreeding adult
G. adamsii	Yellow-billed loon	Nangqwalek[4]: breeding plumage Nangqwalgaaghaq[4]: juvenile or nonbreeding adult
Grebe *Podiceps griseana* (1) *P. auritus* (2)	Grebe Red-necked grebe (1) Horned grebe (2)	Aqfasuget[1], aqfasuq[5]. Note: it seems sometimes aqfasuk is used for grebe and merganser.
Birds of prey		
Buteo lagopus	Rough-legged hawk	
Falco peregrinus	Peregrine falcon	
F. rusticolus	Gyrfalcon	
Asio flammeus	Short-eared owl	
Nyctea scandiaca	Snowy owl	Anipa[1, 2]
Corvids		
Corvus corax	Common raven	

Gray background indicates St. Lawrence Island Yupik names used for more than one species.

a. Small shorebird species listed do not include species that occur only occasionally and in very small numbers [categories “rare” or less common than rare in Lehman (2012)].

( ): Parentheses indicate species likely to occur in the region.

[ ]: Brackets indicate sources for St. Lawrence Island Yupik and local bird names; [1] Romanenko et al. (1997), [2] Badten et al. (2008), [3] Paige et al. (1996), [4] research in this study, [5] informants in this study, [6] Ehrlich et al. (1993), [7] Tahbone and Trigg (2011).

Appendix L.–Topics for key respondent interviews on harvests and uses of loons and other birds.

Key Respondent Interviews, St. Lawrence Bird Harvest

Key Respondent:_____Village: _____ Gender (circle one): M F

Interview date: ____/____/_____ Interviewer: _____ **Start time:** _____

1) Where were you born?_____2) What is your age? _____

3) How long have you lived in Savoonga (years)?_____

4) Do you hunt birds (or used to)?
If yes, how often do you (used to) go bird hunting? (*times per week, month, or year?*)

5) How did you learn to hunt birds and how old were you when you started hunting birds?

Methods of Bird Harvest and Bird Uses

6) Which methods do people currently use to hunt birds?
Shotgun, rifle, slingshot? Do people get chicks on nests? Pick by hand?

7) Do people catch birds in other ways, even if unintentional? *For example, entangled in fishing nets.*

8) How loons are harvested? Same way as other birds? Do people catch loons in other ways, even if unintentional? *Entangled in fishing nets? In the ocean or in lakes?*

9) Do you hunt birds or pick eggs during other subsistence activities?

10) In general, how many meals a week do you eat birds? And eggs?

11) Nowadays, are birds and eggs used in other ways besides food for people? (*crafts, tools, dog food*)

12) And what about some main uses of birds (besides food) in the past?

Species Preferences

13) Are there bird species that people prefer to catch? Why?

14) Are there bird species that people try not to catch? Why?

Loon Occurrence and Identification

15) Which kind of loons do you see on St. Lawrence? (*show numbered loon photos, without names*)
Take note of numbers on pictures.

16) What Native or local names are used for loons? *Since we started working here, this is what we think we have learned (table with Native names)… but I don't want just to assume I got it right.*

17) What do you look on loons to tell them apart? (*How do you tell them apart?*)

18) In general, do people know the different loons? Or do people mostly use just yuwayu?

19) Could you set loons in order of abundance (including both the sea and the tundra), from the most common to the least common during spring and summer (when we don't have bird counts)?
Take note of numbers on pictures.

20) Which kinds of loons breed on St. Lawrence?

21) *If not answered yet:* What time of year and where on and around the island do you see "loon 4" (*G. immer*)? Does this loon breed on the island?

22) Is there something important about loons or loons harvest that you want me to know?

Egg Harvest

23) How do people collect and share eggs?

24) How many people in the village go to the cliffs to harvest eggs?

25) *If crews are mentioned*: How the crews divide the eggs among them?

26) How do crew members then divide their share of eggs with other people?

27) What do you think about harvest surveys for birds or other subsistence resources?

29) Is there something important about birds or bird harvest that you want me to know?

If there are still time….

30) How important are birds and eggs as a food resource to the village?
You can for instance compare to other subsistence resources and store-bought food.

31) Besides being sources of food, how import is bird hunting as an activity? And egg gathering?
For instance, cultural, social, ritual, and spiritual.

End time: _____

Appendix M.–Formulas to calculate estimated harvest and confidence interval.

$$\hat{X}_k = \sum_{j=1}^{k}\left[\left[\sum_{i=1}^{n_j} x_{ji}\right] \times \frac{N_j}{n_j}\right] \qquad CIP(\hat{X}_k) = \frac{t_{1/\alpha} \times \sqrt{\text{var}(\hat{X}_k)}}{\left(\hat{X}_k \div N_k\right)}$$

$$\text{var}(\hat{X}_k) = \frac{1}{N_k^2}\left[\sum_{j=1}^{k} N_j (N_j - n_j)\frac{s_j^2}{n_j}\right]$$

$$s_j^2 = \frac{\left[\sum_{i=1}^{n_j}\left(x_i - \bar{x}_{ji}\right)^2\right]}{n_j} \qquad \bar{x}_{ji} = \frac{\frac{N_j}{n_j}\left[\sum_{i=1}^{n_j} x_{ji}\right]}{N_j}$$

$\hat{X}_k$ = estimated community harvest.

CIP = 95% confidence interval percentile.

var $\left(\hat{X}_k\right)$ = variance of estimated community harvest.

s_j^2 = harvest level strata variance.

$\bar{x}_{ji}$ = sample average for stratum *j* (average household harvest for stratum *j*).

Where:

i = households.

j = harvest level strata (harvester, nonharvester).

k= community.

x_{ij} = harvest reported by individual households.

N_j = total number of households in stratum *j*.

n_j = number of households surveyed in stratum *j*.

N_k = total number of households in community *k*.

$t_{1/\alpha}$ = Student's *t* distribution value with tail area probability α (1.96).

Appendix N.–Number of birds documented in fall bird counts.

Species or species group	Fall 2011			Fall 2012		
	Savoonga	Gambell	Total	Savoonga	Gambell	Total
Ducks						
Northern pintail	86	0	86	2	43	45
Eurasian wigeon	13	14	27	0	3	3
Greater scaup	3	0	3	0	0	0
Common eider	280	1,096	1,376	828	1,502	2,330
King eider	2,492	4,568	7,060	1,767	7,821	9,588
Steller's eider	13	19	32	1	0	1
Spectacled eider	12,207	4,379	16,586	13,211	1,452	14,663
Unidentified eider	0	0	0	516	0	516
Harlequin duck	142	468	610	45	582	627
Long-tailed duck	558	269	827	656	395	1,051
White-winged scoter	74	195	269	33	130	163
Black scoter	2	1	3	0	0	0
Red-breasted merganser	32	12	44	11	17	28
Total ducks	**15,902**	**11,021**	**26,923**	**17,070**	**11,945**	**29,015**
Geese						
Black brant	123	4	127	15	32	47
Emperor goose	9	0	9	26	0	26
Snow goose	1,020	115	1,135	0	0	0
Total geese	**1,152**	**119**	**1,271**	**41**	**32**	**73**
Tundra swan	**0**	**4**	**4**	**0**	**0**	**0**
Sandhill crane	**25**	**0**	**25**	**0**	**0**	**0**
Seabirds						
Pelagic cormorant	1,765	1,050	2,815	1,446	1,106	2,552
Fork-tailed storm petrel	0	0	0	0	1	1
Short-tailed shearwater	603,189	2,348,018	2,951,207	1,797,900	764,108	2,562,008
Northern fulmar	44	930	974	5	17	22
Common murre	10	955	965	3	4,770	4,773
Thick-billed murre	37	2,073	2,110	3	1,603	1,606
Unidentified murre	0	578	578	405	0	405
Pigeon guillemot	174	683	857	277	1,164	1,441
Black guillemot	2	1	3	0	0	0
Ancient murrelet	20	340	360	0	50	50
Kittlitz's murrelet	2	2	4	1	8	9
Parakeet auklet	0	51	51	22	520	542
Least auklet	16	1,728	1,744	114	4,381	4,495
Crested auklet	43	1,950	1,993	675	6,923	7,598
Tufted puffin	128	331	459	724	760	1,484
Horned puffin	241	1,606	1,847	774	3,755	4,529
Parasitic jaeger	1	4	5	1	0	1
Pomarine jaeger	74	32	106	21	5	26
Unidentified jaeger	0	9	9	8	0	8
Herring gull	112	150	262	57	115	172
Glaucous gull	1,693	2,215	3,908	941	1,805	2,746
Glaucous-winged gull	30	145	175	21	473	494
Slaty-backed gull	3	0	3	1	2	3

-continued-

	Fall 2011			Fall 2012		
Species or species group	Savoonga	Gambell	Total	Savoonga	Gambell	Total
Sabine's gull	14	6	20	0	1	1
Black-legged kittiwake	46,329	46,183	92,512	20,174	14,982	35,156
Arctic tern	0	0	0	2	0	2
Total seabirds	**653,927**	**2,409,040**	**3,062,967**	**1,823,575**	**806,549**	**2,630,124**
Shorebirds						
Red phalarope	260	169	429	898	437	1,335
Pacific-golden plover	9	63	72	8	17	25
Ruddy turnstone	0	0	0	0	10	10
Rock sandpiper	4	65	69	41	14	55
Dunlin	0	4	4	0	21	21
Pectoral sandpiper	3	0	3	0	0	0
Sharp-tailed sandpiper	0	2	2	0	0	0
Total shorebirds	**276**	**303**	**579**	**947**	**499**	**1,446**
Loons						
Red-throated loon	1	2	3	1	23	24
Pacific loon	709	1,070	1,779	1,113	1,782	2,895
Arctic loon	6	2	8	4	5	9
Common loon	0	0	0	0	0	0
Yellow-billed loon	17	53	70	18	126	144
Unidentified loon	18	0	18	1	2	3
Total loons	**751**	**1,127**	**1,878**	**1,137**	**1,938**	**3,075**
Grebes						
Horned grebe	5	10	15	0	2	2
Red-necked grebe	0	0	0	5	6	11
Total grebes	**5**	**10**	**15**	**5**	**8**	**13**
Birds of prey						
Rough-legged hawk	0	3	3	0	8	8
Gyrfalcon	1	5	6	2	6	8
Peregrine falcon	0	0	0	1	0	1
Short-eared owl	1	3	4	0	0	0
Snowy owl	0	5	5	18	12	30
Total birds of prey	**2**	**16**	**18**	**21**	**26**	**47**
Corvids						
Common raven	0	0	0	87	295	382
Total birds	**672,040**	**2,421,640**	**3,093,680**	**1,842,883**	**821,292**	**2,664,175**

Appendix O.–Index of relative species abundance (ISA) calculated from fall birds counts.

Species or species group	Fall 2011			Fall 2012		
	Savoonga	Gambell	Total	Savoonga	Gambell	Total
Ducks						
Northern pintail	0.96	0.00	0.51	0.03	0.51	0.28
Eurasian wigeon	0.15	0.18	0.16	0.00	0.04	0.02
Greater scaup	0.03	0.00	0.02	0.00	0.00	0.00
Common eider	3.13	13.91	8.18	10.75	17.80	14.44
King eider	27.84	57.97	41.95	22.95	92.67	59.41
Steller's eider	0.15	0.24	0.19	0.01	0.00	0.01
Spectacled eider	136.39	55.57	98.55	171.57	17.20	90.85
Unidentified eider	0.00	0.00	0.00	6.70	0.00	3.20
Harlequin duck	1.59	5.94	3.62	0.58	6.90	3.88
Long-tailed duck	6.23	3.41	4.91	8.52	4.68	6.51
White-winged scoter	0.83	2.47	1.60	0.43	1.54	1.01
Black scoter	0.02	0.01	0.02	0.00	0.00	0.00
Red-breasted merganser	0.36	0.15	0.26	0.14	0.20	0.17
Total ducks	**177.68**	**139.86**	**159.97**	**221.69**	**141.53**	**179.77**
Geese						
Black brant	1.37	0.05	0.75	0.19	0.38	0.29
Emperor goose	0.10	0.00	0.05	0.34	0.00	0.16
Snow goose	11.40	1.46	6.74	0.00	0.00	0.00
Total geese	**12.87**	**1.51**	**7.55**	**0.53**	**0.38**	**0.45**
Tundra swan	**0.00**	**0.05**	**0.02**	**0.00**	**0.00**	**0.00**
Sandhill crane	**0.28**	**0.00**	**0.15**	**0.00**	**0.00**	**0.00**
Seabirds						
Pelagic cormorant	19.72	13.32	16.73	18.78	13.10	15.81
Fork-tailed storm petrel	0.00	0.00	0.00	0.00	0.01	0.01
Short-tailed shearwater	6,739.54	29,797.18	17,535.40	23,349.35	9,053.41	15,873.66
Northern fulmar	0.49	11.80	5.79	0.06	0.20	0.14
Common murre	0.11	12.12	5.73	0.04	56.52	29.57
Thick-billed murre	0.41	26.31	12.54	0.04	18.99	9.95
Unidentified murre	0.00	7.34	3.43	5.26	0.00	2.51
Pigeon guillemot	1.94	8.67	5.09	3.60	13.79	8.93
Black guillemot	0.02	0.01	0.02	0.00	0.00	0.00
Ancient murrelet	0.22	4.31	2.14	0.00	0.59	0.31
Kittlitz's murrelet	0.02	0.03	0.02	0.01	0.09	0.06
Parakeet auklet	0.00	0.65	0.30	0.29	6.16	3.36
Least auklet	0.18	21.93	10.36	1.48	51.91	27.85
Crested auklet	0.48	24.75	11.84	8.77	82.03	47.08
Tufted puffin	1.43	4.20	2.73	9.40	9.00	9.19
Horned puffin	2.69	20.38	10.97	10.05	44.49	28.06
Parasitic jaeger	0.01	0.05	0.03	0.01	0.00	0.01
Pomarine jaeger	0.83	0.41	0.63	0.27	0.06	0.16
Unidentified jaeger	0.00	0.11	0.05	0.10	0.00	0.05
Herring gull	1.25	1.90	1.56	0.74	1.36	1.07
Glaucous gull	18.92	28.11	23.22	12.22	21.39	17.01
Glaucous-winged gull	0.34	1.84	1.04	0.27	5.60	3.06
Slaty-backed gull	0.03	0.00	0.02	0.01	0.02	0.02

-continued-

Species or species group	Fall 2011			Fall 2012		
	Savoonga	Gambell	Total	Savoonga	Gambell	Total
Sabine's gull	0.16	0.08	0.12	0.00	0.01	0.01
Black-legged kittiwake	517.64	586.08	549.69	262.00	177.51	217.82
Arctic tern	0.00	0.00	0.00	0.03	0.00	0.01
Total seabirds	**7,306.45**	**30,571.57**	**18,199.45**	**23,682.79**	**9,556.27**	**16,295.69**
Shorebirds						
Red phalarope	2.91	2.14	2.55	11.66	5.18	8.27
Pacific-golden plover	0.10	0.80	0.43	0.10	0.20	0.15
Ruddy turnstone	0.00	0.00	0.00	0.00	0.12	0.06
Rock sandpiper	0.04	0.82	0.41	0.53	0.17	0.34
Dunlin	0.00	0.05	0.02	0.00	0.25	0.13
Pectoral sandpiper	0.03	0.00	0.02	0.00	0.00	0.00
Sharp-tailed sandpiper	0.00	0.03	0.01	0.00	0.00	0.00
Total shorebirds	**3.08**	**3.85**	**3.44**	**12.30**	**5.91**	**8.96**
Loons						
Red-throated loon	0.01	0.03	0.02	0.01	0.27	0.15
Pacific loon	7.92	13.58	10.57	14.45	21.11	17.94
Arctic loon	0.07	0.03	0.05	0.05	0.06	0.06
Common loon	0.00	0.00	0.00	0.00	0.00	0.00
Yellow-billed loon	0.19	0.67	0.42	0.23	1.49	0.89
Unidentified loon	0.20	0.00	0.11	0.01	0.02	0.02
Total loons	**8.39**	**14.30**	**11.16**	**14.77**	**22.96**	**19.05**
Grebes						
Horned grebe	0.06	0.13	0.09	0.00	0.02	0.01
Red-necked grebe	0.00	0.00	0.00	0.06	0.07	0.07
Total grebes	**0.06**	**0.13**	**0.09**	**0.06**	**0.09**	**0.08**
Birds of prey						
Rough-legged hawk	0.00	0.04	0.02	0.00	0.09	0.05
Gyrfalcon	0.01	0.06	0.04	0.03	0.07	0.05
Peregrine falcon	0.00	0.00	0.00	0.01	0.00	0.01
Short-eared owl	0.01	0.04	0.02	0.00	0.00	0.00
Snowy owl	0.00	0.06	0.03	0.23	0.14	0.19
Total birds of prey	**0.02**	**0.20**	**0.11**	**0.27**	**0.31**	**0.29**
Corvids						
Common Raven	0.00	0.00	0.00	1.13	3.50	2.37
Total birds	**7,508.83**	**30,731.47**	**18,381.94**	**23,933.55**	**9,730.95**	**16,506.66**

Appendix P.–Local and traditional knowledge on harvests, uses, and ecology of birds and eggs.

This section refers to comments offered by households during harvest surveys and key respondent interviews. The information was kept anonymous and is presented as noted by survey staff, without the intent of being literal transcriptions. This compilation of notes does not intend to quantify the prevalence of opinions and knowledge, although it portrays recurrence of some topics.

Bird and egg harvest methods

1. My grandfather used a snare to catch birds. Birds got caught by the head and by their feet. We also used a long stick, we call it *anaavak* [bird net], about 12 feet or longer to catch least auklets, parakeet auklets, probably some murres and puffins. The mesh was about 1.5 inch. We used anaavak in the spring time, like late June till about when they are feeding their young. There are still *napu* [bird-netting blind], piles of rocks on the shore where people sit to catch low-flying auklets when they come by. One or 2, sometimes 3 at a time if we were lucky. Here in Savoonga, the best wind is from northwest or west, because the birds are circling in front of the cliffs and bluffs, and when they come into the wind, they come lower. We call them *mateganaq*: the wind would attach them when they go against the wind. We have to be still like a rock when they arrive. I probably used it myself until late 50s. Then we never used anymore, because of shotgun. Right now, after that, we use a shotgun called .410 gauge. In August, we used to catch young auklets and least auklets in the rocks, when still in the nest, just before they jump into the water, and probably some guillemots. We call it *iigsaq* [digging into] for the young. Catch them by hand; when they were in a very deep hole, we used a wire, made a hook out of it. Now people use shotguns instead of this.
2. People use 12, 20, 28, .410, and 16 gauge shotguns to hunt birds, some people still use nets for auklets. Only a few people use slingshots, mostly teenagers.
3. Few people at Savoonga get auklets these days. Don't use pole and net anymore, sometimes people still get auklets with shotgun.
4. Some young people get golden plover using their sling shot.
5. Used to hunt phalaropes with a rope about 50 ft long, put on the ground on the edge of a lake, wait for them to be around the rope, then whip rope in the air a few times, vigorously.
6. I wait [for] steady north winds in mid-October to hunt birds because it is easier to retrieve them.
7. I probably went out by boat a couple of trips last month (October) and haven't gone this month yet (at 5 November). I probably went out 4–5 times since September.
8. We can even get a few birds at the FAA towers without shooting a gun, because they hit the wire. Just pick them up.
9. During spring, the emperor geese molt and cannot fly and then you can just walk up to [a] bird and pick it up and take it. They ring its neck and gut right way, because spoil quickly. If they are in camp, or have time, they will pluck the entire bird and then roast it, or put it in stew. Otherwise the bird will be hung up to dry. Sometimes it will be allowed to aged and then develops a smell and a minty taste. Then it is boiled and dipped in seal oil.
10. Get eggs late June and July, usually murre eggs, also seagull and sometimes duck eggs. Climb down to get murre eggs; my nephew does this part. [How many people go out to get eggs?] Usually us and 2 of my nephews, divide them 3 ways as they have their own houses and families. [How many eggs your crew gets in a year?] Probably over 1,000. [How many egg-gathering crews are in Savoonga?] Probably 20 or more people go out egg hunting, in groups of 3–4 people. Each crew gets about 3,000 eggs, it depends on the weather. Eggs are eaten boiled, scrambled, frozen for later, crack it open and vacuum seal.
11. Harvest eggs on cliffs 12 miles east of Savoonga, has been egging by himself.
12. Hunting birds in winter, in the morning go there and get behind the iceberg. Murres are singly, not in flocks anymore. Also eiders.

13. Fall birds are hard to shoot down, too much blubber. Steel shot sucks here. Still use sling shot for cormorants, both when are flying or landed.
14. Sometimes people get guillemot chicks from nest, with a barbed tool when nest hole is too deep to get by hand.
15. People used to get golden plover, not anymore.
16. We used to get phalaropes in large numbers.
17. Used to get phalaropes in marsh, where now is the landing strip, with sling shot, they nested in the open. Don't have phalaropes anymore.
18. Stopped eating birds because of the bird flu.
19. We have a choice when the ducks come, we always shoot the male, let the female go.
20. Try to get only male eiders, because females are breeding.
21. When collecting eggs, if there are 6 there, only take 3, leave 3. But murre eggs, get all you can, until you have no more container, there are so many murres.
22. Don't harvest in summer because birds are breeding.
23. Didn't get short-tailed shearwater, only try to get it if cannot get other preferred foods.
24. Continue hunting birds into December. When ice comes in, birds sometimes get too fat, cannot fly, eat those too.
25. Don't eat adult large gulls anymore because they eat trash at the dump. Now lots of trash all over the island. Still get young large gulls in south part of island, away from dump.
26. Hunt gulls out of town because gulls near town feed on dump. Like gulls because they are meaty and fat.
27. Don't get gulls in town, they are in the dump. When was younger, used to get gull chicks close to camp.
28. Young seagull used to eat a lot, but when you see them in the dump you don't want to go after. Maybe go down the coast, where they are fed fish by their parents, they are fat.

Preference for young birds

1. We catch anything, as much as we need to eat. But we don't catch much of the parents because they are tough to chew on. Except for murres and crested auklets, there is not much difference in the meat, they are both soft. When they become big we don't like to catch them, they become tough, all birds.
2. Only eat young loons, older ones are too tough, like trying to chew on leather, maybe in survival situation they are edible.
3. Only the young guillemot sticks around in the winter, have red feet, it's a rock bird, lays its eggs like auklets under the rock, auklet 1 egg, guillemot 2 eggs. Don't see the black parent in winter time, don't know where they go, maybe fly somewhere where it is warmer. Don't really go for guillemot eggs, maybe only when we were kids, get 6 of them, boil them. People get young guillemots when they are ready to jump out [fledge], get them in the cliffs.
4. Don't hunt much in spring, wait birds multiply. Wait to get young ones, when chicks are grown in fall. Also, young ones are fattier and tender.
5. Frying an adult cormorant is good food, must be fried, breast and the legs. Young cormorants are very good eating; they have tender meat. People also eat the feet of young cormorants.
6. We eat young black-legged kittiwake.
7. I only get the young ones; the meat is more tender; I never get adult.
8. People get the young loons; they are tastier, softer, and fatter. Don't go after parent loon.

Preserving, preparing, and using birds

1. We used any kinds of birds. We used skins of auklets, murres, ducks, loons, and cormorant for parkas, but not anymore. Now we throw the skin away because of this kind of [modern] parka. We still use bird wings to sweep the floor and dust the shelves, mostly for sweeping inside of the house. This one is the wing of a snow goose; we also use wings of cormorant, seagull, swan, and snowy owl (when we get it) because they got more feathers. I guess we are the only ones that still use it.
2. Use all kinds of birds just mainly for food. Once in a while get birds for dog feed, no more sled dogs, just pets.
3. Eat loons probably once or twice a month, other birds too once or twice a month. We eat mostly seals and walrus.
4. Used to get 10–15 young seagulls, at least 10 young cormorants, take the guts out and hang outside the shed, use for food all winter.
5. Puffins are not good; it is too hard.
6. Age cormorants until they smell; just hang them in the food shed. In the morning go your food shed, take 1 or 2 off, bring them inside, put by the stove, thaw all day, cut it up in the evening and have for dinner.
7. Some people keep birds in the freezer, some people hung them up, mostly we hung murres in spring time, when it is drier.
8. Some people use loons for soup, roast, and usually boiled.

Loon Ecology and Grouping Behavior

1. In spring time I see mostly loon couples, flying. In fall time I see groups of up to 5, swimming.
2. This fall there were 60–100 young loons, 500–1,000 feet from the shoreline, feeding on a large concentration of bait fish. There were other birds, shearwaters, murres, the sky was black, seals, and whales all together with birds eating fish.
3. Last year [2011] in mid-November, saw a large flock of 15–20 juvenile loons flying together near Kookoolik. Didn't harvest any, but hadn't seen them flying together in large flocks like that. Saw a few loons as late as December near Kookoolik.
4. See loons flying together, usually 2, sometimes 3. When there is lot of birds, see many loons, has seen up to 8 together.
5. Recently I saw yellow-billed loon breeders around the east side, in the ocean, 3 pairs together (6 of them), first time ever that I saw this many together. I see mostly 2 together. Never saw loons flocking together as other birds, only twos.
6. Loons are mostly alone, or in twos, I never see them in a bunch.
7. Spring time usually see loons breeding around wetlands on the NE side of Savoonga, between Camp Iveetok and NE Cape. When we were working for the military clean up in NE Cape, every pound had different kind of loons nesting. The more common were loons # 1 [Pacific loon] and # 3 [yellow-billed loon].
8. I see red-throated loons only once in a while.
9. See loons at camp, in a lagoon, carrying food in the bill mostly in last part of August when they start bringing food to their young, before August they don't carry anything in their mouth.
10. [Question: What about loons in winter?] Nothing! Loons are in summer.
11. Loons just follow the coast behind the waves.
12. In summer time, get loons like this [points to breeding plumage], in fall time get like this [points to non-breeding plumage].

13. Loons nests near to the edge of pond, lake, or river that never dries up. If they lay their eggs inside [more inland?] they won't fly up, they get tired, a fox would catch them. So that is why these birds lay their eggs about close to the water.
14. The birds that came, come to this island, like loons, most of them are going up to the Siberian side, mainland Alaska, as far as that island north of Russia, Wrangell Island, where the snow geese lay their eggs. The farthest north. Southern, down at the Aleutian Islands, all the way down to Ketchikan, some come that far. This island is the main route of the animals from whale to birds. They rest here for a few days to or so when they are migrating up north in spring time, because there is lots snow up farther yet, where they are to lay their eggs or babies. This island is a resting place for the animal. Spring time and when the grass is faded or withered, they start migrating south. One by one, group by group until nobody lives here anymore. Only raven, seagulls are around almost year around. So are owls, snowy owls.
15. The birds such as the loons, swans and cranes, make different kinds of calls to coo their chicks. When nangqwalek's chicks are hatched, they coo their young with a song like "eeheein kawaahq."
16. When loons come over us, they passed, they quit their voices.
17. These yellow-bill loons can be gone for a while; they go to where they stay, and come back on other years.
18. Saw a yellow-billed loon kill a swan, maybe ten years ago, the loon dive-bombed into the swan at a lake, killed it for protection of nest. There is also an old story about a large yellow-billed loon that killed a man.
19. Those loons, when their chicks hatch they keep a close eye on them. I heard 2–3 years ago from the boys of 2 big swans in a lake landed with 2 yellow-billed loons circling. They were caught off guard like making a gunshot noise, the other swan flew away. Their beaks are really sharp, they penetrated through, killing the swan. They said that it was a killing by big loons, thick ones, went right through that swan. So there's a warning on the loons. There's a warning to us. When common loons, Arctic loons, and red-throated loons lay eggs in lakes, they say not to go around them. There's a story of a man from long ago, told by generations. When the man was wading over yonder, a loon killed him. So there was a warning on the loons because they tend to do anything to protect their chicks so well. They tell us not to wade around them when they have chicks because they murdered a man. I don't know which one it was for sure, yellow-billed or black-billed, those larger types.
20. We don't encounter loon eggs. Only once in a great while we find their eggs.

Loon entanglement in fishing nets

1. People get birds tangled in their nets, but I don't know how frequently, I didn't get one entangled since a long time.
2. Sometimes get loon tangled in fishing net [shows red-throated loon in bird identification guide], but not this year.
3. Most loons caught on nets are in the month of August, maybe 1 or 2. Usually they are alive and people let them get tired before they let loons go.
4. Loons that get tangled in fishing nets may be less than 1% of the total, usually loons and pintails (long-tailed ducks) get tangled.
5. [question: Which loon species usually gets tangled in nets?] [answer] The common loon (shows loon #1 in bird ID guide, Pacific loon). It happens in summer time, July–August, when people are at camps. People eat birds that got entangled.
6. I see yellow-billed loon once in a great while…mostly on a fishing net. Go over there, grab it on the beak, let it loose. It doesn't fly off right way, it's been probably trying to get loose all night when I am sleeping and in the morning I go and check the nets. Don't keep it, it is too hard maybe; I never tasted a parent loon.
7. Every time I got to loose a loon from the net, I always grab its beak first. I talk to it, but it does not talk back. It grunts a few times, exercises its wings, wobbles around, and eventually goes in the water, and it is gone. Probably regained its strength. Especially in windy days, when it is trapped in the net, the waves are going over it. A few I already found dead, not all the time, but once in a while. Both nangqwalek and yuwayu get tangled.

8. When there are sustained north winds, lots of debris wash up with birds entangled on them, usually murres, young loons, puffins.
9. Once my grandmother freed a reindeer from a green net tangled in its antlers. I think he was on the shore eating seaweed or licking salt.

Loon names

1. All loons (yuwayu, yuwayaaghaq, melqupak, eghqaaq, nangqwalek) are almost the same animal, same family, they use the lakes. Nangqwalek is the biggest in the loon family. Smallest loon is aqfasuk [note: grebe], they are small and have a small head, they are also in the loon family.
2. I got the small loons, not the big ones. September–October have loons out here, mostly young ones, no adults, mostly small ones. Small ones are yuwayu. Nangqwalek [showing *Gavia adamsii* on bird identification guide]; mostly young ones [showing nonbreeding plumage in loon identification guide].
3. I wonder which ones of those 2, yellow and black-billed, are the exact nangqwalek, we call them nangqwalek, the largest of the loons. Probably both of them are really nangqwalek. Maybe one term, same thing with the murres, murres are also divided in 2. (Then compares different kinds of nangqwalek with different kinds of murres).
4. Nangqwalek is bigger than loon #1 [Pacific loon], but same looking.
5. Yuwayaaghaq and nangqwalek, just these 2 names, young people nowadays just call them these two. Yuwayaaghaq is for juveniles.
6. I get loon #2 [non-breeding plumage] right now, October–November.
7. Melqupak's neck is white, adults. Their feathers (*melquq*) are also longer, from their neck here to the tail.
8. I received 2 black-billed nangqwalek that had excess fat this year.

Bird ecology

1. Eider duck or long-tailed duck are hunted by owls in winter time.
2. Spectacled eiders eat spiny crabs, with really skinny legs, they are small, I don't know their name. Also eat hermit crab and snails. The eiders dive in bays to get crabs, usually in low tide.
3. This year haven't see young puffins, probably was a bad year for them to breed.
4. What I think about murres and auklets is that there is about a 5-year cycle, every 5 years a species start to die off and recover. Every 5 years I watch them, since the 1980s, these will die off, recover, start washing up in the beach. They don't go way down, just a few start dying and they will recover. It's their life cycle or such.
5. A couple of weeks ago, there were lots of birds close to Savoonga: shearwaters, murres; the sky was black. All birds were eating small fish. Also seals and whales together with birds eating fish.
6. Large gulls eat whole jellyfish on water, away from shore. I see this from boat.
7. An albino cormorant has been around since 2 years; it stayed during winter.
8. When is stormy, small shrimp concentrates on bays, where is calm; then kittiwakes and other gulls concentrate there too to feed.
9. Eiders, some are Steller's eider, when they go out to gather food, they bury their eggs on the downy feathers that they put in their nest. When they return, they put away the feathers and lay on their eggs. Birds live like that.
10. Swans use the same nest for years and years; their nests become deep. Every year they would fix them up with grasses and twigs, and then, year after year it gets bigger.
11. The little birds come up with swan, crane, other big birds that can fly; the little birds land on the back of the big birds and travel with them.

12. Sandhill cranes have no nests. They lay their eggs on any hollow part of the ground anywhere in between rocks. Dunlins, passerines, eiders, and swans build a nest and lay their eggs.
13. Some birds are threatened species. We call them “government birds.”
14. Emperor geese used to molt closer to town, but don’t even see them molting anymore.
15. Seventeen years ago we used to see snow geese in September-October; now we only see them when the land is frozen.
16. Phalaropes used to feed in large numbers where is now the airport.
17. Only a few snow geese this year; this year they went another way.
18. Snow geese didn’t migrate close to Savoonga this year. Northeast wind drove snow geese to fly over mainland on east side of island. But if wind is directly from north at the time of the migration, snow geese fly over the island.

Bird occurrence, abundance, and distribution

1. Long-tailed ducks and spectacled eiders stay yearlong.
2. Canada geese sometimes pass by during their migration in spring time.
3. Canada geese are really rare in St. Lawrence Island.
4. Lots of spectacled eider, even break the antenna at the camp when they come around, at least a thousand. You can hear the “roosh” of their wings.
5. Only the young guillemot sticks around in the winter, have red feet. It’s a rock bird, lays its eggs like auklets under the rock, auklet 1 egg, guillemot 2 eggs. Don’t see the black parent in winter time; don’t know where they go, maybe fly somewhere where it is warmer. Don’t really go for guillemot eggs, maybe only when we were kids, get 6 of them, boil them. People get young guillemots them when they hatched and are ready to jump out, get them in the cliffs.
6. This year didn’t see many Steller’s eiders. Last year started to see them in September, until middle part of October. Few that stay yearlong. Big flocks of 20-30 birds in September, and also small flocks. But this year they went somewhere.
7. Grebes also nest at the island, we call them aqfasuget. Start seeing them in fall time in the salt water, until October.
8. Peregrine falcons showing up; they eat ducks around St. Lawrence Island, usually go after pintails.
9. I have not seen *piyughraapak*, alcatraz. [Romanenko et al. (1997) lists piyughraapak as short-tailed albatross *Diomedea albatrus*].
10. Terns used to breed in island on lake close to my camp. Didn’t get eggs from terns, didn’t gather them. Didn’t see them anymore; they moved maybe.

Human activities, environmental changes

1. During the 1970’s, when people got ATVs, bird populations around Gambell began to be disturbed, and populations of migratory birds have been declining ever since.
2. Further down south from Gambell, where there is less people travelling around by snow machine, there are duck eggs, geese eggs, all kinds of rock birds [cliff nesting].
3. There is more and more ravens, are here in winter too.
4. There used to be lots of Arctic terns that laid their eggs at Qiighqaq Island [Punuk Islands group], but people started to build all these cabins there. Now they are all gone, used to be thousands of Arctic terns that laid their eggs there. Now they are all gone. [question: how is the ground where terns used to nest?] Some parts rocks, some parts are all beach.

5. Start seeing birds here that never saw before; some are small birds. Some time ago, in a warm spell in January there were 3 little birds. It even rained in January.
6. Murres are staying year round; last year I saw flock after flock until late February. Seeing cormorants as late as December, gull, seagulls late as December now. They used to be gone by November. Probably staying around because of open water.
7. Found oiled crested auklet right on shore northeast of Gambell. I washed it in dish soap and water, let it dry, and released it. It could fly and flew away.
8. About a month ago, saw a kittiwake passing by clearly covered with a yellow oily sheen on breast.
9. The western side of cliffs are eroding dating back in 1950's.
10. Cliffs and bluffs, boulders, rocks, since late 50's sliding effect, erosion, permafrost melting, water percolate in cliff where murres breed. Calendar is off…late season. Coastal warming is affecting animals that migrate with the ice.
11. Effects of climate change are mostly erosion along the coast; some lakes and ponds are dry, unusual birds coming around. More freak storms now.

Appendix Q.–Gambell bird harvest estimates 1993-2012.

Species or species group	1993	1996	2002	2004	2005	2006	2007	2009	2010	2011	2012
Ducks											
Wigeon	–	–	–	–	–	–	5	–	–	2	1
Teal	–	–	2	–	–	–	–	16	9	2	3
Mallard	–	13	–	–	–	33	–	–	10	6	3
Northern pintail	12	49	86	512	164	23	34	88	22	62	58
Northern shoveler	–	–	–	–	–	–	–	–	3	–	–
Black scoter	2	–	4	–	–	3	–	–	2	–	–
Surf scoter	–	–	–	–	–	–	–	16	2	2	–
White-winged scoter	–	–	–	–	–	–	–	–	–	3	2
Goldeneye	–	–	–	–	–	–	–	–	3	14	–
Canvasback	–	–	–	–	–	–	–	–	–	7	–
Common eider	262	1,071	1,055	1,155	1,056	510	955	1,441	16	360	260
King eider	59	377	271	265	645	76	346	793	56	101	55
Spectacled eider	–	–	176	–	–	69	75	64	–	45	20
Steller's eider	42	–	–	–	–	–	–	32	–	4	–
Harlequin duck	47	8	–	–	–	2	–	24	9	4	2
Long-tailed duck	60	1,075	366	4	20	–	24	572	–	50	–
Merganser	–	–	–	–	5	2	–	–	2	2	–
Duck (unidentified)	–	4	–	–	–	2	–	8	6	6	–
Total ducks	**484**	**2,597**	**1,960**	**1,937**	**1,890**	**719**	**1,439**	**3,054**	**140**	**671**	**406**
Geese											
Black brant	7	97	270	227	278	115	155	525	22	45	27
Cackling/Canada goose	1	6	22	65	102	46	5	57	5	40	6
Greater white-fronted goose	–	–	6	4	12	21	52	32	2	7	7
Emperor goose	1	110	1,068	1,174	707	86	249	967	–	60	128
Snow goose	118	243	638	926	1,143	306	342	1,608	6	18	21
Goose (unknown)	–	15	–	–	–	–	–	–	–	–	–
Total geese	**127**	**471**	**2,003**	**2,396**	**2,242**	**574**	**803**	**3,190**	**34**	**169**	**189**
Swan	5	15	61	35	22	3	2	119	–	12	6
Sandhill crane	–	21	236	249	77	12	54	99	–	5	1
Seabirds											
Cormorant	500	1,432	767	1,000	622	746	435	1,695	200	690	458
Black-legged kittiwake	–	36	–	–	–	–	–	51	–	–	17
Bonaparte’s/Sabine’s gull	–	–	–	–	–	–	–	16	–	–	–
Mew gull	–	–	–	–	–	–	–	–	–	12	–
Large gull	203	472	487	562	25	–	115	224	23	314	128
Auklet	2,836	5,862	4,284	5,967	3,618	2,116	2,266	5,776	200	2,137	2,537
Murre	1,537	5,029	3,263	4,611	2,676	3,377	2,300	5,790	79	1,635	908
Guillemot	12	–	–	–	5	–	–	496	25	12	–
Puffin	4	36	12	2	20	20	–	3	–	–	–

-continued-

Appendix Q.–Page 2 of 2.

Species or species group	1993	1996	2002	2004	2005	2006	2007	2009	2010	2011	2012
Total seabirds	**5,092**	**12,867**	**8,813**	**12,141**	**6,966**	**6,258**	**5,115**	**14,050**	**527**	**4,799**	**4,048**
Shorebirds											
Godwit	–	–	2	–	–	–	–	–	–	–	–
Golden/Black-bellied plover	–	–	36	–	99	–	–	112	–	–	–
Phalarope	–	–	–	–	–	–	–	–	68	–	–
Total shorebirds	**–**	**–**	**38**	**–**	**99**	**–**	**–**	**112**	**68**	**–**	**–**
Loons											
Common loon	34	93	60	18	57	41	180	90	3	9	–
Pacific loon	24	68	204	410	2	110	71	89	–	10	–
Red-throated loon	–	–	4	2	5	–	5	98	8	–	–
Nonbreeding loon	*	2	*	*	*	*	*	*	*	*	8
Yellow-billed loon	17	40	198	139	45	15	7	138	–	8	–
Total loons	**75**	**203**	**466**	**568**	**109**	**166**	**263**	**416**	**11**	**27**	**8**
Grebe	1	–	–	–	–	–	–	–	2	–	–
Total birds	**5,784**	**16,174**	**13,576**	**17,326**	**11,406**	**7,732**	**7,676**	**21,039**	**781**	**5,683**	**4,658**

Note: This table includes species reported as harvested in at least 1 year.

– : No reported harvest.

* : Not detailed in harvest survey.

Source: 1993: Paige et al. (1996); 1996: Georgette and Iknokinok (1997); 2002: Kawerak (2004); 2004, 2005, 2007, 2009, 2010: Naves (In prep.); 2006: Ahmasuk and Trigg (2008); 2011–2012: this study.

Appendix R.–Gambell egg harvest estimates 1993–2012.

Species or species group	1993	1996	2002	2004	2005	2006	2007	2009	2010	2011	2012
Ducks											
Mallard	–	–	–	–	–	–	–	3	–	–	–
Northern pintail	–	–	–	–	–	40	–	–	–	–	–
Goldeneye	–	–	–	–	–	–	–	–	–	36	–
Common eider	10	174	24	17	238	196	71	790	–	225	31
King eider	6	–	24	–	–	20	–	334	–	–	–
Steller's eider	–	–	–	–	–	–	–	32	–	–	–
Long-tailed duck	–	–	–	9	–	–	–	318	–	–	–
Merganser	–	–	–	–	–	123	–	–	–	–	–
Total ducks	**16**	**174**	**48**	**26**	**238**	**378**	**71**	**1,476**	**–**	**261**	**31**
Geese											
Black brant	–	–	–	–	–	7	–	40	–	24	–
Cackling/Canada goose	–	–	–	–	–	–	–	–	–	83	–
Greater white-fronted goose	–	–	–	–	–	–	–	–	–	53	–
Emperor goose	–	–	–	–	–	–	–	–	–	24	–
Total geese	**–**	**–**	**–**	**–**	**–**	**7**	**–**	**40**	**–**	**184**	**–**
Swan	–	–	–	4	20	–	–	19	–	–	–
Sandhill crane	–	–	–	–	15	–	–	25	–	5	–
Seabirds											
Cormorant	–	34	–	–	–	–	–	–	–	–	–
Mew gull	–	–	–	–	–	–	–	175	–	–	–
Large gull	–	–	–	–	35	224	–	318	–	57	–
Auklet	–	–	–	–	–	–	–	159	–	–	–
Murre	7,027	3,730	1,914	4,954	1,280	6,829	3,588	10,541	388	2,174	5,165
Total seabirds	**7,027**	**3,764**	**1,914**	**4,954**	**1,314**	**7,053**	**3,588**	**11,192**	**388**	**2,231**	**5,165**
Loons											
Common loon	–	–	–	–	–	–	–	48	–	–	–
Pacific loon	–	–	–	–	–	–	–	48	–	–	–
Red-throated loon	–	–	–	–	–	–	–	41	–	–	–
Yellow-billed loon	–	–	–	–	–	–	–	44	–	–	–
Total loons	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**181**	**–**	**–**	**–**
Total eggs	**7,043**	**3,938**	**1,962**	**4,984**	**1,587**	**7,438**	**3,659**	**12,934**	**388**	**2,681**	**5,195**

Note: This table includes species reported as harvested in at least 1 year.

– : No reported harvest.

Source: 1993: Paige et al. (1996); 1996: Georgette and Iknokinok (1997); 2002: Kawerak (2004); 2004, 2005, 2007, 2009, 2010: Naves (In prep.); 2006: Ahmasuk and Trigg (2008); 2011–2012: this study.

Appendix S.–Savoonga bird harvest estimates 1993–2012.

Species or species group	1993	1996	2002	2004	2005	2006	2007	2009	2010	2011	2012
Ducks											
American wigeon	–	–	–	–	–	–	–	–	–	1	–
Northern pintail	–	–	–	–	–	–	–	–	–	–	7
Black scoter	–	–	–	–	–	88	–	–	–	7	–
Surf scoter	–	–	–	–	–	6	–	–	–	8	–
White-winged scoter	–	–	25	–	–	–	–	40	–	9	25
Goldeneye	–	–	–	–	–	–	–	–	32	–	–
Canvasback	–	–	5	–	–	–	–	–	–	–	–
Scaup	10	–	–	–	–	–	–	–	–	–	–
Common eider	32	159	627	376	1,434	937	3,581	704	501	183	157
King eider	8	–	510	118	371	603	2,818	83	52	38	26
Spectacled eider	9	–	288	5	67	290	788	64	45	15	25
Steller's eider	–	–	5	–	12	23	–	–	19	13	17
Harlequin duck	4	–	24	240	1,195	229	1,990	9	44	5	4
Long-tailed duck	–	126	24	5	–	9	624	–	169	5	–
Merganser	–	–	–	124	–	12	124	15	–	–	–
Total ducks	**63**	**285**	**1,508**	**868**	**3,079**	**2,197**	**9,926**	**915**	**863**	**283**	**261**
Geese											
Black brant	8	–	562	181	–	398	836	63	4	53	49
Cackling/Canada goose	–	6	28	–	148	27	8	–	–	34	–
Greater white-fronted goose	–	–	–	–	–	–	–	–	–	1	–
Emperor goose	12	–	544	228	422	352	935	177	75	44	62
Snow goose	15	48	961	156	402	749	956	374	32	181	7
Total geese	**35**	**54**	**2,096**	**565**	**971**	**1,526**	**2,734**	**614**	**111**	**313**	**117**
Swan	–	6	30	73	129	4	611	107	–	5	–
Sandhill crane	–	–	37	21	–	4	23	9	–	6	9
Seabirds											
Short-tailed shearwater	*	*	*	*	*	*	*	*	*	17	48
Cormorant	494	853	3,288	2,054	2,279	2,807	10,423	3,971	2,172	899	452
Black-legged kittiwake	–	13	774	664	2,344	723	2,347	43	3	9	8
Mew gull	–	–	24	–	–	–	–	–	10	–	–
Large gull	98	270	77	84	880	301	1,161	258	181	171	99
Auklet	470	536	1,636	616	1,164	2,502	14,491	2,373	1,052	567	233
Murre	1,824	3,490	6,274	5,646	1,850	7,836	33,529	6,547	3,363	2,541	1,676
Guillemot	–	–	903	410	–	413	–	520	3,005	22	13
Puffin	–	–	–	18	–	–	–	–	–	–	–
Total seabirds	**2,886**	**5,162**	**12,977**	**9,491**	**8,518**	**14,584**	**61,951**	**13,712**	**9,786**	**4,225**	**2,528**
Shorebirds											
Small shorebird	–	–	–	–	–	–	–	–	–	16	–
Total shorebirds	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**16**	**–**

-continued-

Species or species group	1993	1996	2002	2004	2005	2006	2007	2009	2010	2011	2012
Loons											
Common loon	66	197	843	319	801	719	2,312	125	46	72	6
Pacific loon	27	13	7	16	–	1	5	5	–	32	47
Red-throated loon	–	–	–	20	–	432	361	128	–	11	8
Nonbreeding loon	*	13	*	*	*	*	*	*	*	*	107
Yellow-billed loon	17	–	–	132	–	310	1,070	11	–	9	3
Total loons	**110**	**223**	**849**	**487**	**801**	**1,462**	**3,748**	**269**	**46**	**124**	**171**
Grebe	2	–	–	–	–	–	–	–	–	8	9
Total birds	**3,096**	**5,730**	**17,498**	**11,504**	**13,497**	**19,774**	**78,993**	**15,625**	**10,806**	**4,980**	**3,095**

Note: This table includes species reported as harvested in at least 1 year.

– : No reported harvest.

* : Not detailed in harvest survey.

Source: 1993: Paige et al. (1996); 1996: Georgette and Iknokinok (1997); 2002: Kawerak (2004); 2004, 2005, 2007, 2009, 2010: Naves (In prep.); 2006: Ahmasuk and Trigg (2008); 2011–2012: this study.

Appendix T.–Savoonga egg harvest estimates 1993–2012.

Species or species group	1993	1996	2002	2004	2005	2006	2007	2009	2010	2011	2012
Ducks											
Common eider	–	–	–	–	–	–	–	–	3	52	1
King eider	–	–	125	–	–	–	51	23	–	–	–
Spectacled eider	–	–	17	–	–	–	–	–	–	–	–
Total ducks	**–**	**–**	**142**	**–**	**–**	**–**	**51**	**23**	**3**	**52**	**1**
Geese											
Emperor goose	–	–	–	–	–	–	28	–	–	–	–
Total geese	**–**	**–**	**–**	**–**	**–**	**–**	**28**	**–**	**–**	**–**	**–**
Swan	–	–	–	–	–	–	–	–	–	–	10
Seabirds											
Cormorant	–	–	–	–	–	1,434	–	–	–	–	–
Black-legged kittiwake	–	–	–	52	–	–	–	–	–	–	–
Mew gull	–	–	73	–	–	–	–	–	–	–	34
Large gull	–	–	–	156	–	–	–	–	–	54	32
Auklet	–	–	–	116	–	–	–	41	–	–	12
Murre	6,517	10,286	35,836	64,754	65,077	57,994	118,281	91,337	41,140	15,750	20,746
Total seabirds	**6,517**	**10,286**	**35,909**	**65,078**	**65,077**	**59,428**	**118,281**	**91,377**	**41,140**	**15,804**	**20,824**
Shorebirds											
Golden/Black-bellied plover	–	–	–	10	–	–	–	–	–	–	–
Total shorebirds	**–**	**–**	**–**	**10**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Loons											
Yellow-billed loon	–	–	–	8	–	–	–	–	–	–	–
Total loons	**–**	**–**	**–**	**8**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Total eggs	**6,517**	**10,286**	**36,051**	**65,096**	**65,077**	**59,428**	**118,360**	**91,400**	**41,143**	**15,856**	**20,835**

Note: This table includes species reported as harvested in at least 1 year.

– : No reported harvest.

Source: 1993: Paige et al. (1996); 1996: Georgette and Iknokinok (1997); 2002: Kawerak (2004); 2004, 2005, 2007, 2009, 2010: Naves (In prep.); 2006: Ahmasuk and Trigg (2008); 2011–2012: this study.