

AERIAL SURVEY OF EMPEROR GEESE AND OTHER WATERBIRDS

IN

SOUTHWESTERN ALASKA,

FALL 2006

By

Edward J. Mallek¹

and

Christian P. Dau²

Key Words: aerial survey, emperor geese, waterbirds, southwest Alaska.

December 2006

¹U. S. Fish and Wildlife Service
Migratory Bird Management
1412 Airport Way
Fairbanks, Alaska 99701

²U. S. Fish and Wildlife Service
Migratory Bird Management
1011 E. Tudor Road
Anchorage, Alaska 99503

AERIAL SURVEY OF EMPEROR GEESE AND OTHER WATERBIRDS IN SOUTHWESTERN ALASKA, FALL 2006

Edward J. Mallek, U.S. Fish and Wildlife Service, Migratory Bird Management, 1412 Airport Way, Fairbanks, AK, 99701

Christian P. Dau, U.S. Fish and Wildlife Service, Migratory Bird Management, 1011 E. Tudor Rd, Anchorage, AK, 99503

Abstract: This report presents results of the 28th consecutive year of fall aerial emperor goose surveys in southwest Alaska. All bird and marine mammal species were counted with emphasis on emperor geese, Pacific brant, Canada geese, and Steller's eiders. Population estimates for these four species were 81,078, 103,782, 30,100 and 69,870, respectively. The survey was flown from 26-28 September 2006 from the Naknek River to Canoe Bay, along the north and south sides of the Alaska Peninsula. Weather precluded coverage east from Canoe Bay to Wide Bay. The USFWS Turbine-Beaver (N754) was used and a left seat pilot/observer and right seat observer made observations along coastlines and over estuaries from 45 meters (150 feet) ASL and at 200 kilometers/hour (110 knots). Three additional replicate surveys of the Izembek NWR area were flown on 27 September, 2 and 3 October to estimate sizes of the Pacific brant and Canada goose populations. Averages counts for the Izembek area, based on four surveys, were 120,875 Pacific brant and 27,741 Canada geese.

Key words: aerial survey, emperor geese, waterbirds, southwest Alaska. December 2006

INTRODUCTION

This survey has annually monitored fall distribution, abundance, and population trends of emperor geese and other waterbirds at migratory staging areas throughout southwest Alaska since 1979. Data from this survey are used to expand photographic estimates of emperor goose productivity (i.e. percent juveniles) based on the proportional distribution of the population at various fall staging locations. The survey includes coastline and estuarine habitats from Kuskokwim Bay south and west along the north side of the Alaska Peninsula to Unimak Island, and the south side of the Alaska Peninsula east to Wide Bay.

METHODS

The survey was flown using the USFWS Turbine-Beaver (N754) at a ground speed of approximately 200 kilometers/hour (110 knots) and an altitude of 45 meters (150 feet) ASL. The 2006 survey route covered the north side of the Alaska Peninsula coastline from the mouth of the Naknek River to Bechevin Bay and the south side of the Alaska Peninsula east to Canoe Bay. Weather precluded surveying of segments usually included east of Canoe Bay to Wide Bay. Observations were made from both sides of the aircraft and voice recorded into two panel-mounted computers using remote microphones. Computers received input from the aircraft Global Positioning System (GPS) saving coordinates for each observation. Computer programs developed by Jack Hodges (USFWS-MBM, Juneau) were used to collect and transcribe these data.

The coastal flight path was usually 100 meters offshore with deviations to confirm species identification and numbers seaward within 1.6 kilometers (1 mile) of shorelines. In estuaries, a systematic but meandering flight path was followed. Aircraft track was monitored on a computer moving map program to avoid duplication and ensure complete coverage. Whenever

possible, flights were conducted with <20 knots of wind and at or near high tide as this concentrated emperor geese near shorelines.

The greater survey area includes 143 shoreline/estuarine segments (Figures 1-2) which were previously described by Mallek and Dau (2000). In 2006, segments 34-59 were flown on 26 September; segments 60-68, 80-85 were flown on 27 September; and segments 86, 88, 90-93 were flown on 28 September. Adverse climatic condition precluded surveying segments east of Canoe Bay. Three additional surveys of Izembek Lagoon and other estuaries adjacent to Izembek NWR were flown on 27 September (Mallek/Dau) and 2-3 October (Bollinger/Dau). General observations of habitat and survey conditions including wind speed and direction, temperature, sky condition, visibility, and tide stage were recorded en route during all surveys.

SURVEY CONDITIONS

26 September: North winds of 5-12 knots and overcast to broken ceilings of 2,000-4,000 feet persisted throughout the day. Overall survey conditions were good with some glare in the Port Moller/Nelson Lagoon segments. Tides were low to mid from Egegik Bay to Port Heiden and high from Seal Islands Lagoon to Izembek Lagoon. Air temperatures ranged from 40-45°F.

27 September: North winds of 11-20 knots and overcast ceilings of 1,500 feet persisted throughout the day. Visibility was good and tides were high on the Pacific side of the Alaska Peninsula and low on the Bering side. Air temperatures were 40-42°F.

28 September: Winds were initially southwest at 15 knots and increased to northwest 25-30 knots east of Cold Bay. Sky conditions were high and broken and visibility was good however, turbulence precluded surveying east of Canoe Bay.

2 October: Winds were southeast at 10-15 knots with an overcast ceiling of 1,500 feet and light rain. Overall visibility was good. Tides were low on the Bering and high on the Pacific sides of the Alaska Peninsula. Air temperature was 45°F.

3 October: Winds were southwest at 20 knots with broken ceilings and good visibility. There was light rain over the central and eastern portions of Izembek Lagoon. Tides were mid on the Bering and low on the Pacific sides of the Alaska Peninsula. Air temperature was 38°F.

RESULTS/DISCUSSION

The totals for all species observed during the survey are summarized in Table 1. Estimates of emperor goose population sizes (1979-2006) and corresponding 3-year averages are summarized in Table 2. Figure 3 depicts the 28-year population trend for fall staging emperor geese.

Emperor Goose

We estimated the 2006 fall emperor goose population size at 81,078. This estimate is 11% above the 2005 estimate of 73,212 and the current 3-year average of 82,611 is 2% above the previous 3-year average of 81,349 (Table 2). The fall emperor goose population trend indicates a 0.4%/year increase (Figure 3). We did not survey the north coast of Bristol Bay as previous fall

emperor goose surveys conducted in that area documented only 112 emperor geese from 2000 to 2004. Numbers and proportions of emperor geese at primary staging sites along the Alaska Peninsula were as follows: Egegik Bay 951 (1%, segments 36-37); Ugashik Bay 536 (1%, segment 38); Cinder River Estuary 20,798 (26%, segments 40-42); Port Heiden 7,390 (9%, segments 44-46); Seal Islands 20,362 (25%, segment 47); Nelson Lagoon and adjacent estuaries 25,510 (32%, segments 50-57, 551-552); Izembek Lagoon and adjacent estuaries 3,092 (4%, segments 60-65, 67-68, 79-81, 83-85) and Canoe Bay 1,657 (2%, segment 93).

Pacific Brant

A total of 103,782 Pacific brant was observed during the 26-28 September emperor goose survey of which >99% (103,613) were in Izembek Lagoon and adjacent estuaries. Three subsequent higher counts suggest some brant may have been in transit during the emperor goose survey. Replicate counts of Izembek Lagoon and adjacent estuaries (27 September and 2-3 October) provided counts of 127,990, 127,724 and 124,172. The average brant count for the four surveys of the Izembek area (including the emperor goose survey) was 120,875 versus 126,629 for the three peak replicate surveys. The peak average (n=3 surveys) was 6% below the 2005 fall average of 134,189 (n=3 surveys) and 5% below the 32-year average peak fall count of 133,726 (1975-2006, Izembek NWR files).

Canada Goose

We observed 30,100 Canada geese during the 26-28 September emperor goose survey. Izembek Lagoon and adjacent estuaries accounted for 83% (25,112) of the total birds observed. Mild conditions resulted in higher than usual numbers of Canada geese farther north along the Alaska Peninsula. The low total count of Canada geese may be attributed to delayed migration of some birds from areas north of the Alaska Peninsula and abundant crowberry (*Empetrum nigrum*) production which would result in many birds feeding or roosting in adjacent uplands outside the survey area. Additional replicate surveys of Izembek Lagoon and adjacent estuaries (27 September (7,846) and 2-3 October (37,400 and 40,606, respectively) averaged 27,741 geese (n=4 surveys). This average was 15% below the 2005 average (32,508, n=3 surveys) and 35% below the 32-year average peak fall count of 42,625 (1975-2006, Izembek NWR files).

Steller's Eider

We observed a total of 69,870 Steller's eiders during the 26-28 September emperor goose survey, nearly double the 2005 count of 36,373 and 11% above the 1979-2006 average of 63,124. Population trend indicated by this survey indicates a 2.3% annual increase. High numbers of fall staging (i.e. molting) Steller's eiders is indicative of low nesting effort or success. This was the second consecutive year of increased nesting effort by the Arctic Coastal Plain (ACP)-Alaska population at Barrow. Hence, the increase in the fall staging population was not expected. The two-fold increase in birds observed may suggest the ACP-Russia breeding population was less successful than that on the ACP-Alaska.

Numbers and proportions of Steller's eiders at primary Alaska Peninsula staging sites were as follows: Cinder River Estuary 405 (2%, segments 40-42); Port Heiden 3,550 (13%, segments 44-46); Seal Islands 12,595 (18%, segment 47); Nelson Lagoon and adjacent estuaries 39,411 (56%, segments 50-57, 551-552); and Izembek Lagoon and adjacent estuaries 13,909 (20%, segments 60-65, 67-68, 79-81, 83-85).

Replicate surveys of Izembek Lagoon and adjacent estuaries (27 September and 2-3 October) provided counts of 10,490, 11,727 and 10,367, respectively. Based on the emperor goose survey results and these replicate surveys, an average of 11,623 (n=4 surveys) Steller's eiders occurred at Izembek this fall. The 2006 average suggested a nearly three-fold increase from 2005 (4,627) but roughly half the long-term average of 23,448 (1975-2006, Izembek NWR files). Steller's eider numbers in the Nelson Lagoon complex in 2006 (39,411) more than doubled from 2005 (i.e. 18,343) and were 22% above the long-term average of 30,643 (1980-2006). Local population trends indicated by this survey indicate a 4.4% annual increase at Nelson Lagoon versus a 3.3% annual decline at Izembek Lagoon.

ACKNOWLEDGMENTS

Lodging and vehicle support provided by Alaska Peninsula/Becharof and Izembek NWRs is appreciated. Additional replicate surveys of the Izembek area were flown by Karen Bollinger (MBM-Fairbanks) and her contribution is appreciated as well.

REFERENCES

- Gill, R.E., Jr. 1981. Fall survey of emperor geese from Hooper Bay to Unimak Island and along the south Alaska Peninsula from Unimak Island to Wide Bay - October 3-8, 1981. Unpub. Rept., USFWS, Anchorage, AK. 7p.
- Gill, R.E., Jr. and B. Conant. 1980a. Aerial water bird survey - Bethel to Bechevin Bay, Alaska (October 1-4, 1979). Unpub. Rept., USFWS, Anchorage, AK. 11p.
- Gill, R.E., Jr. and R. King. 1980b. Aerial water bird survey - Bethel to Bechevin Bay, Alaska (October 4-8, 1980). Unpub. Rept., USFWS, Anchorage, AK. 11p.
- King, R.J. 1986. Memorandum to Chief, Migratory Birds, Anchorage, AK. 1986 fall emperor goose survey. 16 October 1986. 5p.
- _____ (unpublished). Fall population survey of emperor geese (Chen canagica) on coastal southwest Alaska, 1991-1998. File data, USFWS, Fairbanks, AK.
- King, R. J. and K. S. Bollinger. 1982. Fall survey of emperor geese and other associated water birds of coastal southwest Alaska - 6-10 October, 1982. Unpubl. Rept., USFWS, Fairbanks, AK. 8p.
- King, R.J. and D.V. Derksen. 1983. Fall survey of emperor geese of southwest coastal Alaska, 10-16 October, 1983. Unpubl. Rept., USFWS, Fairbanks, AK. 8p.
- _____ 1984. Fall survey of emperor geese of southwest coastal Alaska, 3-8 October, 1984. Unpubl. Rept., USFWS, Fairbanks, AK. 11p.
- King, R.J. and W.D. Eldridge. 1985. Fall survey of emperor geese (Chen canagica) - southwest

coastal Alaska, 10-14 October, 1985. Unpubl. Rept., USFWS, Fairbanks, AK. 8p.

_____ 1987. Fall population survey of emperor geese (Chen canagica) - southwest coastal Alaska, October 2-5, 1987. Unpubl. Rept., USFWS, Fairbanks, AK. 8p.

King, R.J. and L. Denlinger. 1989. Fall population survey of emperor geese (Chen canagica) in coastal southwest Alaska, October 7-12, 1989. Unpubl. Rept., USFWS, Fairbanks, AK. 17p. (Appendix A summarizes 1988 survey data.)

King, R.J. and A.W. Brackney. 1990. Fall population survey of emperor geese (Chen canagica) on coastal southwest Alaska, October 17-19, 1990. Unpubl. Rept., USFWS, Fairbanks, AK. 15p.

Mallek, E. J. and C. P. Dau. 2000. Aerial survey of emperor geese and other waterbirds in southwestern Alaska, fall 1999. Unpubl. Rept., USFWS, Fairbanks, AK. 19p.

_____ 2002a. Aerial survey of emperor geese and other waterbirds in southwestern Alaska, fall 2000. Unpubl. Rept., USFWS, Fairbanks, AK. 15p.

_____ 2002b. Aerial survey of emperor geese and other waterbirds in southwestern Alaska, fall 2001. Unpubl. Rept., USFWS, Fairbanks, AK. 16p.

_____. 2002c. Aerial survey of emperor geese and other waterbirds in southwestern Alaska, fall 2002. Unpubl. Rept., USFWS, Fairbanks, AK. 15p.

_____ 2003. Aerial survey of emperor geese and other waterbirds in southwestern Alaska, fall 2003. Unpubl. Rept., USFWS, Fairbanks, AK. 16p.

_____ 2004. Aerial survey of emperor geese and other waterbirds in southwestern Alaska, fall 2004. Unpubl. Rept., USFWS, Fairbanks, AK. 17p.

_____ 2005. Aerial survey of emperor geese and other waterbirds in southwestern Alaska, fall 2004. Unpubl. Rept., USFWS, Fairbanks, AK. 17p.



Figure 1. Map of emperor goose aerial survey segments 1-36 in southwest Alaska, 1992-2006.

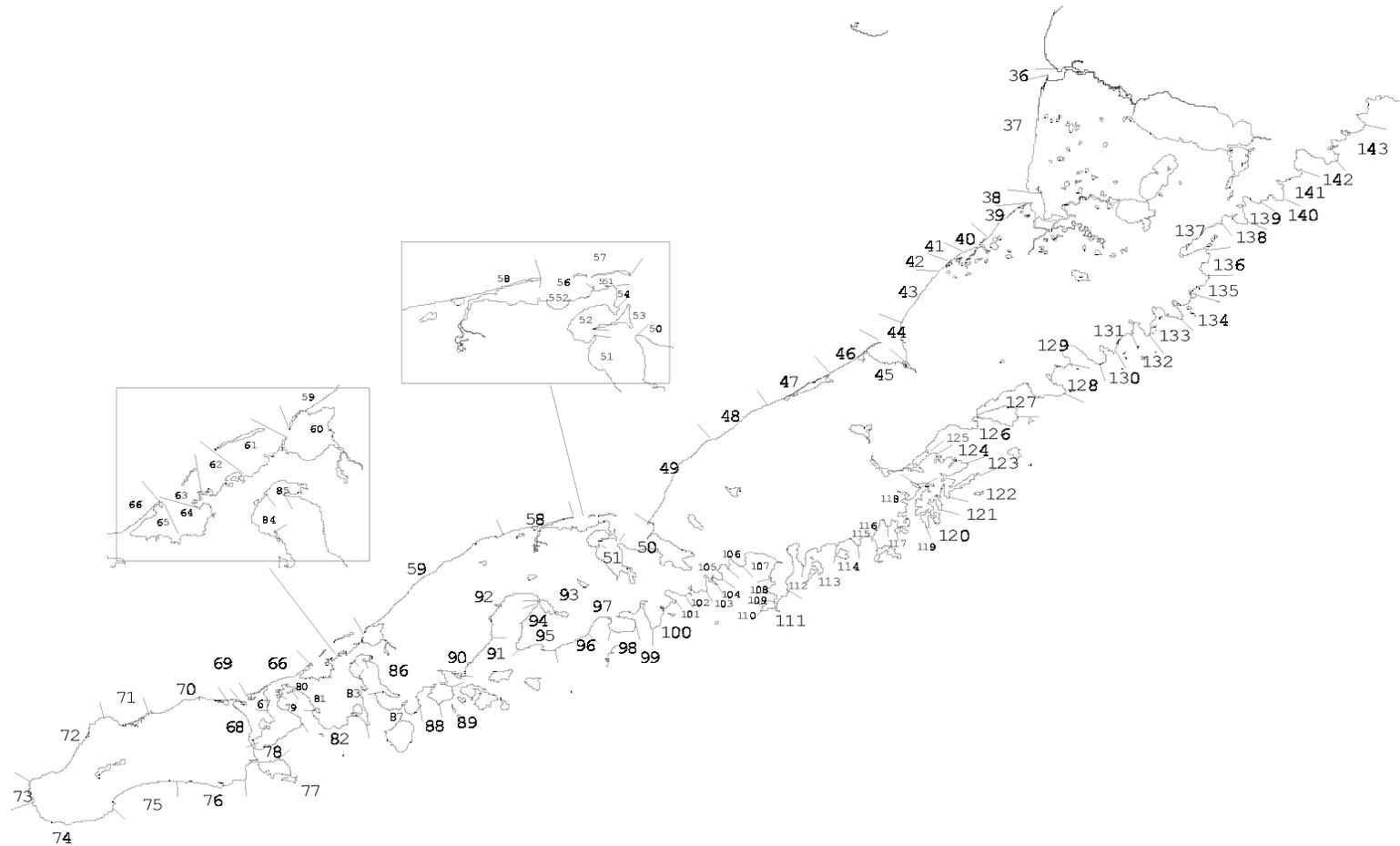


Figure 2. Map of emperor goose aerial survey segments 36-143 in southwest Alaska, 1992-2006.

Table 1. Waterbird and mammal observations by segment, southwest Alaska, 26-28 September 2006.

Species	Survey Segment														
	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Am. G-w Teal			115		8										
Am. Wigeon	85		80												
Arctic Tern			10												
B. Eagle (Adult)	3	1		2							2				
B. Eagle (Juv)															
B-l. Kittiwake		1		29											720
B. Scoter		2421	2158	949	16	2323				365	670	850	1750		1030
Brown Bear															
Canada Goose			929	1213	1020						55	780	686	135	
C. Eider															
C. Loon															
C. Raven															2
Emperor Goose		51	874	26	536	1	15458	97	3885	1357	1259	1405	4726	20352	10
Goldeneye sp.															
Greater Scaup		668	210		335						250	25	2		
Harlequin Duck				10						2					
Harbor Seal		69	320	1	8		100			4					
King Eider											15				
Large Gull	521	747	1019	209	270	39	420	1	341	139	288	58	191	3081	183
Large Shorebird			25									200			
Mallard	300		2224		501		5				33	23		1	
Mew Gull	318	215	778	54	336	15	370		12	65	2	2615	150	125	70
Merganser sp.	23		15		7				8					20	
N. Pintail			5360		5838		6355		185		495	11775		2450	
Pacific Brant															
Pacific Loon															
Pelagic Cormorant															2
Pigeon Guillemot															
R-b. Merganser			15											300	
Red Fox			1												
R-n. Grebe		3		1									2		
R-t. Loon		4					5						1		
Scoter sp.				40											
Sea Otter						1	1								
S-t. Shearwater															3
Small Shorebird		335	300		194		1923			65	1060	11700		11345	
Steller's Eider							405					3550		12595	
Surf Scoter		1		65											
Tundra Swan	681		2		2						11			2	
Walrus															
Grey Wolf															
W-w. Scoter		76	2	844	160	565	15		80	443	30	1	470		100

Table 1 (continued). Waterbird and mammal observations by segment, southwest Alaska, 26-28 September 2006.

Species ¹	Survey Segment										
	49	50	51	52	53	54	551	552	56	57	58
Am. G-w Teal							18	10			
Am. Wigeon							175	25			
Arctic Tern											
B. Eagle (Adult)	2										
B. Eagle (Juv)	7										
B-l. Kittiwake	4311	35	409							10	
B. Scoter	120	2	1290	1580	168	931	671		8		1703
Brown Bear	1										
Canada Goose											
C. Eider									164		
C. Loon											
C. Raven	1										
Emperor Goose		2110	1762	4029		12	4604	4986	1039	6958	10
Goldeneye sp.											
Greater Scaup			32								
Harlequin Duck											
Harbor Seal	70								250		
King Eider											
Large Gull	198	1383	552	224		1	1	1389	3986	60	205
Large Shorebird											
Mallard							45	30			
Mew Gull	80	91	213	2	5			21	1359	1200	5
Merganser sp.									8		
N. Pintail				1700	8		337	565			
Pacific Brant											
Pacific Loon											
Pelagic Cormorant		2	7					6			
Pigeon Guillemot											
R-b. Merganser							20	400	30		
Red Fox											
R-n. Grebe		1	1	1							
R-t. Loon	2									4	
Scoter sp.											
Sea Otter		58	225	10	8		30		110	2	
S-t. Shearwater											
Small Shorebird		1000		7315				680	10920	30	
Steller's Eider		5025		75	325	1200	1205	11118	20453	10	
Surf Scoter			57		2						
Tundra Swan				4							
Walrus	1261										
Grey Wolf								1			
W-w. Scoter			113		2	279			2		

Table 1 (continued). Waterbird and mammal observations by segment, southwest Alaska, 26-28 September 2006.

Species ¹	Survey Segment												
	59	60	61	62	63	64	65	66	67	68	80	81	82
Am. G-w Teal													
Am. Wigeon			150							25			
Arctic Tern													
B. Eagle (Adult)	1	1								1			2
B. Eagle (Juv)		4											7
B-l. Kittiwake	250												
B. Scoter	1198							111	20	1		141	5
Brown Bear													
Canada Goose		8553	3070	1085	150	5578	5631			735	310		
C. Eider													
C. Loon													
C. Raven			2										
Emperor Goose	1	205	72	70	143	55			106	766	84	802	55
Goldeneye sp.											100		
Greater Scaup													
Harlequin Duck			1			10		82	20			8	
Harbor Seal	340			125							5		
King Eider								65					
Large Gull	1179	1020	2147	3185	1442	2065	1110	66	198	629	1214	319	184
Large Shorebird													
Mallard		20	2				975				190		
Mew Gull	82	433	553	240	110	2		5		2		72	75
Merganser sp.													
N. Pintail		3760	600	250	28	660	1095			20	110		
Pacific Brant		3960	31251	6844	6957	24663	18137		1029	3145	3629		
Pacific Loon	1												
Pelagic Cormorant			1		1	80		6	5			123	60
Pigeon Guillemot													
R-b. Merganser									22		203	469	20
Red Fox													
R-n. Grebe	6							44					
R-t. Loon	3				1								
Scoter sp.													
Sea Otter	34	6	63	45	27	72	25	19	67	42			40
S-t. Shearwater													
Small Shorebird		2270	1140		227		800	11		20			
Steller's Eider		4427	6956	1070	765	41	650						
Surf Scoter													
Tundra Swan		4			1						2		
Walrus													
Grey Wolf													
W-w. Scoter	6							21					4

Table 1 (continued). Waterbird and mammal observations by segment, southwest Alaska, 26-28 September 2006.

Species	Survey Segment ¹									Grand Total
	83	84	85	86	90	91	92	93	125	
Am. G-w Teal			50							201
Am. Wigeon										540
Arctic Tern										10
B. Eagle (Adult)	1	1	2				1	1	2	23
B. Eagle (Juv)										18
B-l. Kittiwake							35			5800
B. Scoter	27	17	10		42		38	5		20620
Brown Bear										1
Canada Goose								170		30100
C. Eider										164
C. Loon				1				1		2
C. Raven					12		1			18
Emperor Goose	605	63	40	80	222	23	242	1657	240	81078
Goldeneye sp.										100
Greater Scaup										1522
Harlequin Duck	97	18	2	18	25	3	11	20		327
Harbor Seal		30			25					1347
King Eider										80
Large Gull	85	389	268	475	1221	272	300	877	980	35131
Large Shorebird										225
Mallard	40							423	30	4842
Mew Gull				1	1148	25	314	503		11666
Merganser sp.										81
N. Pintail	50	150	40							41831
Pacific Brant	65	104	3998							103782
Pacific Loon	1	1					1			4
Pelagic Cormorant					28	5	10	2		338
Pigeon Guillemot	7									7
R-b. Merganser	196	20	26	98	225		503	725	10	3282
Red Fox										1
R-n. Grebe	4					13				76
R-t. Loon										20
Scoter sp.										40
Sea Otter				2			1			888
S-t. Shearwater										3
Small Shorebird	20		30				225			51610
Steller's Eider										69870
Surf Scoter										125
Tundra Swan									5	714
Walrus										1261
Grey Wolf										1
W-w. Scoter	150	4					31			3398

¹ Segment 125 (Chignik Lagoon) was surveyed partially and from >500 ft AGL due to turbulence.

Table 2. Emperor goose fall survey data, southwest Alaska, 1979-2006.

YEAR	TOTAL	3YR. AVG.	DATES	OBSERVERS	SURVEY AREA
1979	59,808	NA	10/1-4	B. Conant/R.E. Gill, Jr.	North Alaska Peninsula only
1980	65,971	NA	10/4-8	R.J. King/R.E. Gill, Jr.	North Alaska Peninsula only
1981	63,156	62,978	10/3-8	R.J. King/R.E. Gill, Jr./D.V. Derksen	All
1982	80,608	69,912	10/6-10	R.J. King/K.S. Bollinger	All
1983	72,551	72,105	10/10-16	R.J. King/D.V. Derksen	All
1984	82,842	78,667	10/3-8	R.J. King/D.V. Derksen	All
1985	59,790	71,728	10/10-14	R.J. King/W.D. Eldridge	All
1986	68,051	70,228	10/5-11	R.J. King/W.D. Eldridge	All
1987	65,663	64,501	10/2-5	R.J. King/W.D. Eldridge	All
1988	76,165	69,960	10/7-12	R.J. King/W.D. Eldridge	All
1989	70,729	70,852	10/7-12	R.J. King/L. Denlinger	All
1990	109,531	85,475	10/17-19	R.J. King/A.W. Brackney	All
1991	75,295	85,185	10/3-8	R.J. King/A.W. Brackney	All
1992	82,295	89,040	10/10-17	R.J. King/A.W. Brackney	All
1993	71,051	76,214	10/23-26	R.J. King/D.A. Dewhurst	Alaska Peninsula only
1994	87,086	80,144	10/8-14	R.J. King/K. Laing	All
1995	91,009	83,049	10/14-20	R.J. King/K.S. Bollinger	All
1996	87,018	88,371	9/28-29	R.J. King/W.D. Eldridge	North Alaska Peninsula only ¹
1997	86,669	88,232	10/3-5	R.J. King/C.P. Dau	North Alaska Peninsula only ¹
1998	67,744	80,477	10/7-9	R.J. King/E.J. Mallek	Alaska Peninsula only
1999	60,226	71,546	10/1-5	E.J. Mallek/C.P. Dau	North Alaska Peninsula only ¹
2000	61,626	63,199	10/1-5	E.J. Mallek/C.P. Dau	Kuskokwim Bay south
2001	59,987	60,613	9/26-10/1	E.J. Mallek/C.P. Dau	Kuskokwim Bay south
2002	78,692	66,768	9/29-10/2	E.J. Mallek/C.P. Dau	Kuskokwim Bay south
2003	77,290	71,990	9/27-10/2	E.J. Mallek/C.P. Dau	Kuskokwim Bay south
2004	93,544	83,175	9/30-10/3	E.J. Mallek/C.P. Dau	Kuskokwim Bay south
2005	73,212	81,349	10/4-8	E.J. Mallek/C.P. Dau	Alaska Peninsula only
2006	81,078	82,611	9/26-28	E.J. Mallek/C.P. Dau	Alaska Peninsula only

¹ Previous south side of the Alaska Peninsula used in estimate.

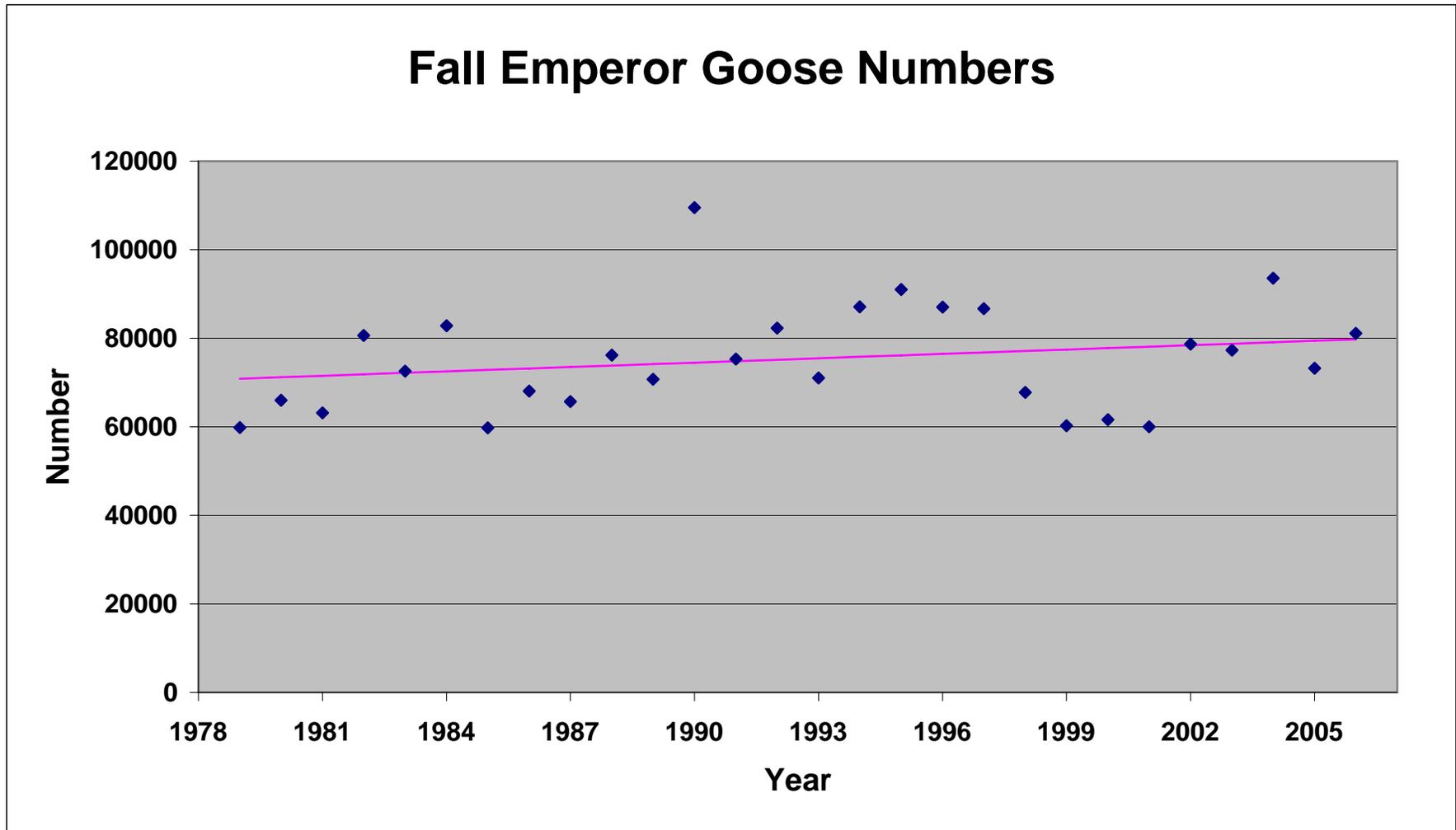


Figure 3. Twenty-eight year trend of fall staging emperor geese in southwest Alaska: mean = 75,310, slope = 329, $p = 0.25$, R square = 0.05, mean annual growth rate = 0.44%.