A SURVEY OF SPRING STAGING WATERFOWL ALONG THE NAKNEK RIVER, ALASKA PENINSULA, ALASKA MARCH – MAY 2002 and 2003

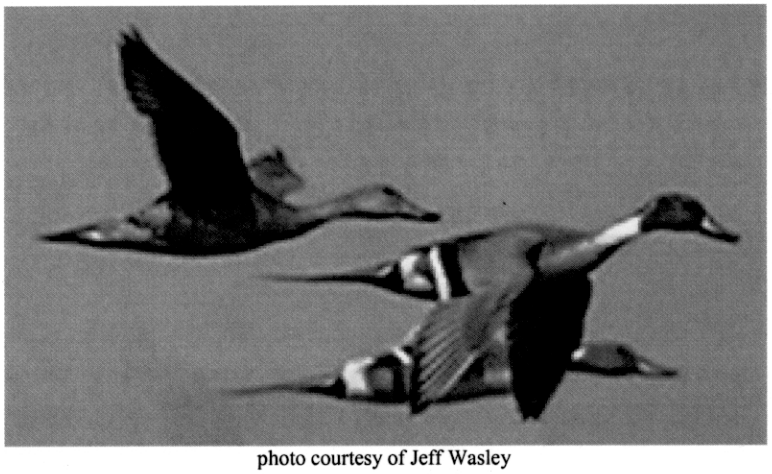


photo courtesy of Jeff Wasley

BY:

Brandt W. Meixell

&

Susan E. Savage

Key Words: abundance, Alaska Peninsula, American wigeon, black scoter, Canada goose, common goldeneye, common merganser, disturbance, Eurasian wigeon, greater scaup, greater white-fronted goose, ground-based surveys, long-tailed duck, mallard, migration, Naknek River, northern pintail, northern shoveler, red-breasted merganser, staging, tundra swan, waterfowl, white-winged scoter

U.S. Fish and Wildlife Service
Alaska Peninsula/Becharof National Wildlife Refuge
P.O. Box 277
King Salmon, Alaska 99613

August 2004

TABLE OF CONTENTS

LIST OF TABLES, FIGURES, AND APPENDICES

TABLES

FIGURES

APPENDICIES

Abstract

A survey of spring staging waterfowl along the Naknek River of the Alaska Peninsula, Alaska, was conducted from 17 March through 10 May 2002 and 14 March through 22 May 2003. The refuge conducted annual aerial waterfowl surveys along the Naknek from 1983 to1988 and 1991 to 1999 and initiated ground surveys in 1991. Twenty-two species of waterfowl were observed during the 2002 survey, 19 on the upper route and 17 on the lower route. Twenty-two species were observed during the 2003 survey, 21 on the upper route and 15 on the lower route. Data collected in each year of the ground surveys since 1992 was organized into a consistent format and counts of the upper and lower route were separated and analyzed. Using these data, averages of the date of first observation, date of peak abundance, and peak abundances were calculated for 13 species on the upper route and 8 species on the lower route. On the upper route in 2002, American green-winged teal (*Anas crecca carolinensis*), greater scaup (*Aythya marila*), red-breasted mergansers (*Mergus serrator*), and Canada geese (*Branta canadensis*) arrived later than was previously recorded for its species. Mallards (*Anas platyrhynchos*) exhibited the earliest date of peak abundance and American green-winged teal showed the smallest recorded peak abundance. In 2003, on the upper route, Eurasian wigeon (*Anas penelope*) exhibited their largest peak abundance while greater white-fronted geese (*Anser albifrons*), Canada geese, and common mergansers (*Mergus merganser*) recorded the smallest peak abundance for their species. White-winged scoters (*Melanitta fusca*) were observed for the first time on the upper route. In conjunction with the ground surveys, and during separate surveys, the causes, effects and degree of effect of disturbance on spring staging waterfowl was monitored.

Introduction

The management and conservation of waterfowl is a mandate of the U.S. Fish and Wildlife Service. In March, April, and May, thousands of geese, swans, ducks, and other water birds stage on the Naknek River, northern Alaska Peninsula, during spring migration. From 1983 to 1988, aerial surveys were conducted annually in spring by the Alaska Peninsula/Becharof National Wildlife Refuge staff, and were the primary method of surveying waterfowl on the river. Ground-based surveys (ground surveys or surveys) were conducted simultaneously with aerial surveys in 1986 due to the concern that some species may be overlooked when counted from the air. During spring of 1991, the first comprehensive ground survey was designed and conducted. This survey used multiple observation points, monitored more frequently over a longer period of time, and was independent of aerial surveys (Burke 1992). Following the same protocol, with the addition of two survey points in later years, these surveys have been conducted annually since their initiation in 1991, with the purposes of establishing a historical record of waterfowl species composition, abundance, and phenology during spring migration and monitoring annual variations, especially in abundances of common species.

Traditionally, the ground surveys were conducted each year by a different individual, most commonly a biological intern, and an end of season report was written. The year 2001 was the last in which an intern was recruited to perform the surveys. In 2002, volunteers, biological technicians hired for other projects, and permanent refuge staff performed the surveys. A biological technician was hired in 2003 to conduct the waterfowl surveys, quantify historic survey data, and establish a protocol to monitor disturbance of spring staging waterfowl on the Naknek River.

The first attempt at quantifying human disturbance to spring staging waterfowl on the Naknek River was made in 1994 (MacGowan 1994). A protocol was established and the same methods, with changes to times and days of observation, were used for the following three years. In 1998, the disturbance study was discontinued because of limited availability of staff time (Spies 1998). In 2003, a disturbance study was reinitiated with the objectives of documenting baseline levels and sources of disturbance and their effects on waterfowl. These data can be used in the future to assess if increased use of the river (caused by changes to hunting regulations or development along the river bank) changes disturbance to waterfowl staging on the river in spring. Some changes to the original protocol were made and the selection of observation times was standardized. Disturbance observations were recorded during all ground surveys and on three additional days per week.

Study Area

The Naknek River is located at the northern end of the Alaska Peninsula, Alaska, and connects the communities of King Salmon, Naknek, and South Naknek (Figure 1). It lies north of Becharof National Wildlife Refuge and west of Katmai National Park and Preserve. The river drains Naknek Lake, which lies within Katmai National Park, and flows westward for 51.2 km empting into the northern end of Bristol Bay. The lower river, from the mouth to Flat Nose Henry Road, is heavily tidally influenced and its banks are characterized mainly by upland shrubs and wet and dry tundra. The upper river (upstream of Flat Nose Henry Road) is tidally influenced to Rapids Camp, 35.2 km from the mouth, and flows through mixed boreal forest, shrubland, and wet and dry tundra. The river cuts through glacial deposits and significant earthen cliffs are exposed especially below Paul's Creek and at Paradise Point and the Big Creek Overlook. On both the upper and lower river, mud flats are exposed at or near low tide and, especially on the upper river; large concentrations of waterfowl are often found at these locations. Other major rivers near the Naknek, which also drain into Bristol Bay, are the Kvichak to the north and the Egegik and Ugashik Rivers to the south.

Methods

Weather

Weather data including average monthly temperature and monthly precipitation for March, April and May was obtained from the local National Weather Service Office in King Salmon. Ice – out dates were obtained from Richard Russell (local observer and retired Alaska Department of Fish and Game Fisheries Biologist) or from data collected by waterfowl observes during ground surveys.

Ground-based Surveys

Ground-based surveys were conducted 17 March through 10 May 2002 and 14 March through 22 May 2003. Surveys until 19 April 2002 and 20 March 2003 were conducted by a volunteer. From 23 April through 10 May 2002, they were conducted by a wildlife biologist and/or two biological technicians and from 25 March through 21 May 2003, surveys were conducted by a biological technician.

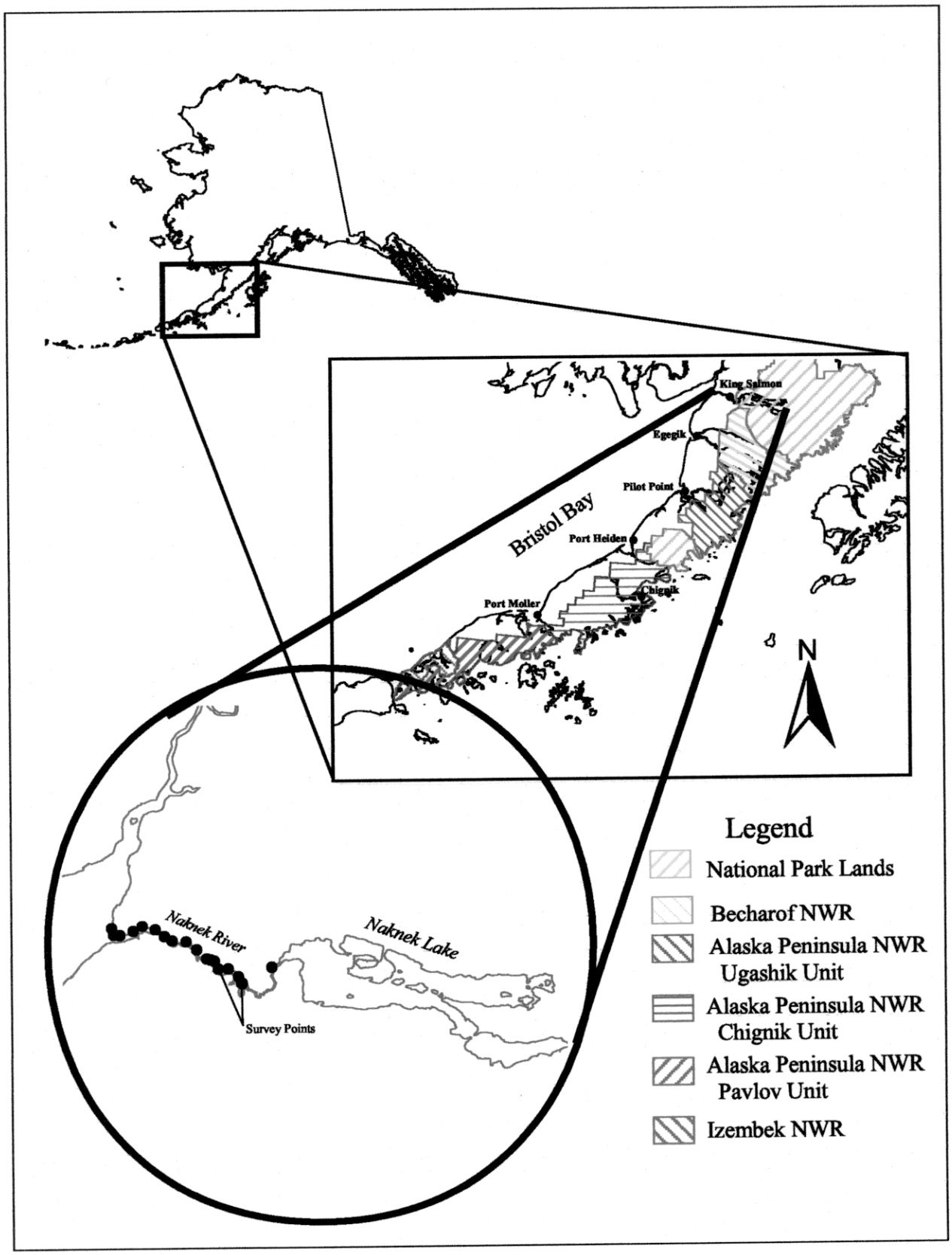


Figure 1. Map of survey area on the Naknek River, Alaska Peninsula, Alaska.

The general survey protocol including detailed point descriptions is found in the refuge's draft Wildlife Inventory Plan: Naknek Spring Waterfowl Survey (USFWS 2001). The surveys were divided into an upper route and a lower route, which due to time constraints, were monitored on separate days. The lower route consisted of 10 survey points (SP) between Flat Nose Henry Road (SP 9B) and Kvichak Bay (SP 1) and was surveyed two to four times per week in 2003 (Figure 2). The upper route, which typically holds larger concentrations of waterfowl, consisted of nine survey locations between the mouth of King Salmon Creek (SP 10) and Lake Camp (SP 17) and was monitored three to five times per week in 2003, weather and daylight permitting (Figure 3). In 2002, each route was surveyed once per week. Bristol Bay Borough and Paugvik LTD land maps were consulted to ensure permission was obtained for access to all survey points. Land status along the survey route is included in Appendix 1.

To more easily compare 2002 and 2003 survey data to past records and to calculate average dates and abundances, past data was re-formated and counts of the upper and lower route separated. Data from 1991 was not used because 1) only survey totals by date are available (details by point have not been found as of this writing), and 2) the surveys on the upper route began on 4 April and the lower route began on 14 April 14. These later starting dates would miss first arrival or peak dates and any peak counts that occurred earlier than these dates and bias the calculated means of these parameters. The survey points Flat Nose Henry Road and Oxbow were added in 1997; in an effort to accurately compare data collected in all years of survey, counts from these locations were not included in average, but if species were not observed elsewhere information from these locations is noted in the species accounts.

The first analysis includes a discussion of phenology and abundance by the tribes of waterfowl. Of the 30 species of waterfowl observed during all years of surveys, certain species are observed each year in regular abundances. These species, eight on the lower route and 13 on the upper route, were categorized as principal species. Species were selected as principal when they were present on the survey every year and numbers indicated that 12-year average peak count would exceed a certain value (25 for upper and 40 for lower route). The date of first observation, date of peak abundance, and peak abundances for each of the principal species was determined for each survey route and for each year. Dates of first observation and dates of peak abundances were converted to Julian dates and a mean and standard deviation (SD) determined for each species over the 12-year period from 1992-2003. Mean peak abundances (and SD) were also calculated for the same period. Dates of first observation, dates of peak abundances and peak abundance counts are presented for non-principal waterfowl species for 2002 and 2003 with no descriptive statistics.

Disturbance

On 11 April 2003 a disturbance study was re-initiated to document baseline levels and sources of disturbance. Waterfowl disturbance data had been collected in 1994-1997 (MacGowan 1994, Moore 1996, Ruhl & Moore 1996, Ruhl 1997). In 2003 more detail was collected regarding causes, effects, and degree of effect on spring staging waterfowl. A disturbance event was defined as any external source that caused a change in the behavior of the waterfowl or any source perceived by the observer to potentially cause a change in the behavior of waterfowl. Observations were recorded during all ground surveys. Additionally, disturbance was monitored during one randomly selected day and two-hour period on weekdays and a randomly selected two-hour period on both Saturday and Sunday each week. Observations were made for one hour on each observation day from Paradise

Lower Route

Survey Points:

1. **Kvichak Bay**
2. **Sewage Lagoon/Overlook**
3. **End of State Road**
4. **Barge Dock**
5. **Leader Creek**
6. **Monsen Park**
7. **Savonoski Crossing**
8. **Wolverine Road**
9. **Paul's Creek**

9B. Flat Nose Henry Road

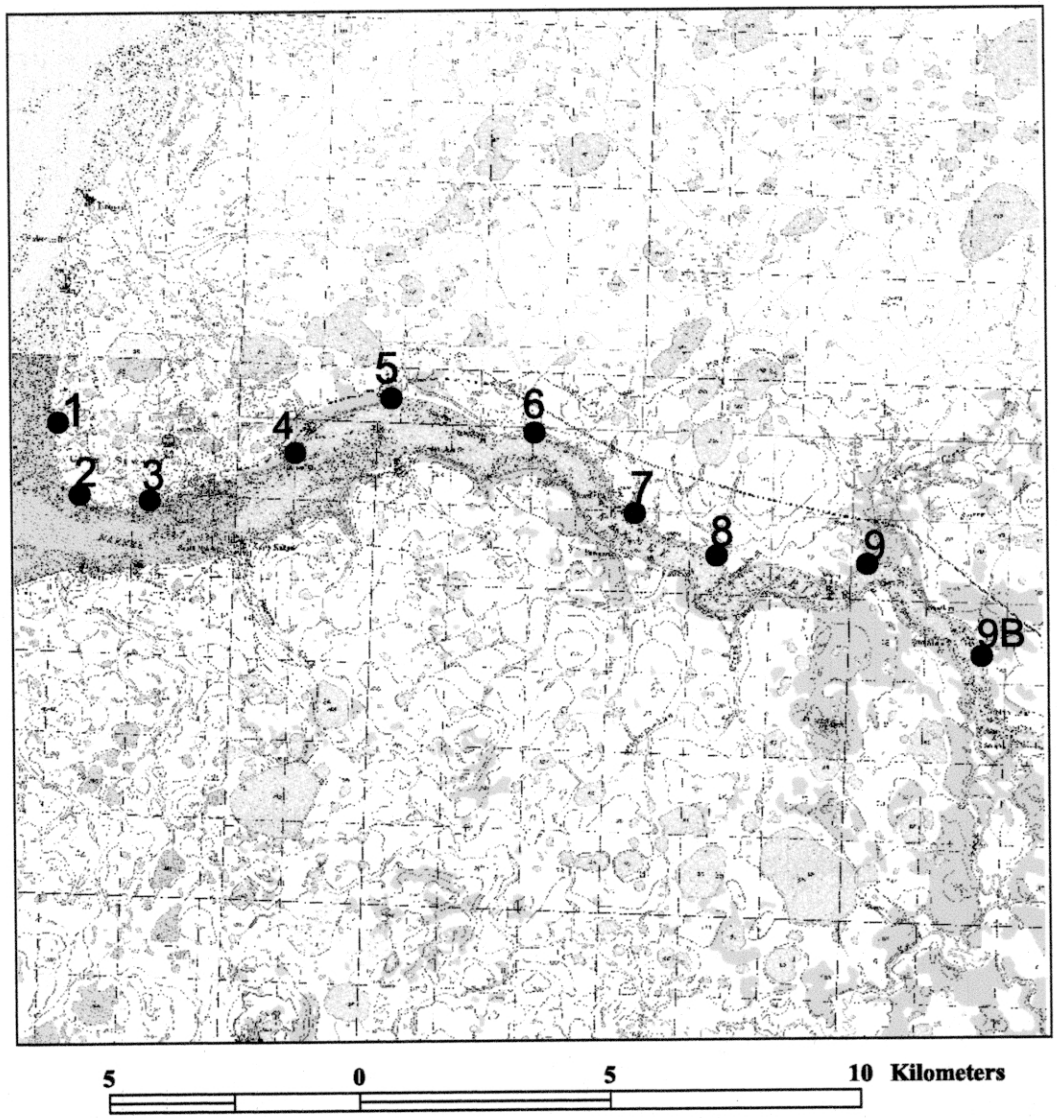


Figure 2. Map of the Naknek River spring waterfowl Lower Route survey points.

Upper Route

Survey Points:

10. King Salmon Creek
11. Eskimo Creek
12. FWS Dock
13. Grassy Point
14. Paradise Point
15. Big Creek
16B. Oxbow
16. Rapids Camp
17. Lake Camp

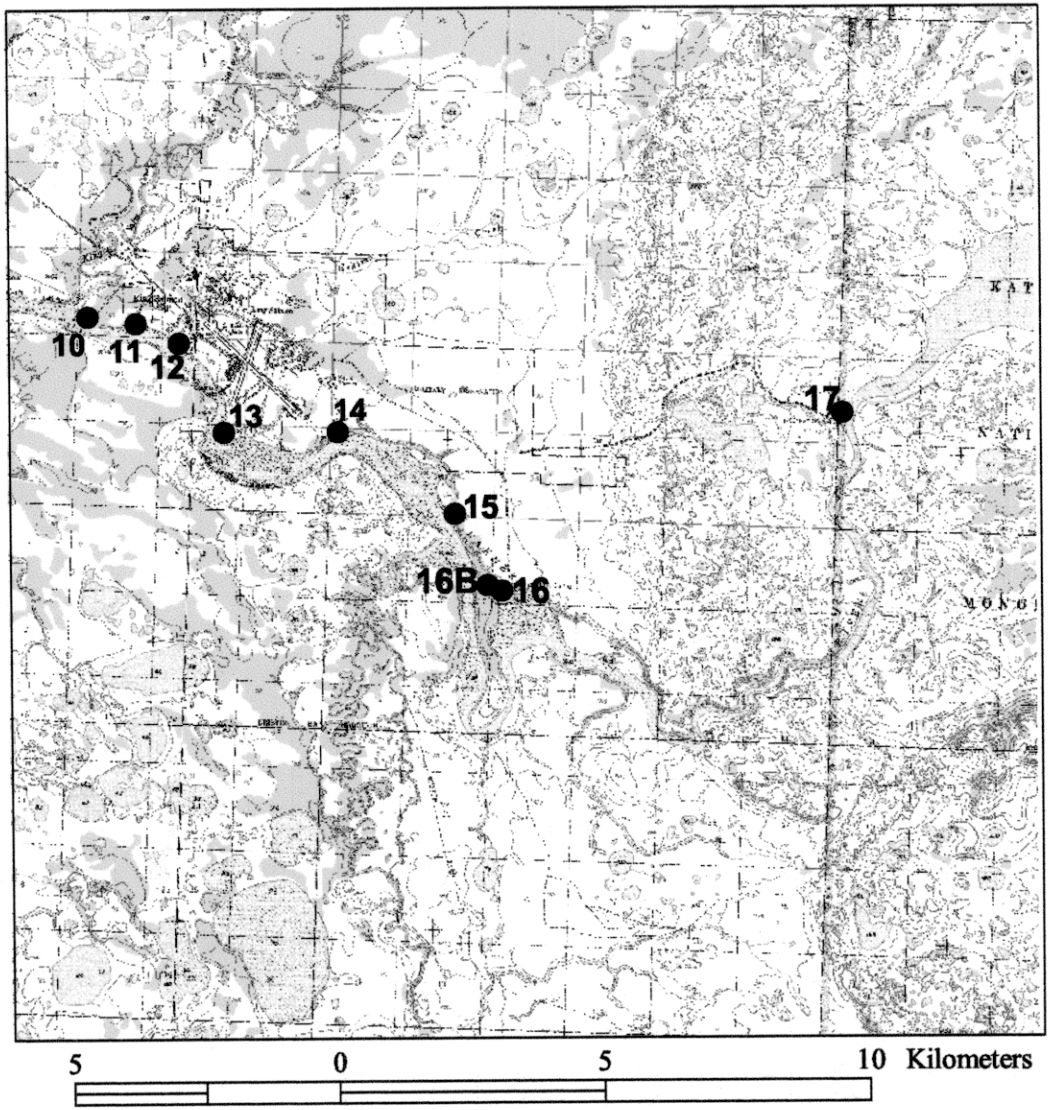


Figure 3. Map of the Naknek River spring waterfowl Upper Route survey points.

Point and Rapids Camp. During disturbance-only surveys, population counts were performed on 15-minute intervals in an attempt to accurately record quantities and species of waterfowl present both before and after disturbance events. Observations were made on a handheld tape recorder and later transcribed and entered into a Microsoft Excel database file. The disturbance protocol is located in Appendix 2 and will be added to the refuge's draft Wildlife Inventory Plan, Naknek Spring Waterfowl Survey protocol.

Analysis could be conducted on many levels with this data. Because of the limited availability of staff time, this year the analysis examined the effect of disturbance on two groups of waterfowl: geese\swans and ducks. Although five levels of disturbance effects were recorded during disturbance observations, effects were simplified into two levels: 1) no effect (category 1) and 2) any effect (categories 2-5). The number of each waterfowl group was summed by each disturbance category before the disturbance event. Then the number of waterfowl was summed for effect categories 2-5 after each disturbance. A ratio of number affected to total number present before the disturbance was calculated.

Results

Weather

The spring of 2002 was characterized by above average temperatures, below average precipitation (Table 1) and a relatively early date of ice-out (Table 2). The river at the USFWS dock was free of ice by 17 March 2002, more than a week earlier than the 12-year average date on 26 March (SD = 13.4). Temperatures were much colder than average in March 2003 when the river re-froze after being open in late January and February. Less than normal precipitation fell. April and May 2003, however, were warmer than average with near or above average levels of precipitation. After the river opened on 9 April (two weeks past the 12-year average), the spring thaw occurred rapidly. Big Creek was free of ice by 15 April and the mud flats in the lagoon at Rapids Camp were also ice-free shortly thereafter.

Distribution

Some survey locations consistently hold larger concentrations of waterfowl. In addition, each species favor different river sections and this may change over the spring season. Some patterns seem to be consistent between years. Both 2002 and 2003 showed trends comparative to previous years. In early spring, large concentrations of waterfowl, consisting mainly of sea ducks, were observed on the upper half of the lower route, Paul's Creek (SP 9) to City Dock (SP 4). By the third week of April, and through the rest of the spring, few waterfowl were observed from these survey points. Largest concentrations of waterfowl were found throughout the spring at Paradise Point and Big Creek. Use of the Rapids Camp and Lake Camp areas increased as spring progressed while at the same time, locations down river from Grassy Point saw decreases in waterfowl abundance.

Abundance, Timing of Staging, and Composition

Twenty-two species of waterfowl were observed during the 2002 survey, 19 on the upper route and 17 on the lower route. Twenty-two species were observed during the 2003 survey, 21 on the upper route and 15[1] on the lower route. Although dates of first arrival and dates and counts of peak

[1] Eurasian wigeon was not counted for 2003 because it was only sited at Flat Nose Henry Rd. which is not included in the counts for this report.

Table 1. Summary of spring **weather in King Salmon, Alaska Peninsula , Alaska** 1992-2003 with historical averages.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	**48-year Avg.**
MARCH													
Avg. Temp	22	31.1	19.5	17.37	33.08	20.79	33.03	14.58	30.37	25.52	25.9	19.9	**22.6**
Tot. precip	1.4	0.26	0.91	0.17	0.38	0.13	0.75	0.33	0.32	0.58	0.15	0.15	**0.91**
APRIL													
Avg. Temp	32.37	40.97	35.98	40.27	34.88	37.63	36.87	32.52	34.87	35.77	33.4	37.7	**32.56**
Tot. precip	0.19	0.5	1.35	1.51	0.87	0.38	0.98	0.76	0.63	1.35	0.99	0.93	**1**
MAY													
Avg. Temp	42.68	48.24	45.44	46.39	46.48	47.76	42.31	40.35	42.47	40.52	45.9	44.3	**43.05**
Tot. precip	0.74	0.7	1.74	1.44	0.84	0.67	3.05	1.2	1.18	0.63	0.71	1.84	**1.29**

Table 2. Dates of ice-out at on upper Naknek River, Alaska Peninsula, Alaska, 1992-2003.

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	**12-Year Mean**	SD (days)
Ice-out	6-Apr	23-Mar	30-Mar	29-Mar	7-Mar	8-Mar	9-Mar	18-Apr	31-Mar	31-Mar	17-Mar	9-Apr	**26-Mar**	13.4

abundance, both by species and tribe, vary from year to year (upper route: Tables 3-6; lower route: Tables 7-10), most years show similar patterns, at least in the order in which tribes and species peak (Figures 4-11). Although spring 2002 was generally warmer and ice went out earlier than in spring 2003, more species arrived and peaked later (especially on the upper route) in 2002 than in 2003. Sea duck date of peak abundances on upper route and diver date of peak abundance on lower route were an exception to this generalization. The greatest abundances of dabblers and divers were recorded on the last day of survey in 2002, the typical decline of these tribes was not documented; this indicates the actual peak dates and numbers remain unknown. This will affect means of peak dates and peak numbers and total composition percentages by tribe. The peak count of waterfowl on the upper route was reached in 2002 on 29 April with 4,062 birds while in 2003 it was on 25 April at 4,873 birds (Figures 4, 5). On the lower route, peak counts for waterfowl were 1,859 on 28 March 2002 and 992 on 20 March 2003 (Figures 6, 7). The following is a discussion of abundance, timing of staging, and composition of waterfowl by tribe for both the upper and lower routes.

Upper Route

Geese (Anserini)

Greater white-fronted geese are the predominant species in this tribe found along the Naknek River. Canada goose abundance is lower and varies more from year to year. Both emperor geese (*Chen canagica*) and brant (*Branta bernicula*) are observed in some years. Greater white-fronted and Canada geese both reached their peak abundance on 23 April 2002 and 18 April 2003 (Table 4, 5). In 2002, peak abundance counts for geese totaled 667 birds with 32% of water abundance on that date (Figure 12) and in 2003 they peaked at 460 birds and 15% of waterfowl abundance on that date (Figure 13). Within two weeks of their peak counts, goose numbers declined significantly in both years. Of total counts in 2002, geese represented 7% of waterfowl and in 2003, 5%.

Swans (Cygnini)

This tribe is represented by one species, tundra swan (*Cygnus columbianus*). Swans are primarily found on the upper route. Their peak abundance of 856 on 9 May 2002, occurring on the same day as the peak abundance of both the dabbling and diving ducks, represented 21% of waterfowl composition (Figure 12). In 2003, swans peaked at 903 birds on 29 April four days after the dabbling ducks peaked and composing 30% of waterfowl (Figure 13). After their abundance increased in early April, swans generally composed more than 20% of waterfowl observed. On the last day of survey in 2003, swans made up 60% of the total 1,047 waterfowl observed. In 2002, swan represented 13% of all waterfowl counted while in 2003 they represented 25%.

Dabbling ducks (Anatini)

Although a few individuals are often observed in early spring, dabbling ducks tend to peak comparatively late and were the second latest peaking tribe, next to diving ducks. Dabbling duck quantities often increase rapidly in conjunction with the peak of northern pintails, the species of greatest abundance on the Naknek River during spring migration, and then numbers drop off quickly. Some species however, especially American wigeon (*Anas Americana*) and northern

Table 3. Date of first observation of principal species on the upper route, Naknek River, Alaska Peninsula, Alaska, 1992-2003.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	**12-Year Avg.**	SD (days)
Greater white-fronted goose	6-Apr	15-Apr	4-Apr	2-Apr	3-Apr	3-Apr	10-Apr	12-Apr	13-Apr	7-Apr	9-Apr	11-Apr	**8-Apr**	4.4
Canada goose	9-Apr	16-Apr	11-Apr	4-Apr	10-Apr	16-Apr	16-Apr	12-Apr	13-Apr	17-Apr	23-Apr	11-Apr	**13-Apr**	4.7
Tundra swan	27-Mar	16-Mar	29-Mar	23-Mar	25-Mar	17-Mar	24-Mar	8-Apr	6-Mar	13-Mar	29-Mar	27-Mar	**23-Mar**	8.6
Eurasian wigeon	21-Apr	1-Apr	31-Mar	9-Apr	10-Apr	16-Apr	10-Apr	17-Apr	3-Apr	10-Apr	15-Apr	15-Apr	**11-Apr**	6.7
American wigeon	15-Apr	2-Apr	13-Apr	9-Apr	28-Mar	16-Apr	22-Apr	17-Apr	13-Apr	5-Apr	9-Apr	11-Apr	**11-Apr**	6.8
Mallard	6-Apr	18-Mar	29-Mar	4-Apr	18-Mar	25-Mar	19-Mar	8-Apr	16-Mar	29-Mar	29-Mar	7-Apr	**28-Mar**	8.3
Northern shoveler	21-Apr	19-Apr	21-Apr	1-May	26-Apr	21-Apr	28-Apr	24-Apr	16-Apr	24-Apr	23-Apr	18-Apr	**23-Apr**	4.2
Northern pintail	2-Apr	11-Mar	29-Mar	2-Apr	25-Mar	3-Apr	22-Mar	17-Apr	20-Mar	13-Mar	9-Apr	7-Apr	**29-Mar**	11.0
American green-winged teal	16-Apr	2-Apr	31-Mar	4-Apr	12-Apr	16-Apr	22-Apr	19-Apr	16-Apr	19-Apr	29-Apr	18-Apr	**14-Apr**	8.5
Greater scaup	10-Apr	16-Mar	31-Mar	9-Apr	29-Mar	21-Mar	24-Mar	9-Apr	23-Mar	3-Apr	15-Apr	27-Mar	**31-Mar**	9.3
Common goldeneye	27-Mar	26-Feb	29-Mar	2-Mar	18-Mar	17-Mar	9-Mar	19-Mar	6-Mar	1-Mar	17-Mar	14-Mar	**13-Mar**	10.0*
Common merganser	27-Mar	26-Feb	11-Mar	2-Mar	18-Mar	17-Mar	9-Mar	19-Mar	6-Mar	1-Mar	17-Mar	14-Mar	**12-Mar**	8.8*
Red-breasted merganser	15-Apr	5-Apr	28-Mar	29-Mar	18-Mar	20-Mar	14-Apr	12-Apr	7-Mar	10-Apr	23-Apr	17-Mar	**1-Apr**	14.3

*resident species present on first day of survey

Table 4. Date of peak abundance of principal species on the upper route, Naknek River, Alaska Peninsula, Alaska, 1992-2003.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	**12-Year Avg.**	SD (days)
Greater white-fronted goose	1-May	21-Apr	21-Apr	21-Apr	12-Apr	21-Apr	22-Apr	25-Apr	19-Apr	19-Apr	23-Apr	18-Apr	**21-Apr**	4.5
Canada goose	17-Apr	19-Apr	21-Apr	20-Apr	17-Apr	19-Apr*	22-Apr	17-Apr	27-Apr	17-Apr	23-Apr	18-Apr	**20-Apr**	3.1
Tundra swan	1-May	21-Apr	21-Apr	21-Apr	1-May	21-Apr	23-Apr	25-Apr	27-Apr	17-May	9-May	29-Apr	**28-Apr**	8.2
Eurasian wigeon	1-May	26-Apr	27-Apr	1-May	3-May	30-Apr	6-May	13-May	19-Apr	10-May	9-May	25-Apr	**2-May**	6.8
American wigeon	1-May	6-May	27-Apr	1-May	8-May	28-Apr	10-May	11-May	3-May	10-May	9-May	5-May	**5-May**	4.8
Mallard	22-Apr	9-Apr	13-Apr	9-Apr	16-Apr	16-Apr	10-Apr	28-Apr	19-Apr	19-Apr	9-Apr	11-Apr	**15-Apr**	6.3
Northern shoveler	13-May	6-May	29-Apr	4-May	18-May	2-May	10-May	13-May	3-May	10-May	9-May	16-May	**9-May**	6.0
Northern pintail	1-May	26-Apr	22-Apr	24-Apr	27-Apr	21-Apr	23-Apr	11-May	27-Apr	8-May	9-May	25-Apr	**29-Apr**	7.0
American green-winged teal	13-May	3-May	27-Apr	1-May	29-Apr	21-Apr	6-May	11-May	27-Apr	10-May	29-Apr	29-Apr	**2-May**	6.7
Greater scaup	8-May	26-Apr	10-May	1-May	8-May	28-Apr	5-May	13-May	2-May	15-May	9-May	14-May	**7-May**	6.2
Common goldeneye	6-Apr	5-Apr	6-Apr	4-Apr	5-Apr	2-Apr	22-Mar	25-Apr	13-Apr	7-Apr	9-Apr	11-Apr	**7-Apr**	7.9
Common merganser	15-Apr	24-Mar	31-Mar	4-Apr	25-Mar	27-Mar	22-Mar	25-Apr	7-Mar	7-Apr	23-Mar	15-Apr	**1-Apr**	13.0
Red-breasted merganser	29-Apr	21-Apr	6-May	1-May	18-Mar	2-May	28-Apr	11-May	19-Apr	2-May	29-Apr	25-Apr	**26-Apr**	13.3

* Same peak count occurred on 17 Apr and 21 April so 19 Apr used in calculation.

Table 5. Peak abundance counts of principal species on the upper route, Naknek River, Alaska Peninsula, Alaska, 1992-2003.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	**12-Year Avg.**	SD (days)
Greater white-fronted goose	502	445	642	846	918	1,343	911	930	1,188	1,208	631	444	**834**	307.2
Canada goose	167	39	126	139	71	54	63	61	157	56	36	16	**82**	51.1
Tundra swan	2,649	1,343	1,719	1,267	763	837	1,177	1,291	1,161	1,074	856	903	**1,253**	514.8
Eurasian wigeon	23	17	52	12	17	28	27	34	19	52	15	70	**31**	18.2
American wigeon	260	84	235	128	141	77	161	339	204	283	135	274	**193**	84.7
Mallard	540	362	289	292	325	491	402	280	173	279	234	271	**328**	105.2
Northern shoveler	201	25	84	66	50	35	223	150	99	288	260	199	**140**	92.0
Northern pintail	11,480	2,610	6,321	1,730	1,488	948	1,974	2,979	3,723	4,750	2,425	3,130	**3,630**	2,883.0
American green-winged teal	543	70	345	172	73	73	98	245	250	269	3	99	**187**	152.3
Greater scaup	263	103	166	109	59	52	122	989	113	268	144	295	**224**	254.2
Common goldeneye	402	273	737	1,106	450	863	380	462	478	482	656	626	**576**	234.7
Common merganser	3,248	2,073	4,462	2,301	1,532	1,372	2,878	1,156	1,146	1,812	2,140	753	**2,073**	1,048.3
Red-breasted merganser	376	96	152	81	132	90	226	670	134	115	119	155	**196**	169.6

Table 6. Date of first observation, date of peak abundance, and peak abundance count of non-principal species on the upper route, Naknek River, Alaska Peninsula, Alaska, 2002-2003.

	First Observation		Date of Peak Abundanc		Peak Abundance Coun	
	2002	2003	2002	2003	2002	2003
Brandt	29-Apr	25-Apr	29-Apr	25-Apr	22	4
Gadwall	23-Mar	15-Apr	23-Mar	25-Apr	1	3
Redhead	23-Apr	27-Mar	23-Apr	27-Mar	1	1
Harlequin duck	9-May	**	9-May	**	2	**
White-winged scoter	**	25-Apr	**	25-Apr	**	2
Black scoter	**	6-May	**	16-May	**	9
Long-tailed duck	**	5-May	**	5-May	**	2
Bufflehead	29-Mar	21-Mar	23-Apr	25-Apr	7	5
Barrow's goldeneye	17-Mar	15-Apr	29-Apr	16-Apr	12	2

**species not observed

Table 7. Date of first observation of principal species on the lower route, Naknek River, Alaska Peninsula, Alaska, 1992-2003.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	**12-Year Avg.**	SD (days)
Greater white-fronted goose	20-Apr	8-Apr	25-Apr	2-May	18-Apr	18-Apr	21-Apr	26-Apr	12-Apr	18-Apr	3-May	25-Mar	**19-Apr**	10.6
Northern pintail	20-Apr	7-Apr	7-Apr	7-Apr	26-Mar	18-Apr	23-Mar	26-Apr	12-Apr	18-Apr	25-Apr	14-Apr	**12-Apr**	10.7
Greater scaup	14-Apr	7-Apr	25-Apr	26-Apr	10-Apr	29-Mar	28-Mar	18-Apr	12-Apr	7-Mar	28-Mar	28-Mar	**7-Apr**	14.3
Black scoter	29-Apr	7-Apr	4-Apr	5-Apr	18-Apr	18-Apr	19-Apr	21-Apr	12-Apr	9-Apr	25-Apr	22-Apr	**16-Apr**	8.3
Long-tailed duck	24-Mar	12-Mar	30-Mar	27-Mar	20-Mar	19-Mar	20-Mar	19-Mar	15-Mar	7-Mar	28-Mar	18-Mar	**20-Mar**	6.8
Common goldeneye	1-Apr	19-Mar	4-Apr	3-Mar	20-Mar	25-Mar	23-Mar	25-Mar	15-Mar	2-Mar	28-Mar	25-Mar	**21-Mar**	10.2
Common merganser	24-Mar	1-Mar	24-Mar	3-Mar	20-Mar	17-Mar	11-Mar	14-Mar	15-Mar	2-Mar	28-Mar	18-Mar	**15-Mar**	9.2
Red-breasted merganser	1-Apr	7-Apr	7-Apr	29-Mar	20-Mar	17-Mar	15-Apr	18-Apr	11-Apr	9-Apr	19-Apr	17-Apr	**7-Apr**	10.8

Table 8. Date of peak abundance of principal species on the lower route, Naknek River, Alaska Peninsula, Alaska, 1992-2003.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	**12-Year Avg.**	SD (days)
Greater white-fronted goose	7-May	25-Apr	25-Apr	2-May	22-Apr	18-Apr	21-Apr	26-Apr	18-Apr	7-May	3-May	2-May	**27-Apr**	6.8
Northern pintail	29-Apr	25-Apr	25-Apr	2-May	4-May	18-Apr	7-May	10-May	28-Apr	7-May	10-May	14-Apr	**30-Apr**	8.4
Greater scaup	14-May	25-Apr	29-Apr	2-May	25-Apr	8-May	14-May	10-May	12-May	16-May	3-May	15-May	**7-May**	7.8
Black scoter	29-May	8-Apr	14-Apr	12-May	9-May	15-May	14-May	27-May	4-May	16-May	10-May	7-May	**9-May**	15.1
Long-tailed duck	3-Apr	8-Apr	29-Apr	26-Apr	10-Apr	2-Apr	14-May	26-Apr	14-Apr	9-Apr	28-Mar	3-Apr	**15-Apr**	13.9
Common goldeneye	1-Apr	7-Apr	7-Apr	7-Apr	20-Mar	1-May	15-Apr	26-Apr	5-Apr	9-Apr	28-Mar	17-Apr	**10-Apr**	11.5
Common merganser	1-Apr	22-Mar	15-Apr	3-Apr	26-Mar	20-Mar	7-Apr	21-Mar	21-Mar	18-Mar	28-Mar	20-Mar	**21-Mar**	24.3
Red-breasted merganser	14-May	25-Apr	25-Apr	3-Apr	18-Apr	28-Mar	7-May	5-May	18-Apr	18-Apr	3-May	2-May	**22-Apr**	15.0

Table 9. Peak abundance counts of principal species on the lower route, Naknek River, Alaska Peninsula, Alaska, 1992-2003.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	**12-Year Avg.**	SD (days)
Greater white-fronte goose	231	135	67	83	16	26	1	28	48	80	5	5	60.4	67.2
Northern pintail	206	41	67	70	24	22	32	184	54	90	25	72	73.9	60.8
Greater scaup	796	231	267	145	407	463	540	417	68	180	73	118	308.8	221.0
Black scoter	180	162	272	44	62	115	66	59	78	85	143	77	111.9	66.6
Long-tailed duck	130	413	406	1,080	1,019	469	280	571	1,335	688	572	102	588.8	383.2
Common goldeneye	40	60	58	57	59	7	31	89	85	88	77	63	59.5	24.5
Common merganser	3,270	1,639	1,762	642	2,176	393	422	1,609	607	974	1,202	985	1306.8	841.7
Red-breasted merganser	822	399	324	63	128	351	157	130	142	238	99	83	244.7	213.2

Table 10. Date of first observation, date of peak abundance, and peak abundance counts of non-principal species on the lower route, Naknek River, Alaska Peninsula, Alaska, 2002-2003.

	First Observation		Date of Peak Abundance		Peak Abundance Count	
	2002	2003	2002	2003	2002	2003
Canada goose	25-Apr	2-May	25-Apr	2-May	15	2
Tundra swan	25-Apr	1-Apr	25-Apr	2-May	2	26
Gadwall	10-May	**	10-May	**	2	**
Eurasian wigeon	25-Apr	**	25-Apr	**,+	2	**
American wigeon	25-Apr	24-Apr	25-Apr	2-May	3	6
Mallard	19-Apr	9-Apr	25-Apr	17-Apr	31	9
Northern shoveler	**	7-May	**	15-May	**	6
American green-winged te	3-May	28-Apr	3-May	7-May	3	16
Harlequin duck	**	9-May	**	9-May	**	2
White-winged scoter	19-Apr	**	19-Apr	**	16	**
Bufflehead	3-May	**	3-May	**	1	**

**species not observed

+ Eurasian wigeon only seen at Flat Nose Henry Road which is not used in species counts.

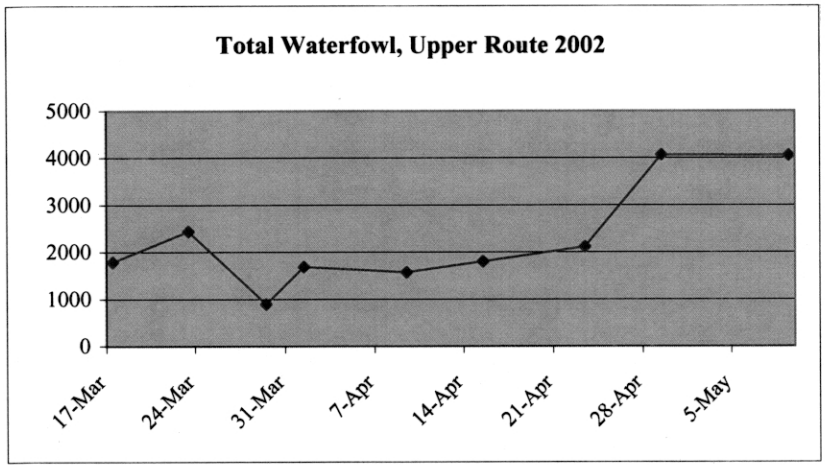


Figure 4. Total waterfowl abundance on the upper route, Naknek River, Alaska Peninsula, Alaska, 2002.

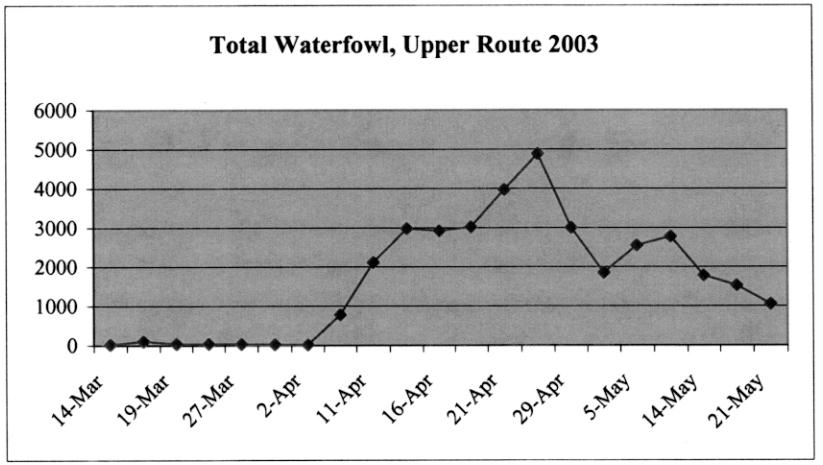


Figure 5. Total waterfowl abundance on the upper route, Naknek River, Alaska Peninsula, Alaska, 2003.

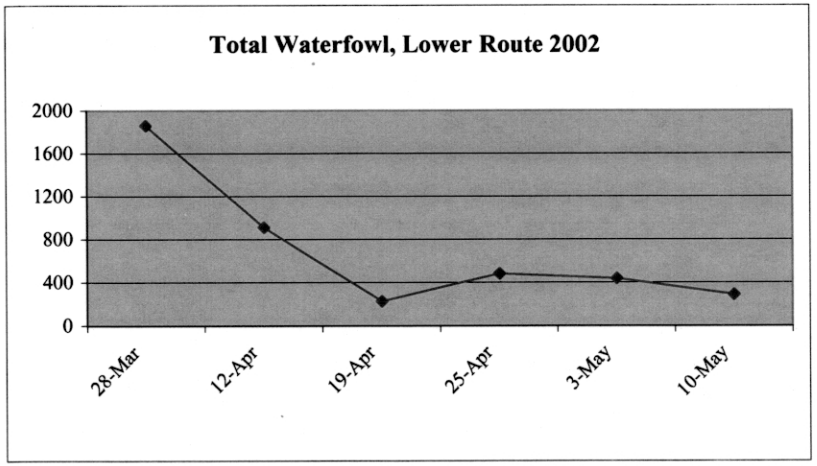


Figure 6. Total waterfowl abundance on the lower route, Naknek River, Alaska Peninsula, Alaska, 2002.

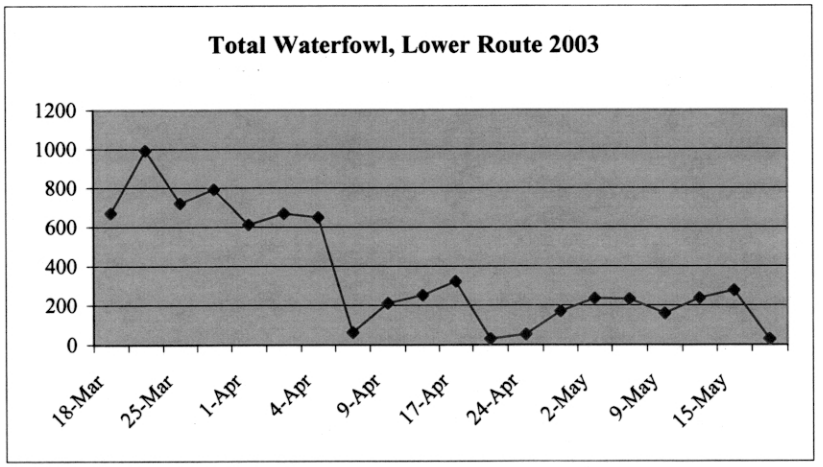


Figure 7. Total waterfowl abundance on the lower route, Naknek River, Alaska Peninsula, Alaska, 2003.

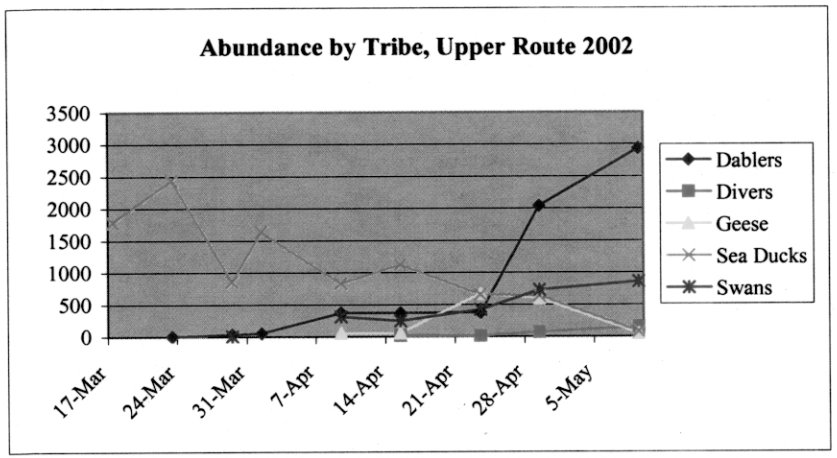


Figure 8. Waterfowl abundance by tribe on the upper route, Naknek River, Alaska Peninsula, Alaska, 2002.

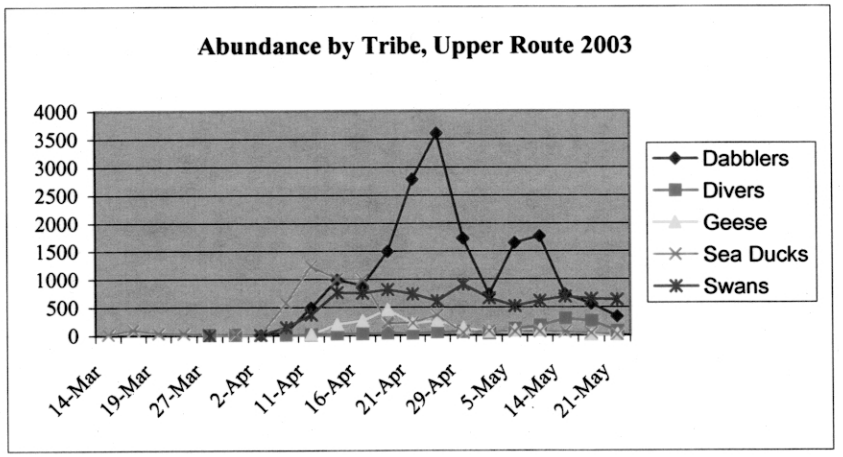


Figure 9. Waterfowl abundance by tribe on the upper route, Naknek River, Alaska Peninsula, Alaska, 2003.

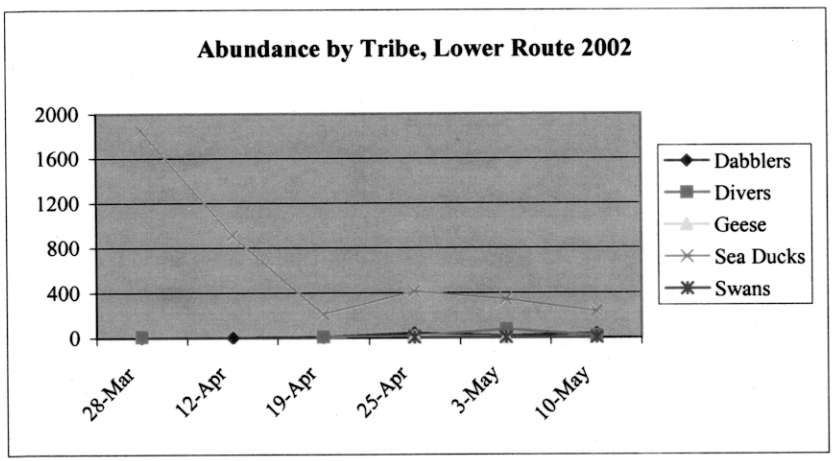


Figure 10. Waterfowl abundance by tribe on the lower route, Naknek River, Alaska Peninsula, Alaska, 2002.

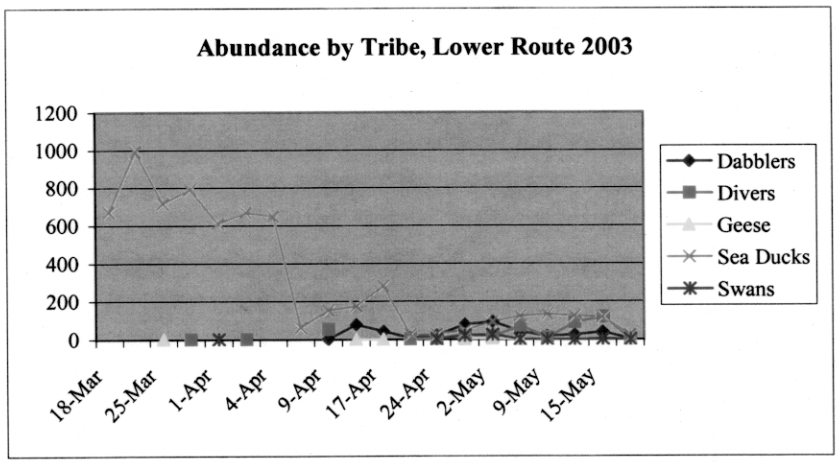
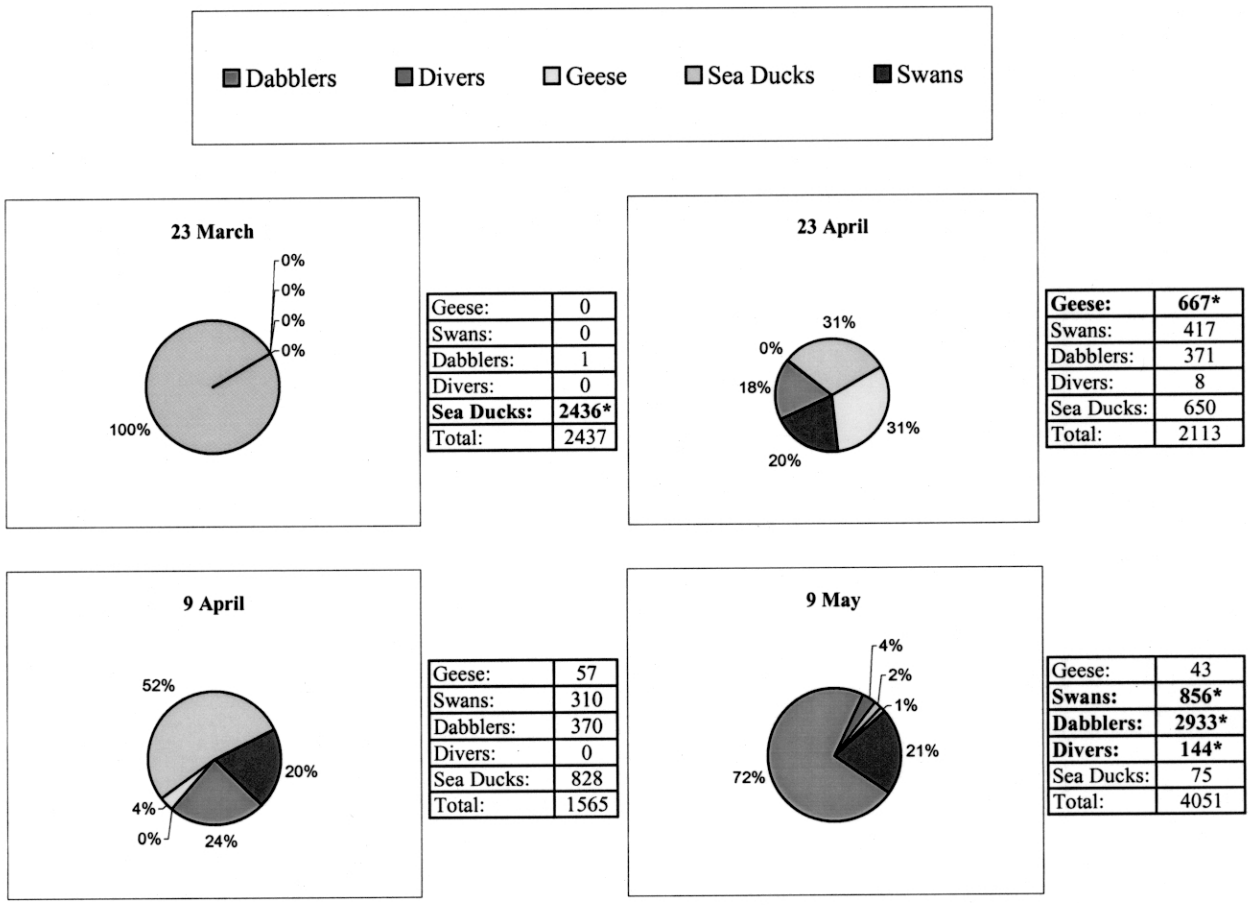


Figure 11. Waterfowl abundance by tribe on the upper route, Naknek River, Alaska Peninsula, Alaska, 2003.

Figure 12. Tribe Composition on the upper route, Naknek River, Alaska Peninsula, Alaska, 2002.



Geese:	0
Swans:	0
Dabblers:	1
Divers:	0
Sea Ducks:	**2436***
Total:	2437

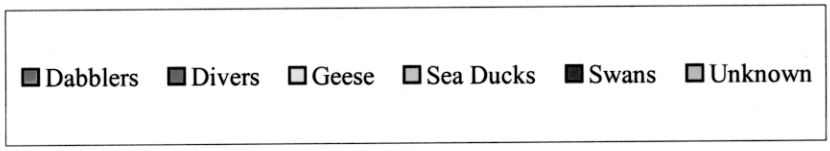
Geese:	**667***
Swans:	417
Dabblers:	371
Divers:	8
Sea Ducks:	650
Total:	2113

Geese:	57
Swans:	310
Dabblers:	370
Divers:	0
Sea Ducks:	828
Total:	1565

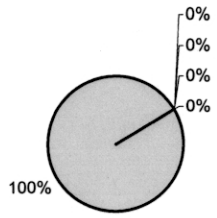
Geese:	43
Swans:	**856***
Dabblers:	**2933***
Divers:	**144***
Sea Ducks:	75
Total:	4051

***=peak abundance**

Figure 13. Tribe Composition on the upper route, Naknek River, Alaska Peninsula, Alaska, 2003.

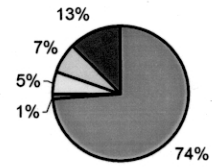


21 March



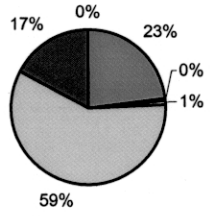
Geese:	0
Swans:	0
Dabblers:	0
Divers:	0
Sea Ducks:	29
Total:	29

25 April



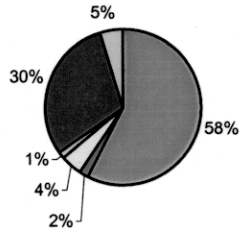
Geese:	260
Swans:	610
Dabblers:	**3596***
Divers:	53
Sea Ducks:	354
Total:	4873

11 April



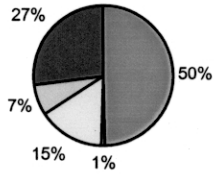
Geese:	18
Swans:	364
Dabblers:	489
Divers:	8
Sea Ducks:	**1230***
Total:	2109

29 April



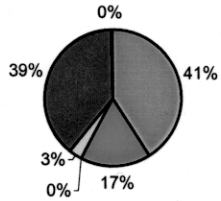
Geese:	129
Swans:	**903***
Dabblers:	1723
Divers:	57
Sea Ducks:	41
Unknown:	140
Total:	2993

18 April



Geese:	**460***
Swans:	813
Dabblers:	1492
Divers:	32
Sea Ducks:	212
Total:	3009

14 May



Geese:	0
Swans:	688
Dabblers:	730
Divers:	**295***
Sea Ducks:	56
Unknown:	4
Total:	1773

***=peak abundance**

shovelers (*Anas clypeata*), continue to show a relatively high abundance through the spring. On the last day of the upper route survey in 2002 (9 May) dabbling ducks represented 72% of waterfowl on the river and recorded their greatest abundance of 2,933 birds (Figure 12). Dabblers showed a much earlier peak in 2003 when their peak abundance of 3,596 was reached on 25 April, representing 74% of the 4,873 waterfowl present (Figure 13). As noted above, the 2002 survey potentially missed late peaks of dabbling and diving ducks. In 1999 (another late spring) surveys were conducted through 21 May. Peaks of many dabblers occur between May 11 and 13 and then fall on May 21 (Figure 9 of Kirk 1999). Generally dabblers fall off at the end of the survey and other groups represent a higher percent composition (see Figure 9 and 13 of 2003 – a more typical year). Dabbling ducks represented 30% of total waterfowl observed in 2002 while they represented 50% of total waterfowl in 2003.

Diving Ducks (Aythyini)

Diving ducks, the least represented of the common tribes and consisting mainly of greater scaup, showed the latest peaking trends and a low relative abundance (Figure 8, 9). They reached their peak abundance of 144 birds, along with dabbling ducks, on 9 May 2002 composing 4% of waterfowl (Figure 12). In 2003, divers were present on all but one survey date after 21 March and numbers increased on each survey until peaking on 14 May at 295 birds and representing 17% of waterfowl observed (Figure 13). On the last day of survey, 21 May, diver numbers were reduced to 68 birds and made up only 6% of total waterfowl. In 2002, diving duck composition for the survey was 1% while in 2003 it was 3%.

Sea Ducks (Mergini)

Of the five tribes of waterfowl found on the Naknek River, sea ducks were the first to reach their peak abundance each spring. In early spring, they accounted for the majority of waterfowl presence on the river. Common mergansers and common goldeneye (*Bucephala clangula*), two species known to winter in the Bristol Bay area (Kessel and Gibson 1978), were observed on the first day of survey each year and were often the only species observed during the first week. In 2002, sea ducks reached their peak abundance on 23 March with a count of 2,436 birds and were the only tribe observed that day except for a lone gadwall (*Anas strepera*). In 2003, more than two weeks later than in the previous year, they peaked at a significantly smaller abundance of 1,230 birds and made up 59% of the total 2,109 birds on 11 April. Sea ducks represented 49% of the total waterfowl counted in 2002 and 15% in 2003.

Lower Route

Geese

This tribe is observed infrequently and in low abundances on the lower route and only greater white-fronted and Canada geese have been observed. Their presence was documented on two days in 2002 and three days in 2003, with counts totaling no more than 15 birds. Total composition for this tribe was less than 1% in both years.

Swans

Like geese, swans are observed infrequently and in low abundance on the lower route. A season total of four birds were observed on two dates in 2002 and a total of 51 were observed on five dates in 2003. They accounted for less than 1% composition in both years.

Dabbling Ducks

Although contributing to a majority of birds on the upper route, abundances of dabbling ducks sharply contrast on the lower route. Their peak abundance count of 39 birds on 25 April 2002 and 92 birds on 2 May 2003 accounted, respectively, for 8% and 39% of waterfowl observed on those days (Figures 14, 15). Dabbling ducks, in most years including 2003, showed later peak abundances on the lower route than the upper route, although in 2002 they peaked a week and a half earlier on the lower route. Total dabbling duck composition was 2% in 2002 and 6% in 2003.

Diving Ducks

Diving ducks, as on the upper route, are represented almost entirely by greater scaup. Like sea ducks, diving ducks are observed in greater abundance on the lower route. They reached their peak in 2002 on 3 May and represented 17% of total waterfowl while in 2003 they peaked on 15 May and represented 43% of waterfowl observed (Figures 14, 15). This was consistent with their date of peak abundance on the upper route in both years. Diving duck composition for the survey equaled 3% in 2002 and 5% in 2003.

Sea Ducks

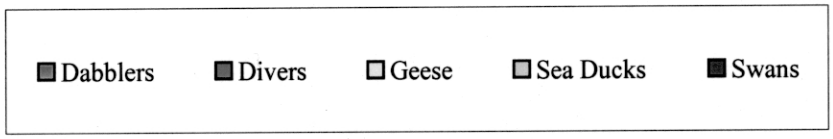
On the lower route, sea ducks were by far the most abundant tribe, accounting for 94% of waterfowl counted in 2002 and 88% in 2003. As was the case on the upper route, they reach their peak abundance earlier than other tribes. Unlike other tribes, sea ducks were observed in peak abundance about the same time on the lower route as on the upper route. On 28 March, the first day of survey in 2002, sea duck counts peaked at 1,851 birds and represented 99.5% of waterfowl abundance. In all surveys on the lower route in 2002, sea duck abundance was near or above 80%. The same trends were observed in 2003 when sea ducks composed over 99% of waterfowl in all counts up to April 9 including their peak of 992 on 20 March when they were the only tribe represented. Abundance of sea ducks dropped to 26% on 28 April when other tribes were peaking, but was then present in greater than 40% abundance through the rest of the survey.

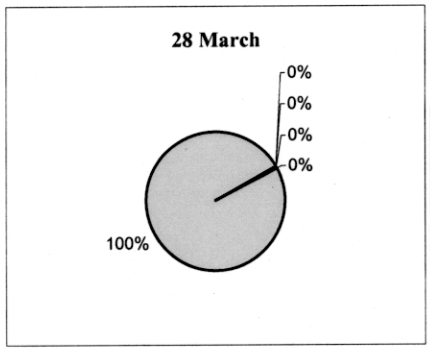
Species Accounts

Upper Route

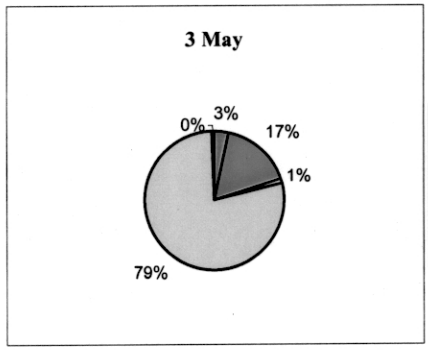
During ground surveys since 1992, 28 species of waterfowl have been observed on the upper route (See Appendix 3). Some species were observed on only one or few occasions and in low abundances while others were observed numerous times each year and in relatively high abundance. The thirteen species designated as principal for the upper route were seen every year, noted on more than one date and at more than one location, and their 12-year average peak abundance was

Figure 14. Tribe Composition on the lower route, Naknek River, Alaska Peninsula, Alaska, 2002.

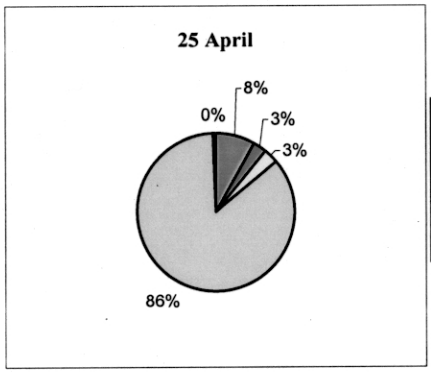




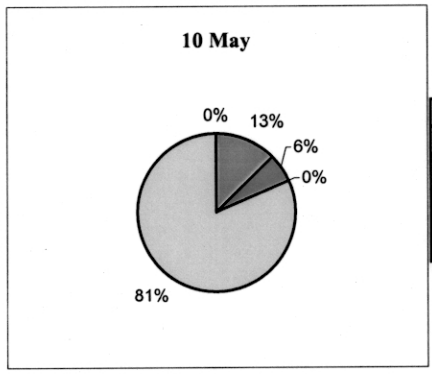
Geese:	0
Swans:	0
Dabblers:	0
Divers:	8
Sea Ducks:	**1851***
Total:	1859



Geese:	5
Swans:	2
Dabblers:	14
Divers:	**73***
Sea Ducks:	341
Total:	435



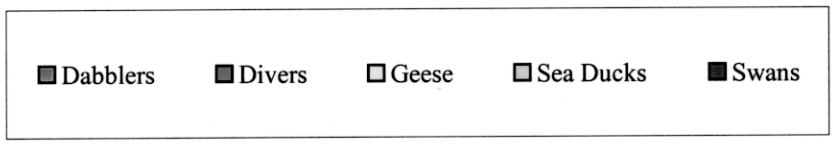
Geese:	**15***
Swans:	2
Dabblers:	**39***
Divers:	13
Sea Ducks:	410
Total:	479



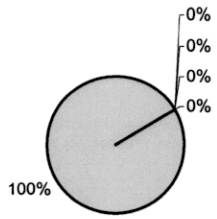
Geese:	0
Swans:	0
Dabblers:	36
Divers:	17
Sea Ducks:	234
Total:	287

***=peak abundance**

Figure 15. Tribe Composition on the lower route, Naknek River, Alaska Peninsula, Alaska, 2003.

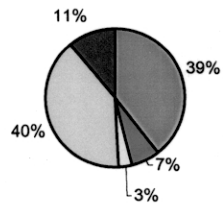


20 March



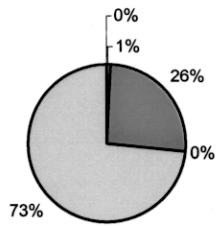
Geese:	0
Swans:	0
Dabblers:	0
Divers:	0
Sea Ducks:	**992***
Total:	992

2 May



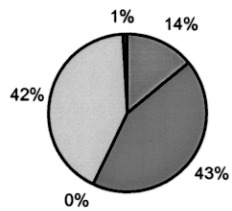
Geese:	**7***
Swans:	**26***
Dabblers:	**92***
Divers:	16
Sea Ducks:	93
Total:	234

9 April



Geese:	0
Swans:	0
Dabblers:	2
Divers:	54
Sea Ducks:	154
Total:	210

15 May



Geese:	
Swans:	**2**
Dabblers:	39
Divers:	118
Sea Ducks:	116
Total:	275

***=peak abundance**

greater than 25 birds. These species and are underlined. For each of the principal species, information regarding their dates of first arrival, dates of peak abundance, and peak abundances in 2002 and 2003 as compared to historical trends and patterns is found below (Tables 3-5). For non-principal species, the same data is discussed, although historical averages were not calculated (Tables 6-8). The survey point at which each species was first observed in 2002 and 2003 and the abundance recorded on that day is generally noted.

Greater white-fronted geese are the most common species of goose on the upper route. They were first observed at Grassy Point (SP 13), Paradise Point, and Big Creek on 9 April 2002 and at Paradise Point on 11 April 2003. Greater white-fronted geese show a strong affinity to their date of first observation and their date of peak abundance (SD = 4.4 and 4.5, respectively). The average day of first arrival is 8 April and the average day of peak abundance is 21 April. Peak numbers for greater white-fronted geese, 631 on 23 April 2002 and 444 on 18 April 2003, were well below the 12-year average of 834 (SD = 307.2) although 1993 through 1995 showed similar lows before rising to the 12-year high of 1,343 in 1997.

Emperor geese were not observed in 2002 or 2003 and have only been sighted on three occasions and in two years during the history of the ground surveys (Appendix 3). A single bird was observed on 11 April and 24 April 1995 at Paradise Point and a flock of 29 was observed at the same location on 8 April 1998.

Canada geese were observed each year during the survey, although quantities and peak abundances are variable. First observation and peak observation date were both 23 April 2002; observations at four locations resulted in a peak abundance of 36 birds. In 2003 they were first observed on 11 April at Paradise Point and Big Creek and reached a peak of 16 birds on 18 April. Like greater white-fronted geese, variation around the average date of first arrival and date of peak abundance is relatively small (SD = 4.7 and 3.1, respectively). The 12-year average date of first arrival is13 April and 20 April is the average date of peak abundance. Date of peak abundance is often similar to greater white-fronted geese. Peak abundances have been greater than 125 birds in four years with a high count of 167 in 1992 and a low of 16 in 2003 with an average of 82 birds (SD = 51.1). On 11 April 2003, at both Paradise Point and Big Creek, what was identified as an Aleutian Canada goose was observed paired with what was believed to be a cackling Canada goose.

Brant were observed at four locations on 29 April and at Big Creek on 9 May 2002. In 2003 they were observed on 25 April at Lake Camp. Brant have also been sighted in three other years at six different locations. The highest abundance since the beginning of ground surveys was in 2002 with a total of 22 birds, 15 of which were counted at Paradise Point.

Tundra swans are among the most common species of spring staging waterfowl on the upper Naknek River. They also arrive comparatively early and, unlike most species, after reaching their peak they remain relatively abundant through the end of the survey with counts of often greater than 500 birds into the middle of May. Tundra swans were first observed from the Big Creek overlook in both 2002 and 2003. The dates of first observation were similar: 29 March 2002 and 27 March 2003. The 12-year average date of first observation is 23 March (SD = 8.6). Although peak counts were relatively similar in 2002 and 2003, the dates of peak abundance differed by 11 days. In 2002, tundra swans peaked at 856 on 9 May while in 2003 they peaked at 903 on 29 April. The 12-year

average date of peak abundance was 28 April (SD = 8.2). Both peak abundances were lower than the 12-year average of 1,253 (SD = 514.8). The 9 May 2002 date of peak abundance was the second latest recorded in 12-years, although it was still a full week earlier than in 2001 when swans peaked at 1,074 birds on 17 May.

Gadwalls, categorized as uncommon spring migrants on the Alaska Peninsula (Kessel and Gibson 1978), were observed once in 2002 on 23 March from the Big Creek overlook. In 2003, they were observed on five occasions, the first being at Paradise Point on April 15. The peak abundance count of 3 was documented on 25 April and 14 May. Gadwalls have been observed in every year except 1993 but rarely reach high numbers, as the largest peak abundance was 13 on 28 April 1997.

Eurasian wigeon are considered uncommon spring migrants to the Alaska Peninsula (Kessel and Gibson 1978). They were observed in every year of the survey and were first observed in both 2002 and 2003 on 15 April from the Big Creek overlook. Their 12-year average date of first arrival is 11 April (SD = 6.7). Eurasian wigeon peaked on 9 May at 15 birds in 2002 and on 25 April at 70 birds in 2003. The 12-year average date of peak abundance is 2 May (SD = 6.8) and the 12-year average peak abundance is 31 birds (SD = 18.2). The highest peak abundance of Eurasian wigeon was detected in 2003, while 2002 showed the second lowest. In the ten previous years, the largest peak abundance was 52 in 1994 and the smallest was 12 in 1995. The majority of Eurasian wigeon sightings were of males. It is believed that on occasion, male Eurasian wigeon were observed to be paired with female American wigeon, although it is difficult to distinguish between the females of these species.

American wigeon were first observed in 2002 on 9 April from the Big Creek overlook and in 2003 on 11 April at Paradise Point and Big Creek. The 12-year average date of first observation is 11 April (SD = 6.8). The date of peak abundance in 2002 was 9 May at 135 birds and in 2003 on 5 May at 274 birds. The 12-year average date of peak abundance is 5 May (SD = 4.8) with an average peak of 193 birds (SD = 84.7). Similar to tundra swans and greater scaup, American wigeon numbers tend to stay high well into the month of May and through the end of the survey. In 2003 there were 87 counted on May 21, the last survey day.

Mallards on average, are the earliest arriving species of dabbling duck on the upper route. They were first observed from the Big Creek overlook on 29 March in 2002. This is only one day later than the 12-year average of 28 March (SD = 8.3). In 2003 the first mallards were not observed until 7 April when they were counted at Paradise Point, Big Creek and Rapids Camp (SP 16A). The only year that showed a later first arrival date than 2003 was in 1999 when a pair of mallards was first observed at Rapids Camp on 8 April. As in six of the 10 previous years, mallards were the first of the dabbling ducks to arrive on the upper river, although the first arrival date was the same for mallards and northern pintail in 2003. In 2002, mallards peaked on 9 April with an abundance of 234 birds. This is six days ahead of the 12-year average of 15 April (SD = 6.3) and below the average peak abundance of 328 (SD = 105.2). Although showing a very late first arrival date, mallards in 2003 peaked on 11 April at 271 birds. In 1999, when they first arrived only a day later than in 2003, mallards did not reach their peak until 28 April. If ranked in order of highest to lowest, the years from 1999 through 2003 show the 5 lowest peak abundances over the 12 years of survey.

Northern shovelers were one of the latest arriving and latest peaking species of waterfowl during spring migration. They were first observed in 2002 at Paradise Point on 23 April and in 2003 at Rapids Camp on 18 April. Their 12-year average date of first arrival is 23 April (SD = 4.2). Their arrival date is the least variable of all species analyzed. Of the principal species, they were the last to arrive, or tied with the latest, in every year except 2002, when they were first observed six days earlier than American green-winged teal (but see below). Both 2002 and 2003 showed peak abundance counts that were well above the 12-year average of 140 (SD = 92). On 9 May 2002, 260 birds were counted and on 16 May 2003, 199 birds were counted. The only peak abundance count greater than that of 2002 was on 10 May 2001 with a count of 288. Peak counts during the last six years have generally been higher than counts during the first six years of the survey. The 12-year average date of peak abundance, 9 May, is more variable than their arrival date (SD = 6.0), but still less than many other principal species.

Northern pintails (*Anas acuta*), the most abundant species of waterfowl on the Naknek River, were first observed in 2002 on 9 April, at both Paradise Point and Big Creek; their numbers totaled 134 for the day. In 2003, they were first observed on 7 April at Rapids Camp, but with a count of only 2. Four days later, on 11 April, they were observed at Paradise Point and Big Creek with a total of 207. Dates of first observation in 2002 and 2003 were more than a week later than the average of 29 March. Curiously, pintails show the second greatest variance in date of first arrival (SD = 11.0), the largest of any dabbling duck and second only to red-breasted mergansers. They vie with Mallards for the position of first arriving dabbler, which are observed, on average, one day earlier. Date of peak abundance in 2002 was considerably late (9 May) and second only to 1999 when the peak was on 11 May. In 2003, northern pintails peaked on 25 April, four days earlier than the 12-year average of 29 April (SD = 7.0). This is noteworthy considering their late date of first observation in 2003. Their peak abundance was 2,425 birds in 2002 and 3,130 in 2003. Both years peaked at counts lower than the 12-year average of 3,630 (SD = 2,883). However, only two years following the 12-year peak of 11,480 in 1992 have shown above average counts.

American green-winged teal are the second latest arriving and one of the latter peaking species in spring migration. They were observed only once in 2002 when three were counted on 29 April at the USFWS Dock. In 2003 they were first observed on 18 April from the Big Creek overlook, which is four days later than their 12-year average date of first observation of 14 April (SD = 8.5). The spring of 2002 proved to be an uncharacteristic one for American green-winged teal as they are typically observed on each survey between their date of first observation and the third week of May. The 12-year date of peak abundance is 2 May (SD = 6.5). The peak abundance of American green-winged teal in 2003 was 99 on 29 April, still lower than the 12-year average of 187 (SD = 152.3). In each of the three years prior to 2002, peak abundances were greater than 225 birds and never before 2002 were they below 70.

Baikal Teal (*Anas formosa*) have been observed in 2000 only. One male was noted at King Salmon Creek on 3 May. Baikal teal are extremely rare in the Bristol Bay area and this bird probably represented a 50-year record (D.Gibson, P.C.).

Canvasbacks (*Aythya valisineria*), considered rare migrants in the Bristol Bay area (Kessel and Gibson 1978), were not observed during surveys in either 2002 or 2003, although they have been observed in all other years of the survey and were observed at Lake Camp during an unofficial

survey on 26 March 2003. On 11 May 1999, a survey-high peak abundance of 42 birds was observed.

Redheads (*Aythya americana*), categorized as uncommon to rare spring migrants to the Peninsula (Kessel and Gibson 1978), have been observed in nine of the past 12 years. In 2002, a single was observed on 23 April from the Big Creek overlook and in 2003; a female was observed on 27 March and 31 March at Lake Camp.

Ring-necked ducks (*Aythya collaris*) are categorized as casual visitors to Southwestern Alaska (Kessel and Gibson 1978) and were not observed in 2002 or 2003. They were observed on four occasions between 22 April and 13 May in 1992 and singles were observed at Big Creek in 1994, Paradise Point in 1997 and at Rapids Camp in 1999, all during the month of April.

Tufted Duck (*Aythya fuligula*) are not noted for Southwestern Alaska (Kessel and Gibson 1978, Gibson & Kessel 1997), but are noted as casual spring migrant in the northern Bering Sea and southcoastal Alaska including Kodiak (Kessel & Gibson 1978). They have only been observed on the Naknek River in two years, 1997 at Grassy Point and Big Creek and in 1998 at Paradise Point.

Greater scaup are the only commonly occurring species of diving duck on the Naknek River and show comparatively high abundances on both the upper and lower routes. Greater scaup were first observed on 15 April at Big Creek in 2002 and on 27 March at Lake Camp in 2003. Their 12-year average date of first observation is 31 March and is relatively variable (SD = 9.3). The latest date of first observation was recorded in 2002 and the next latest was in 1995 and 1999 when they were first sighted on 9 May. Greater scaup reached their peak abundance of 144 on 9 May in 2002 and 295 on 14 May in 2003. Their average date of peak abundance is 7 May (SD = 6.2) and the average peak abundance is 224 birds (SD = 254.2). Greater scaup are the second latest peaking species on the Naknek River.

Steller's eiders (*Polystica stelleri*) were observed in abundances of one to two birds in 1994, 1999, and 2001 at four different locations on the upper route. They were not observed in either 2002 or 2003 although an injured male was recovered near the road above the Big Creek overlook in early April 2003. The bird was sent to the Bird Treatment and Learning Center in Anchorage and then subsequently to the Seward Sea Life Center.

Harlequin ducks (*Histronicus histronicus*) were observed on the upper route at the mouth of King Salmon Creek on 9 May 2002 and were not sighted in 2003. In previous years, they have been observed on one occasion each in 1992, 1994, and 1997, between 5 May and 19 May.

White-winged scoters were observed on the upper route, for the first time since the beginning of the survey, on 25 April 2003 at Grassy Point.

Black Scoters (*Melanitta nigra*), although common on the lower route, are observed sporadically and in low numbers on the upper route. They were observed in small quantities in all years except 1995 and 2002. In 2003 black scoters were observed on 6 May, 14 May and 16 May at Grassy Point and Big Creek in abundances of three, seven, and nine, respectively.

Long-tailed ducks (*Clangula hyemalis*), like black scoters, can be observed in large concentrations at Kvichak Bay, but are far less common on the upper route. Their presence was not documented in 2002; a pair was observed at Grassy Point on 5 May in 2003. Long-tailed ducks were observed in four of the five years previous to 2002 with a highest peak abundance of 12 birds. Observation of long-tailed ducks on the upper route was not documented prior to 1997.

Bufflehead (*Bucephala albeola*) are observed each year on the upper route, although peak abundances of more than 10 birds are not common. They were first observed at Big Creek on 29 March in 2002 and at Lake Camp on 21 March in 2003 and reached a peak abundance of seven birds on 23 April 2002 and five birds on 25 April 2003.

Common goldeneye are documented as winter residents of the Bristol Bay area (Kessel and Gibson 1978) and have been observed on the first day of the survey in all years and the last day of the survey in most years. They were observed at six locations on 17 March in 2002 and at Paradise Point and Lake Camp on 14 March in 2003. The average date of first observation is reflective more of the initiation of the survey than on the biology of the birds. Common goldeneye peaked on 9 April with an abundance of 656 birds in 2002 and on 11 April 2003 with an abundance of 626 birds. On average, peak abundances are reached on 7 April (SD = 7.9) and average peak count was 576 birds (SD = 234.7).

Barrow's goldeneye (*Bucephala islandica*) were observed in all years of the survey except 1992 and are usually sighted on a minimum of three to five surveys per year. They were observed on three days with a peak abundance of 12 on 29 April 2002 and on three days with a peak abundance of two on 16 April and 5 May 2003. The survey-high peak abundance was recorded on 29 March 1994 with a count of 15 birds.

Common mergansers are known winter residents in Bristol Bay (USFWS, Christmas Bird Count data 1986-2003) and, like common goldeneye, were observed on the first day of the survey in all years. They were usually found anywhere that open water existed and show the earliest peak abundance date of all species. They were observed on the first day of survey from all survey points other than Lake Camp in 2002 and from USFWS dock and Lake Camp in 2003. Although they are often present into May, abundances are significantly reduced after the average date of peak abundance on 1 April (SD = 13.0). In 2002, common mergansers reached a peak of 2,140 on 23 March while in 2003 they showed a 12-year low peak abundance of 753 birds on 15 April. Average peak abundance is 2,073 (SD = 1048.3). In 2003, a peak abundance count of fewer than 1,100 birds was documented for the first time.

Red-breasted mergansers show the greatest variance of all species in both date of first observation and date of peak abundance, (SD=14.3 and 13.3, respectively). Red-breasted mergansers were first observed at King Salmon Creek and Big Creek on 23 April 2002 while they were first sighted at Lake Camp on 17 March 2003. The 12-year average date of first observation falls between these two days on 1 April. Although days of first observation in 2002 and 2003 were over a month apart, red-breasted mergansers reached their peak abundances on 29 April in 2002 and 25 April in 2003 with counts of 119 and 155 birds, respectively. The average peak abundance count is 196 (SD = 169.6).

Lower Route

Compared to the upper route, the lower route of the spring ground surveys shows few trends or patterns. Most of the species considered principal on the upper route were observed on the lower route in lower numbers and showed few patterns in arrival, peak, or abundance. Many species are observed for the first time on the lower route a month or more later than on the upper route. Habitat is different, and likely, preferred sources of food are less available. Principal species on the lower route are those that are observed in all years with 12-year average peak abundances of greater than 40 birds. In contrast to the upper route, there are only eight principal species on the lower route, four of which are sea ducks. Six of the principal species on the lower route are considered principal on the upper route. For each of the principal species, their dates of first arrival, dates of peak abundance, and peak abundances in 2002 and 2003 is presented with comparison to historical trends (Tables 7-9). For non-principal species, the same data is presented (Table 10), although historical averages were not calculated. Relative abundance for historic years is presented in Appendix 3. Counts on the lower route are highly variable, due mostly to weather conditions and visibility. As species abundance is often lower, the presence or absence of a species on a given survey or in a given year is of greater importance than yearly trends in arrival and abundance.

Greater white-fronted geese were observed only on 3 May in 2002 with a count of five birds. They were observed first on 25 March in 2003 and sporadically until they peaked on 2 May also with a count of five birds. The average date of first arrival is 19 April (SD = 10.6) and average date of peak abundance is 27 April (SD = 6.8). They were the least variable species in date of peak abundance. The average peak abundance was 60.4 (SD = 67.2); other than 1998, the 2002 and 2003 peaks of five birds were the lowest observed in all years. Their low abundance on lower route contrasts with their high abundance on upper route.

Canada geese have been observed in eight years since 1992, including each of the last five with a high count of 30 in 2000, although in most years counts are often less than six birds. A flock of 15 birds was observed at Wolverine Road on 25 April in 2002 and a pair was observed at Paul's Creek on 2 May 2003.

Tundra swans were observed on two surveys in 2002 on 25 April and 3 May and on five surveys in 2003 between 1 April and 15 May with peak abundances reaching two and 26, respectively. They are observed in all years of the survey although, in some years, on as few as one or two days of observation.

Gadwalls, an uncommon species on the upper route, are even less common on the lower route. They have been observed in six years, including 10 May 2002. Their historic peak abundance was four in 1998. They were not observed on the lower route in 2003.

Eurasian wigeon were observed in eight years of the survey, including 25 April 2002 when two were observed at Wolverine Road. In 2003 this species was only observed at Flat Nose Henry Road which is not included in the analysis. The 12-year high peak abundance for Eurasian wigeon was 12 birds in 1999.

American wigeon were observed in all years. Three birds were sighted on 25 April 2002. They were sited on seven occasions with a peak abundance of six on 2 May 2003.

Mallards were present on the lower route in all years and were observed on four surveys between 19 April and 10 May with a peak abundance of 31 birds on 25 April in 2002. In 2003 they were observed on nine surveys between 9 April and 13 May with a peak abundance of nine on April.

Northern shovelers were observed in nine years of the survey. They were not observed in 2002 and were sighted on three surveys in 2003 between 7 May and 15 May with a peak abundance of six on the last day observed.

Northern pintail, the most common species on the upper route, was the sixth most common species on the lower route. They were first observed on 25 April 2002 and 14 April 2003 with the average date of first observation being 12 April (SD = 10.7). They peaked at 25 birds on 10 May 2002 and 72 birds on 14 April 2003. While their date of first observation on lower route is approximately two weeks behind the date on upper route, the 12-year average date of peak abundance of 30 April (SD = 8.4) is only one day later than on the upper route (29 April). Their 12-year average peak count is 73 (SD = 60.8).

American green-winged teal were observed in all years other than 1995. Three were observed on 3 and 10 May 2002. In 2003 they were observed on six occasions between 28 April and 15 May with a peak abundance of 16 birds on 7 May.

Canvasbacks on the lower route, as on the upper route, are observed infrequently and in small numbers. They were observed in 1992, 1996, and 1997 with an abundance of two birds in each year.

Greater Scaup, the third most abundant species on the lower route, were first observed at Kvichak Bay on 28 March 2002 and at the Overlook (SP 2) on the same day in 2003. The average date of first observation, 7 April, shows he most variation of the principal species (SD = 14.3). Average date of peak abundance (7 May), however, is one of the least variable of the principal species (SD = 7.8), and occurs on the same day as on the upper route. Twelve-year average peak abundances for greater scaup on the lower route (x = 309, SD = 221) are considerably larger than that of the upper route. The peaks of 2002 and 2003, which were 73 birds and 118 birds respectively, are much lower than average. The observation that lower route numbers were low contrasts with the counts on upper route which were slightly above average in 2003.

Steller's eiders have only been observed on two occasions in 2001 with counts for the survey totaling three birds.

King eiders (*Somateria spectabilis*) have not been sighted since 1999 but were observed at Kvichak Bay in seven of the first eight years of the survey. They have been observed as early as 25 March in 1993 and as late as 25 April in 1994. Peak abundances in years that they were observed, range from one in 1992 to 1500 in 1994.

Harlequin ducks were observed at Wolverine Road (SP 8) on 9 May in 2003. Previously, as in 2003, they have been observed in pairs once each year during early May in 1992, 1996, 1997 and 1999.

Surf Scoters (*Melanitta perspicillata*) were observed between 25 April and 14 May in 1992, 1994, 1996 and 1997 with peak abundances ranging from to two birds in 1997 to 36 birds in 1992.

White-winged scoters have been observed in three years including 2002 when 16 were observed on 19 April 2002.

Black Scoters are the latest arriving and peaking species of sea duck and are most commonly observed from the three survey points nearest to Kvichak Bay. They were first observed on 25 April at End of State Road (SP 3), the Overlook, and Kvichak Bay in 2002 and on 22 April at End of State Road and Kvichak Bay in 2003. The average date of first arrival for black scoters is 16 April (SD = 8.3). They peaked in 2002 at 143 birds on 10 May and at 77 birds on 7 May in 2003. The average peak abundance is 112 birds (SD = 66.6) and average date of peak abundance is 9 May (SD = 15.1).

Long-tailed ducks are known to winter in the Bristol Bay area and are observed on the first day of survey in most years so their average date of first observation is reflective of the start date of the survey. They peaked on 28 March at 572 birds in 2002 and on 3 April at 102 birds in 2003. The average date of peak abundance is 15 April and is relatively variable (SD = 13.9). The average peak abundance is 589 (SD = 383.2). Peak abundance dates and counts are likely highly variable due to the irregularity in weather and visibility at Kvichak Bay.

Bufflehead were observed in seven years with quantities of no greater than six birds. A single was sighted on 3 May 2002 at Monsen Park (SP 6).

Common goldeneyes are a relatively common species on the lower river being observed on the majority of survey days. They were first observed on 28 March 2002 and 25 March 2003 with an average date of first observation of 21 March (SD = 10.2). Although they are regularly seen on the first date of survey on the upper route this is not always the case for lower. They reached their peak abundance of 77 birds on 28 March 2002 and of 63 birds on 17 April 2003. Their 12-year average peak abundance date is 10 April (SD = 11.5) and average peak abundance counts was 60 birds (SD = 24.5).

Barrow's goldeneyes have been observed in abundances of one to three birds in four years with dates of observation ranging between 7 April and 12 May. They were not observed in 2002 or 2003.

Common mergansers are the most common species on the lower river. They are observed on the first day of survey in all years. Their average peak abundance date of 21 March, however, is highly variable (SD = 24.3). They reached their peak abundance of 1,202 on 28 March in 2002 and 985 on 20 March in 2003. Both peak counts are below the 12-year average of 1,307 (SD = 841.7), although three of the ten previous years have shown peak abundances at less than 650 birds.

Red-breasted mergansers are the second-latest arriving and peaking sea duck behind black scoters and, unlike most species, show less variance in their first arrival dates (SD = 10.8) on the lower route

than the upper route (SD = 14.3). They were first observed on 19 April 2002 and on 17 April 2003, more than a week and a half later than the average of 7 April. Red-breasted mergansers' 12-year average date of peak abundance is 22 April (SD = 15.0) and the count averages 245 birds (SD = 213.2). In 2002 and 2003 peak abundances were later and lower than average. In 2002, they reached their peak abundance of 99 birds on 3 May and in 2003 they peaked a day earlier on 2 May at 83 birds.

Disturbance

Disturbance to waterfowl was monitored for 57 hours 7 minutes 10 seconds between 11 April and 22 May 2003. Of this, 28 hours 1 minute 10 seconds occurred during 24 ground surveys at 238 total stops and 29 hours 6 minutes occurred during 28 disturbance-only surveys at two locations. A total of 135 potential disturbance events were documented: 104 man-made, 28 natural, and 3 unknown (Table 11). Four events occurred when no waterfowl were present at the observation point. The disturbance events were fairly evenly distributed between ground (71 events) and disturbance-only (64) surveys. Of the man-made disturbance events there were 46 aircraft, 19 watercraft, five land vehicles, 33 observer-related sources, and one loud noise of unknown source. Bald eagles accounted for all the natural disturbances (13 adult eagles, 16 juvenile).

During analysis, effects were tallied by major waterfowl group (ducks or geese\swans). There was one event where the species could not be counted separately before the event occurred, thus the category ducks\geese was used for this event (no swans were present). About twice as many ducks as geese\swans were present during the surveys prior to the disturbance events. The number of events for which each group of waterfowl was present is given in both Table 11 and Table 12. The number of waterfowl present before the disturbance and the number disturbed are presented by waterfowl group and disturbance type in Table 12.

There was a considerable difference in the effect of disturbance sources on ducks versus geese\swans (Table 12). Ducks showed greater susceptibility to most disturbance sources. Approximately 40% of ducks present versus approximately 21% of geese\swans were disturbed by all events. Over half the ducks present were disturbed by C-130 aircraft, by the unidentified loud noise, by the observer in the truck and on foot (but see below), by the non-motorized boat (but see low total numbers), by the trucks with trailers, by bald eagles, and by unknown sources. Over half the geese\swans were disturbed by the observer in the truck or on foot, by dirt bikes and by trucks with trailers. Dirt bikes (one event) and motorized boats (12 events) were the only disturbance events that disturbed a significantly (more than 10% difference) higher proportion of geese\swans than ducks.

For those disturbances with only one event in their class, typically 100% or 0% of the birds present were disturbed. These will be disregarded as representing small and potentially unrepresentative samples. Disturbance was also relatively high for "unknown" sources, but it is difficult to discuss an event that cannot be described. The next highest category of disturbance for both ducks and geese\swans was the observer on foot or in the truck. This ratio over-estimates observer-caused disturbance because both number of events and number of waterfowl before disturbances is under represented. The observer only recorded "events" when approach to the counting point caused disturbance. Only 28 approaches were documented although we know that the observer approached

Table 11. Summary of disturbance data, Naknek River, Alaska Peninsula, ALaska, 2003. Reports number of disturbance events by general type, if detected during ground or disturbance surveys, number of events for which each waterfowl group were present, total number of waterfowl present before disturbances, and number disturbed.

	Disturbance			Count of Events With:				Waterfowl Count	
Dist Type	Total	Ground Surveys	Disturbance Surveys	Ducks	Geese\ Swans	Ducks\ Geese	No Waterfowl	Before Disturbance	Waterfowl Disturbed
Aircraft - large, C 130	3	2	1	3	3			983	148
Aircraft - large, Jet (737)	4	1	3	3	4			788	125
Aircraft - large, twin prop	3	1	2	3	3			557	12
Aircraft - medium, twin prop	10	5	5	6	8			4,215	266
Aircraft - small, jet	1	0	1	1	1			310	0
Aircraft - small, twin prop	2	2	0	2	1			973	26
Aircraft - small, single prop	23	10	13	20	14			3,406	38
Loud Noise	1	0	1	1	1			86	28
Observer in Truck	7	5	2	4	4			171	140
Observer on Foot	26	26	0	24	9			1,067	1,048
Vehicle - Dirt Bikes	1	0	1	1	1			1,000	253
Vehicle - Motor Boat	16	7	9	12	13	1	2	6,786	1,627
Vehicle - Non motorized Boat	3	2	1	1	0		2	3	3
Vehicle - Truck	1	0	1	1	1			140	0
Vehicle - Truck with Trailer	3	1	2	3	3			1,418	845
Bald Eagle - Adult	13	5	8	10	9			4,439	2,611
Bald Eagle - Juvenille	15	3	12	12	12			5,541	3,306
Unknown	3	1	2	3	2			1,406	675
Grand Total	135	71	64	110	89	1	4	33,289	11,151

Table 12. Summary of disturbance data by waterfowl type, Naknek River, Alaska Peninsula, Alaska, 2003. Reports number of disturbance events where group was present, number of waterfowl present before disturbances and number disturbed, and ratio of number disturbed to number present before disturbance.

	Ducks				Ducks and Geese			Geese and Swans			
Disturbance Type	Number of Events	Count before	Number Disturbed	Ratio Disturbed	Number of Events	Count before	Number Disturbed	Number of Events	Count before	Number Disturbed	Ratio Disturbed
Aircraft - large, C 130	3	198	103	0.52				3	785	45	0.06
Aircraft - large, Jet (737)	3	422	83	0.20				4	366	42	0.11
Aircraft - large, twin prop	3	391	10	0.03				3	166	2	0.01
Aircraft - medium, twin prop	6	3,187	254	0.08				8	1,028	12	0.01
Aircraft - small, jet	1	46	0	0.00				1	264	0	
Aircraft - small, twin prop	2	602	26	0.04				1	371	0	
Aircraft - small, single prop	20	2,382	37	0.02				14	1,024	1	0.00
Loud Noise	1	28	28	1.00				1	58	0	
Observer in Truck	4	52	50	0.96				4	119	90	0.76
Observer on Foot	24	763	747	0.98				9	304	301	0.99
Vehicle - Dirt Bikes	1	900	200	0.22				1	100	53	0.53
Vehicle - Motor Boat	12	4,205	787	0.19	1	400	0	13	2,181	840	0.39
Vehicle - Non motorized Boat	1	3	3	1.00				0		0	
Vehicle - Truck	1	134	0	0.00				1	6	0	
Vehicle - Truck with Trailer	3	962	555	0.58				3	456	290	0.64
Bald Eagle - Adult	10	3,133	2,405	0.77				9	1,306	206	0.16
Bald Eagle - Juvenille	12	4,206	3,027	0.72				12	1,335	279	0.21
Unknown	3	1,100	675	0.61				2	306	0	
Grand Total	110	22,714	8,990	0.40	1	400	0	89	10,175	2,161	0.21

238 stops during ground surveys and 28 stops during disturbance-only surveys. Limited staff time precludes recalculation of waterfowl numbers prior to all observer-related events.

Airborne threats generally had a greater impact on ducks than geese\swans. Bald eagles consistently disturbed ducks (72-77%), but geese\swans were much less disturbed by eagles (16-21%). If the records are scrutinized more closely, it becomes evident that tundra swans are rarely disturbed by bald eagles. Ducks were also frequently disturbed by large and noisy aircraft (52%, 3 events of C-130), whereas geese\swans were rarely disturbed (6%, 3 events of C-130). Other aircraft had a lesser effect on ducks and even less so on geese\swans.

The next highest disturbance event for both ducks and geese\swans was trucks towing trailers. There were only three such events and all occurred at Rapids Camp. Because traffic can run for approximately 2 km along the beach, there is a large potential to approach close to many flocks. Because of the distance, the disturbance can last for several minutes and because of the quality of the beach, trucks can also travel quickly and appear threatening.

Disturbance from the 16 motorized boat events was relatively low for ducks (19%) and moderate (39%) for geese\swans. Fishermen were involved in eight or more of the motorized watercraft disturbances to waterfowl and at least one watercraft disturbance was the result of a waterfowl hunter.[2]

Discussion

As the Naknek River is an important spring staging area for waterfowl and large concentrations of more than 25 Anatid species use the area each year, there is important information to be gained from spring ground surveys. Although spring migration counts in one area may not be a justifiable indicator of overall population numbers, special attention should be paid to consistent declines in observed quantities of particular species. Most certainly, establishing baseline data about species composition and phenology on the Naknek River is important and is something that is within the reach of this survey. As is apparent from data collected over the last 12 years, quantities of waterfowl observed, and when they are observed, vary from year to year. Some attempts have been made to explain these fluctuations in abundances and any number of reasons, or combinations thereof, may be responsible. Weather conditions and timing of ice-out, both in Alaska and elsewhere, probably play a more important role in yearly fluctuations than actual changes in population numbers. As more data is gathered in future years, efforts should be focused on learning more about the possible factors that affect these fluctuations.

There are two reasons date of first observation, date of peak observation and peak count may not be accurate for 2002. As mentioned in **Methods**, in 2002 ground surveys for both the upper and lower route were conducted only once per week as compared to other years in which they were typically performed a minimum of three times per week on the upper route and twice per week on the lower route. Whereas actual first and peak dates are probably no more than -2 days from observed for upper and -4 days from observed for lower in most years, when surveys are only done one time per week that number increases potentially to -6 to -8 days. Additionally, in 2002 surveys ceased on 10 May and considering the late spring conditions leading to late arrivals for many species, peaks for

[2] Humans were dressed in camouflage, and a shotgun was carried in the boat.

dabbling and diving ducks may not yet have been reached and thus documented as being too low or too early. In addition, this affected species composition by tribe especially at the end of the survey (Figures 14 versus 15).

This survey has traditionally counted animals without examining habitat requirements or availability. The disturbance monitoring will focus on one element of habitat availability. Disturbance studies are plentiful across a variety of avian groups. Additional research should be conducted to examine the methods and analysis used by previous investigators.

For our study, initially disturbance was analyzed by examining the percentage of each waterfowl group that was flushed (categories 3-5). This analysis did not take into account the number of birds present before a disturbance event. Therefore, the data was re-examined to consider waterfowl counts before and after the disturbance event. Although this analysis provides a picture of the number and percent of birds affected, it does not present the magnitude of the impact (as scored by category) on the birds. Much greater detail is available in the data for an interested reader. In addition, effect could also be examined by distance between birds and source when the birds responded and the distance the birds moved.

Recommendations

1. Spring waterfowl surveys on the Naknek River should be conducted annually, at all presently established survey locations, with the objectives of establishing a historical record of waterfowl species composition, abundance, and phenology and monitoring annual variations, especially in abundances of common species.
2. Ground surveys should be conducted a minimum of three times per week on the upper route and twice per week on the lower route and continue into the third week in May especially in late springs.
3. Disturbance surveys should be continued in conjunction with ground surveys and additionally on three days per week, following the protocol established in 2003.
4. It may be appropriate to calculate averages of date of first observation, date of peak abundance, and peak abundance on five or ten-year intervals as more information is collected. Observations from survey points Oxbow and Flat Nose Henry Road should be added as 10 years of data is reached.
5. Boundaries separating each observation location on both upper and lower routes should be documented in protocol so that analysis by survey location may be made. Alternatively, data from high density and overlapping survey points such as Paradise Point and Big Creek could be summed and then analyzed.
6. In future years, the survey point at which each species is first observed and those which hold the largest concentrations of each species, should be paid special attention.
7. The use of a hand-held tape recorder for collection of both ground survey and disturbance data is recommended.
8. Special care should be given to the accurate collection of ice-out data on the Naknek River and more attempts at finding a correlation between species arrival and peak and ice-out dates made.

9. Establish cooperators to report ice-out dates on the Kvichak, Egegik, Ugashik, and other area rivers and attempt to find correlations between waterfowl abundance on the Naknek River and those dates on the above rivers.
10. Analyze population counts taken during disturbance-only surveys to examine the effect of changing tide on waterfowl abundances.

Acknowledgments

A special thanks to Bob Blush for conducting the waterfowl surveys before the technician's arrival, familiarizing the technician with the survey routes, and assisting with the mundane but necessary task of reformatting historic survey data. Thanks to Wildlife Biologist Jodi Doster and Biological Technicians Adrienne Leppold and Robb Kaler for data collection in 2002. Thanks also to Maintenance personnel Steve Howard and Gary Terry for their work on survey vehicles and other survey equipment, Corey Adler for his assistance with ArcView, Jeff Wasley for providing the photograph for the cover of the report, and Refuge Manager Daryle Lons and Deputy Refuge Manager Mark Koepsel for their interest and support throughout the spring surveys.

Literature Cited

Burke, T.A. 1992. Spring staging of waterfowl along the Naknek River, Alaska Peninsula, Alaska, April – May 1991. U.S. Fish and Wildlife Serv., King Salmon, Alas. (Unpubl). 40pp.

Gibson, D.D. 2000. Personal Communication – e-mail regarding history of Baikal Teal observations on the Alaska Peninsula.

Gibson, D.D. & B. Kessel. 1997. Inventory of the species and subspecies of Alaska Birds. Western Birds 28:45-95.

Kessel, B. and D.D. Gibson. 1978. Status and distribution of Alaskan birds. Cooper Ornith. Soc., Los Angeles, Calif. 100pp.

Kirk, L. 1999. Spring staging of waterfowl along major drainages of Bristol Bay, with an emphasis on the Naknek River, Alaska, March - May 1999. U.S. Fish and Wildlife Serv., King Salmon, Alas. (Unpubl). 36pp.

MacGowan, B. 1994. Spring staging of waterfowl along major drainages of Bristol Bay, with an emphasis on the Naknek River, Alaska, March - May 1994. U.S. Fish and Wildlife Serv., King Salmon, Alas. (Unpubl). 47pp.

Moore, H. 1996. Spring staging of waterfowl along major drainages of Bristol Bay, 1991-1995, with an emphasis on the Naknek River, March - May 1995. U.S. Fish and Wildlife Serv., King Salmon, Alas. (Unpubl). 33pp.

National Weather Service. 2003. Local climatological data monthly summary March - May 2002-2003. King Salmon, Alas.

Ruhl, G. 1997. Spring Staging of waterfowl along major drainages of Bristol Bay, with an emphasis on Naknek River, Alaska, March - May 1997. U.S. Fish and Wildlife Service, King Salmon, Alaska (Unpublished). 30pp.

Ruhl, G. and H. Moore. 1996. Spring staging of waterfowl along major drainages of Bristol Bay, with and emphasis on Naknek River, Alaska, March - May 1996.U. S. Fish and Wildl. Serv., King Salmon, Alas. (Unpubl). 36pp.

Russell, R. 2000. Personal Communication – Dates of ice coveron the Naknek River at King Salmon, 1970 – Present. King Salmon, Alaska (Unpubl). 2 pp.

Spies, M. 1998. Spring Staging of waterfowl along major drainages of Bristol Bay with an emphasis on the Naknek River, Alaska, March – May 1998. U.S. Fish and Wildlife Serv., King Salmon, Alas. (Unpubl). 32pp.

USFWS. 2001. Draft Wildlife Inventory Plan, Naknek Spring Waterfowl Survey. Alaska Peninsula / Becharof National Wildlife Refuge. King Salmon, Alaska. (Unpubl.).

USFWS. 2003. Christmas Bird Count Records for King Salmon, Alaska (1986 – 2003). Unpubl. 1pp.

Appendix 1. Information on survey points including land status.

Point Name	Point	Longitude	Latitude	Elevation	Land Status	Land Notes
Kvichak Bay (formally Mouth of Naknek River)	1	-157.0623425	58.7376192	32	Borough Easement (Road)	on Puag'vik Corp land
Sewage Lagoon and Overlook	2	-157.0539968	58.7248240	107	Borough	
End of State Rd.	3	-157.0298333	58.7242738	52	State Road easement	across Peter Pan Cannery Property
Municipal Barge Dock	4	-156.9800824	58.7338174	33	Borough	
Leader Creek	5	-156.9475613	58.7441813	29	Seattle Marine or Lummy	
Martin Monsen Park	6	-156.8978193	58.7389789	43	Borough	
Savonoski Crossing	7	-156.8623115	58.7251333	22	Borough Road	
Wolverine Dr.	8	-156.8332834	58.7180397	37	Borough Subdivision	lot not purchased
Paul's Creek	9	-156.7815097	58.7174012	33	Les and Judy Burtner	Phone # Avail-Refuge office
FlatNose Henry Rd	9B	-156.7411776	58.7017009	46	Borough Easement (Road)	Borough Maintained w/in Native Allotments
King Salmon Creek	10	-156.7022823	58.6850987	7	Paug'vik Corporate Land	
Eskimo Creek	11	-156.6864559	58.6842020	30	US Air Force?	
FWS Dock	12	-156.6719682	58.6811239	19	FWS	
Grassy Point	13	-156.6565126	58.6663220	11	City Dock is Borough leased, Grassy Point - State?	
Paradise Point	14	-156.6194687	58.6670480	53	State?	
Big Creek	15	-156.5804148	58.6538032	60	Paug'vik Corporate Land (Road)	road crosses 14C1 claims first several 100 yds, no titles as of 4/2003
Rapids Camp	16	-156.5644182	58.6409466	79	Paug'vik Corporate Land	
Oxbow	16B	-156.5690448	58.6418697	45	Chuck-A-Lou Subdivision, Charles Syneder - Kenai	91-6 (2) # 4,5 Rd. is Rainbow Run
Lake Camp	17	-156.4555308	58.6732374	49	NPS	NPS

Appendix 2. Disturbance Protocol, 2003.

The Naknek River is an important spring staging area for waterfowl and is used heavily by several species of ducks, geese, and swans. Use of the river by humans is minimal in early spring and increases in the summer and during fall as opportunities for commercial and sport fishing and waterfowl and big game hunting arise. As hunting and fishing regulations and opportunities change and if development along the river increases, the potential for disturbance to waterfowl may increase. In recent years, human activity on the upper river has increased in March and early April because guided sport fishing for rainbow trout has been promoted. In 2003 (the year this protocol was initiated) refuge staff anticipate spring use of the river may change because of pending legalization of spring waterfowl hunting.

Objectives:
(1) To document baseline levels and sources of disturbance and their effects on waterfowl. (2) To assess the effects and magnitude of disturbance on spring staging waterfowl caused by any future changes to regulation which increase use of the river or development along the riverbank which may increase use or degrade habitat.

When/Where:
Alaska Peninsula / Becharof NWR staff will monitor disturbance under two circumstances. Observers will document any incidental disturbance observed at any and all locations while conducting ground surveys. Observations strictly for disturbance will be made three times per week at each of two locations (Paradise Point and Rapids Camp). Disturbance observations will be made on one day during the week and both days on the weekend. Observations will be made for one hour at each of the above-mentioned locations. Weekday and time are selected randomly each week except early morning and late evening slots are double weighted[3] to increase their probability of being selected (as more likely to encounter waterfowl hunters at these times). Beginning observation time will be listed by half-hour increments, starting with sunrise and ending 2.5 hours prior to sunset. The location for first observation on a given day will also be chosen randomly. When observation is complete at the first location, the observer will move to the next location and begin immediately.

Methods:
While the observer is conducting disturbance-only observations, population counts will be performed on 15-minute intervals, starting with the arrival of the observer. In the case of disturbance observation during ground surveys, population numbers will be estimated, if necessary. For both surveys, any external source that causes a change in the behavior of the waterfowl or any source perceived by the observer to potentially cause a change in behavior of the waterfowl will be considered a disturbance event and documented as such. The time at which the disturbance begins and ends will be recorded and rounded down to the nearest 10-second interval. A detailed description of the disturbance source should be recorded and include specifics such as whether or not humans are visible, the size of and speed at which the source may be traveling, and whether the source is powered by a motor and a type and estimated size of the motor. A description of the disturbance and the events leading up to it will also be described in detail. Specifics such as the direction the source is heading (up-river, down-river) and the behavior of the source will be noted.

[3] The first four and last four potential starting times will be listed.

All species and quantities of those species, affected and unaffected, both prior to and following the disturbance will be recorded. The number (preferred) or percent of each species involved, the proximity of the disturbance to the species at first sign of effect and the category of effect (1-5, see below) should be recorded. Also, an assessment should be made by the observer to determine to the best of his/her knowledge whether the disturbance was caused by/because of a hunter.

The categories of disturbance are:

1. No effect observed
2. No flush, birds swam/walked away from disturbance
3. Flushed and re-landed within 200 m of original location (note approximate distance from original location)
4. Flushed and re-landed further than 200 m. of original location (note approximate distance from original location)
5. Flushed and left vicinity of original location (no longer in sight)

Appendix 3. Waterfowl species recorded over 12 years including relative abundance in each year. R = Rare, U = Uncommon, C = Common, A = Abundant.

UPPER ROUTE	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Greater white-fronted goose	A	A	A	A	A	A	A	A	A	A	A	A
Emperor goose				R			U					
Canada goose	A	U	C	C	C	C	C	C	C	C	U	U
Aleutian Canada goose												R
Brant				3				U		R	U	R
Tundra swan	A	A	A	A	A	A	A	A	A	A	A	A
Gadwall	R		R	R	U	U	U	U	U	U	R	U
Eurasian wigeon	U	U	C	U	U	U	U	C	U	C	U	C
American wigeon	A	C	A	C	A	C	A	A	A	A	C	A
Mallard	A	A	A	A	A	A	A	A	A	A	A	A
Northern shoveler	A	U	C	C	C	C	A	C	C	A	A	A
Northern pintail	A	A	A	A	A	A	A	A	A	A	A	A
Baikal Teal									R			
American green-winged teal	A	C	A	C	C	C	C	A	C	A	R	C
Canvasback	U	R	U	U	U	R	R	U	R	U		
Redhead	U	U	U	R		R		R		R	R	R
Ring-necked duck	R		R			R		R				
Tufted duck						R	R					
Greater scaup	A	C	A	C	A	C	A	A	A	A	C	A
Eider spp.			R									
Steller's eider			R					R		R		
Harlequin duck	R		R			R					R	
White-winged scoter												R
Black Scoter	R	R	U		U	R	R	R	U	R		U
Long-tailed duck						R	R	R		U		R
Bufflehead	U	U	R	R	U	R	R	U	U	R	U	U
Common goldeneye	A	A	A	A	A	A	A	A	A	A	A	A
Barrow's goldeneye		U	U	U	R	U	R	R	R		U	R
Common Merganser	A	A	A	A	A	A	A	A	A	A	A	A
Red-breasted merganser	A	C	C	C	A	C	A	A	C	C	C	C

Appendix 3, continued. Waterfowl species recorded over 12 years including relative abundance in each year. R = Rare, U = Uncommon, C = Common, A = Abundant.

LOWER ROUTE	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Greater white-fronted goose	C	C	U	U	U	U	R	U	U	C	R	U
Canada goose	R	R	R					U	U	R	U	R
Tundra swan	C	U	R	R	U	U	U	R	U	U	R	U
Gadwall						R	R	R	R	R	R	
Eurasian wigeon	R	R	R			R		U	R	R	R	
American wigeon	C	U	U	R	U	U	U	U	U	U	R	U
Mallard	C	U	C	U	U	U	U	U	C	C	U	U
Northern shoveler	U		R	R	R	R	U	R		U		U
Northern pintail	C	U	C	U	C	U	U	C	C	C	U	C
American green-winged teal	C	U	U		U	U	U	U	U	U	R	U
Canvasback	R				R	R						
Greater scaup	A	C	C	C	A	A	A	A	C	A	C	C
Steller's eider										R		
Kiing Eider	R	C	A	A	C	U		C				
Harlequin duck	R				R	R		R				R
Surf scoter	U		R		R	R						
White-winged scoter	R		R				R				U	
Black Scoter	C	C	A	U	C	C	C	C	C	C	C	C
Long-tailed duck	C	A	A	A	A	A	A	A	A	A	A	C
Bufflehead		R	R		R	R	R	R			R	
Common goldeneye	C	C	C	U	C	U	U	C	C	C	C	C
Barrow's goldeneye		R		R	R		R					
Common Merganser	A	A	A	A	A	A	A	A	A	A	A	A
Red-breasted merganser	A	A	A	C	C	A	C	C	C	A	C	C