

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

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December 2006

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Abstract: The 26th consecutive spring aerial emperor goose survey was conducted from 27 April–2 May. A total of 76,108 emperor geese were observed (up 41.0% from 2005, up 19.6% from the 26 year average) in coastline and estuarine habitats from Goodnews Bay to Unimak Island, including north and south sides of the Alaska Peninsula east to Wide Bay. The 3-year average of consecutive spring surveys is now 59,142 birds (up 2.9% from the previous 3-year average). Other species of emphasis included Pacific brant and Steller's eider with estimated populations of 80,201 and 30,395, respectively. An amphibious Cessna 206 (N234JB) was used, flown at 45 meters (150 feet) ASL and 200 kilometers/hour (110 knots). The survey was flown approximately one week later than in 2005 as climate patterns were delayed but emperor geese were found normally distributed.

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INTRODUCTION

This survey has annually monitored spring distribution, abundance and population trends of emperor geese and other waterbirds at migratory staging areas throughout southwestern Alaska since 1981. The traditional survey route included coastline and estuarine habitats from the Yukon-Kuskokwim Delta (Y-K Delta) 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. Coverage along the south side of the Alaska Peninsula emphasizes known emperor goose staging and use areas and omits areas of marginal habitat where birds have not been seen during previous surveys. A 3-year moving average of these population data, collected in accordance with the Pacific Flyway Emperor Goose Management Plan, is used as the index to established harvest thresholds. The data also assess annual and long-term variation in seasonal migratory phenology and determine trends in distribution and habitat use for emperor geese.

METHODS

The survey was flown from 27 April-2 May. Survey timing was a week later than in 2005 due to the late, cold spring. Other recent surveys had been adjusted earlier based on observations of the phenology of ice break-up within the survey area, local observations of migrating and staging emperor geese and in recent years by the movement of birds implanted with satellite transmitters.

The survey area includes a maximum of 143 shoreline/estuarine segments identified on 1:500,000 scale aeronautical maps and 1:63,360 scale topographical maps (Figures 1-2) and was previously described by Mallek and Dau (2000). Segments along the south side of the Alaska Peninsula with marginal habitat, where no emperor geese were observed during previous surveys, have been omitted. General observations of habitat and survey conditions including wind speed and direction, temperature, sky condition, visibility and tide stage were recorded en route.

An amphibious Cessna 206 (N234JB) flown at a ground speed of approximately 200 kilometers/hour (110 knots) and an altitude of 45 meters (150 feet) ASL was used. The planned route of flight was from Jacksmith Bay (in the southern portion of Kuskokwim Bay) south to Bechevin Bay (on Unimak Island) along the north side of the Alaska Peninsula, and then eastward along the south side of the Alaska Peninsula to Wide Bay. The coastal flight path was approximately 100 meters offshore with deviations, normally within 1.6 kilometers (1 mile) of exposed shorelines, to confirm species identification and estimate numbers. In estuaries, a systematic but meandering flight path was followed to ensure complete coverage. Whenever possible, flights were conducted with <20 knots of wind and primary staging areas were flown at or near high tide as this concentrated geese near shorelines. Observations were made from both sides of the aircraft and voice recorded into two laptop computers using remote microphones. Computers received input from the aircraft Global Positioning System (GPS) saving coordinates for each observation. Specialized record and transcribe programs were used to process these data (J. Hodges, MBM-Juneau).

SURVEY CONDITIONS

Climatically, 2006 was later than the record early springs of 2003 and 2004 and less so in comparison to 2005, deviating from the recent trend towards earlier, mild springs. Northerly winds were not favorable for migration and most emperor geese were congregated in Alaska Peninsula estuaries. Nearshore sea ice in 2006 was patchy north of Cape Newenham and, with the exception of the area near Tongue Point and upper Togiak Bay, northern Bristol Bay was essentially ice free. Sea ice/brash was present in southern Bristol Bay from Kvichak Bay south to Ugashik Bay. Estuaries along the Alaska Peninsula were essentially ice free. Restricted visibility in the vicinity of Cape Newenham prevented us from surveying Nanvak Bay and the area from Aniakchak Bay to Imuya Bay along the south side of the Alaska Peninsula.

April 27: Kuskokwim Bay to Cape Newenham (Segments 14-22). General conditions were northerly winds of less than 10 knots, clear to broken ceilings and temperatures increasing from 18-25°F. Snow conditions in lowlands were 100% throughout the area. Ice conditions were: freshwater ponds were frozen, Jacksmith Bay was obscured by fog, Goodnews and Chagvan bays had 75% and 95% ice cover, respectively. Nanvak Bay was obscured by fog. Broken sea ice was absent to patchy in the area. Otherwise, survey conditions were favorable with 10-20 knot winds, temperature 15-20°F and good visibility in areas without fog.

April 27: Cape Newenham to King Salmon (Segments 23-34). Survey conditions were good with northerly winds of 10-20 knots, clear to broken skies and temperatures increasing during the day from 20 to 30°F. Snow cover in lowlands was 95% or greater through segment 30 (Nushagak Peninsula) gradually diminishing to 30% at Naknek. Freshwater ponds were completely frozen north of the Kvichak River with some melt along the margins of lakes south to Naknek. Shorefast sea ice was present in northern Bristol Bay (west of Tongue Point to Matogak River and the northerly portion of Togiak Bay). Survey conditions were favorable with moderate glare in some locations.

April 28: Naknek River to Port Heiden (Segments 35-43). From King Salmon to Port Heiden, winds were northwesterly at 8 knots and the temperature at King Salmon was 25°F. Skies were scattered with a ceiling of 2000 feet. Survey conditions were favorable with moderate glare in some locations. Onshore snow cover was 30% to Cinder River Lagoon decreasing to 10% to the southwest. Tides were high at Egegik and Ugashik bays, and mid at Cinder River Lagoon. Low ceilings and precipitation precluded surveying from Port Heiden south. Estuaries were 95% or greater ice free. Sea ice/brash was present from 5-12 kilometers offshore south to Cinder River Lagoon.

April 29: Port Heiden to Port Moller (Segments 44-49). Winds were northwesterly at 10 knots, temperature was 38°F and skies were overcast with a ceiling of 1800 feet. Onshore snow cover was 10%. Survey conditions were favorable to Port Moller but low ceilings and precipitation precluded surveying from the Nelson Lagoon complex south. Tide was mid level at Port Heiden and Seal Islands.

April 30: Port Moller to Moffet Lagoon (Segments 50-59). Winds were easterly at 8-10 knots, temperature was 35°F and skies were scattered with a ceiling of 4000 feet. Onshore snow cover was 10%. Tides were mid level in Port Moller, Herendeen Bay and Nelson Lagoon. Survey conditions were favorable.

May 1: Izembek Lagoon and south of Cold Bay: (Segments 60-68, 80-85). Winds were northerly at 15 knots, temperature was 35°F and skies were overcast with a ceiling of 1500 feet. Tide was high in Izembek Lagoon and low in Pacific estuaries south to Bechevin Bay. There was occasional light drizzle however, overall survey conditions were favorable

May 2: Cold Bay to Wide Bay (Segments 86-137). Winds were initially 5 knots increasing throughout the day to southeasterly at 15 knots. Temperature was approximately 45°F and overcast ceilings lowered from 2000 to 700 feet throughout the day. Segments 128 (Aniakchak Bay) to 136 (Imuya Bay) were omitted due to low ceilings and fog. Survey conditions were favorable in all segments flown.

RESULTS/DISCUSSION

Bering Sea ice was mostly absent within the survey area and coastal snow cover was extensive north of the Alaska Peninsula (Table 1). Migratory phenology of emperor geese appeared normal and we found no reports of emperor geese north of our starting

point at Goodnews Bay prior to the survey. No emperor geese had been observed by 4 May on Kigigiak Island however a local resident reported a small flock south of Tooksook Bay on that date (Bryce Lake, YDNWR, pers comm.). The 180 emperor geese seen at Chagvan Bay (segment 20) on 27 April were below the long-term average of 964 for that estuary. Most emperor geese were distributed normally in estuaries along the north side of the Alaska Peninsula. Observations from Unalaska, in the eastern Aleutian Islands, suggested the last migrants had departed by 2 April, approximately one week later than the last sighting of 25 March 2005 (S. Golodoff, pers. comm.). This observation suggests most birds had likely moved into our survey area. Emperor geese were last reported on Kodiak Island (Women's Bay) on 11 May with a previous sighting of 225 at Ugak Bay on 30 April and most were believed to have migrated west prior to the completion of the survey (R. MacIntosh, pers. comm.). Emperor goose and other waterbird numbers are summarized by segment in Table 2.

Emperor Goose

The 2006 emperor goose count of 76,108 was 41% above the 2005 estimate of 53,965 (Table 3) and 15% above the 26 year average of 63,647 (95% CI = 6,169). The current 3-year average management index of 59,142 birds increased 3% from the previous average of 57,492 (2003-2005) (Table 3). Emperor goose migratory phenology was comparable to 2005 and did not appear to change in response to cold and delayed spring conditions in Bristol Bay and further north. Chagvan Bay, north of Cape Newenham, had 180 birds versus 15 seen in 2005 and the long-term average of 964 birds. Only 40 emperor geese were seen in northern Bristol Bay (Cape Newenham to Kvichak River). Most emperor geese were observed in estuaries along the northside of the Alaska Peninsula (94% of total birds, average 91%). The 4,274 emperor geese observed along the south side of the Alaska Peninsula east of Cold Bay was a slightly larger than normal proportion of the population (6% versus the average of 4%).

Proportional geographic distribution of emperor geese compared to long-term averages is summarized in Table 4. Figure 3 illustrates the 26-year and 10-year trend of emperor geese.

Pacific brant

We observed a total of 80,201 brant during the survey (Table 2), 72,725 (91%) of which were in Izembek Lagoon and adjacent areas. Chagvan Bay had 1,509 brant versus 1,200 in 2005 and the long-term average of 9,927. Nanvak Bay, which holds an average of 3,941 (663 in 2005), could not be surveyed due to fog. The total of 5,962 brant (7% of the survey total) observed at high use areas along the southside of the Alaska Peninsula was above the 1981-2005 average (2,721 birds, 4% of total) suggesting migration was delayed and still in progress. Migrant brant were first observed at Kodiak Island on 12 April and were seen regularly through mid May (R. MacIntosh, pers. comm.).

Steller's Eider

We observed 30,395 Steller's eiders (Table 2), 26% below the 2005 count of 41,095 and 22% below the long-term average of 39,101 for surveys beginning south of Kuskokwim Bay. Most Steller's eiders (26,887 birds, 88% of the total) were observed from Port Heiden to Izembek Lagoon and 135 birds were observed along the southside of the Alaska Peninsula.

Early spring climatic conditions have coincided with lower spring counts of Steller's eiders as some migrants may have moved north of the survey area prior to the initiation of the survey. Satellite tracking showed nine currently active Steller's eiders (two males and seven females) captured during winter at Kodiak Island were present along the Alaska Peninsula during the survey (D. Rosenberg, Alaska Dept. Fish and Game, pers. Comm.).

Equal sex ratio of adult plumaged birds recorded by the right seat observer (93% of 94 flocks observed) suggested paired birds predominated and only seven flocks of primarily brown plumaged birds were observed. In some previous surveys, the few Steller's eider flocks along the western Alaska Peninsula have been predominately brown plumaged birds, either unpaired females and/or subadults however in 2006 only four such flocks were observed in that area.

CONCLUSIONS

The spring 2006 emperor goose population estimate of 76,108 is 20% above the long-term survey average (1981-2006) of 63,647. The current 3-year average population of 59,142 (2004-2006) is 3% above the previous 3-year average of 57,942 (2003-05) and 5% below the long-term average of 3-year indices (62,154 birds). The Pacific Flyway Emperor Goose Management Plan establishes a management threshold of 80,000 geese in spring for consideration of legalized harvest.

Growth of the emperor goose population is adversely affected by continuing illegal harvest, recent low annual productivity and low juvenile survival. Productivity in 2005 (19% juveniles or an estimated 13,544 juveniles in fall 2005) (USFWS-MBM files) followed nine consecutive years of below average production. The most recent harvest surveys suggest over 4,500 emperor geese are taken annually (Wolfe and Paige 2002). Harvest may be under estimated since data are not collected from all use areas in Alaska and Chukotka. Hence, the cumulative impacts of illegal harvest and natural mortality could be approaching or exceeding recruitment of juveniles into the breeding population. This indicates an immediate need for 1) a comprehensive statewide assessment of current take 2) increased efforts to reduce take and 3) continued monitoring of survival rates.

Low survival rates for juvenile emperor geese continue to be of concern as evidenced by the most recent nine years (18.5% in 2005), when the proportion of juveniles in fall has averaged 13% versus the previous 11 year and long-term (1979-2005) averages of 23% and 19%, respectively (Anderson et al. 2004, MBM-R7 files).

Recovery of the emperor goose population continues to be hampered by a combination of mortality factors which approach or exceed recruitment of breeding age geese into the population. Primary factors limiting recovery of the population and realistic management options to control and monitor these factors are:

- 1) Illegal hunting year-round but primarily in spring, summer and fall. Comprehensive harvest surveys are needed in Alaska and Russia to assess harvest. Options to eliminate or greatly reduce harvest should be initiated.
- 2) Predation during nesting and brood rearing as indicated by low productivity in recent years and chronic low survival of juveniles from pre-fledging through winter (Schmutz et al. 1997). Predator management on the Y-K Delta should be initiated as a means to increase recruitment of breeding birds into the population (Bowman et al.1997). Monitoring of age and season specific survival rates should be continued.
- 3) Wintering ecology of emperor geese is poorly understood. Mortality of juveniles is high and management options to reduce it are limited. However, it is important to investigate and determine the severity of factors such as climate, predation, hunting, and pollution/contaminants so that appropriate beneficial actions can be undertaken.
- 4) Annual monitoring of spring and fall population sizes and trends as well as distribution, habitat use and productivity are of continuing management importance.

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

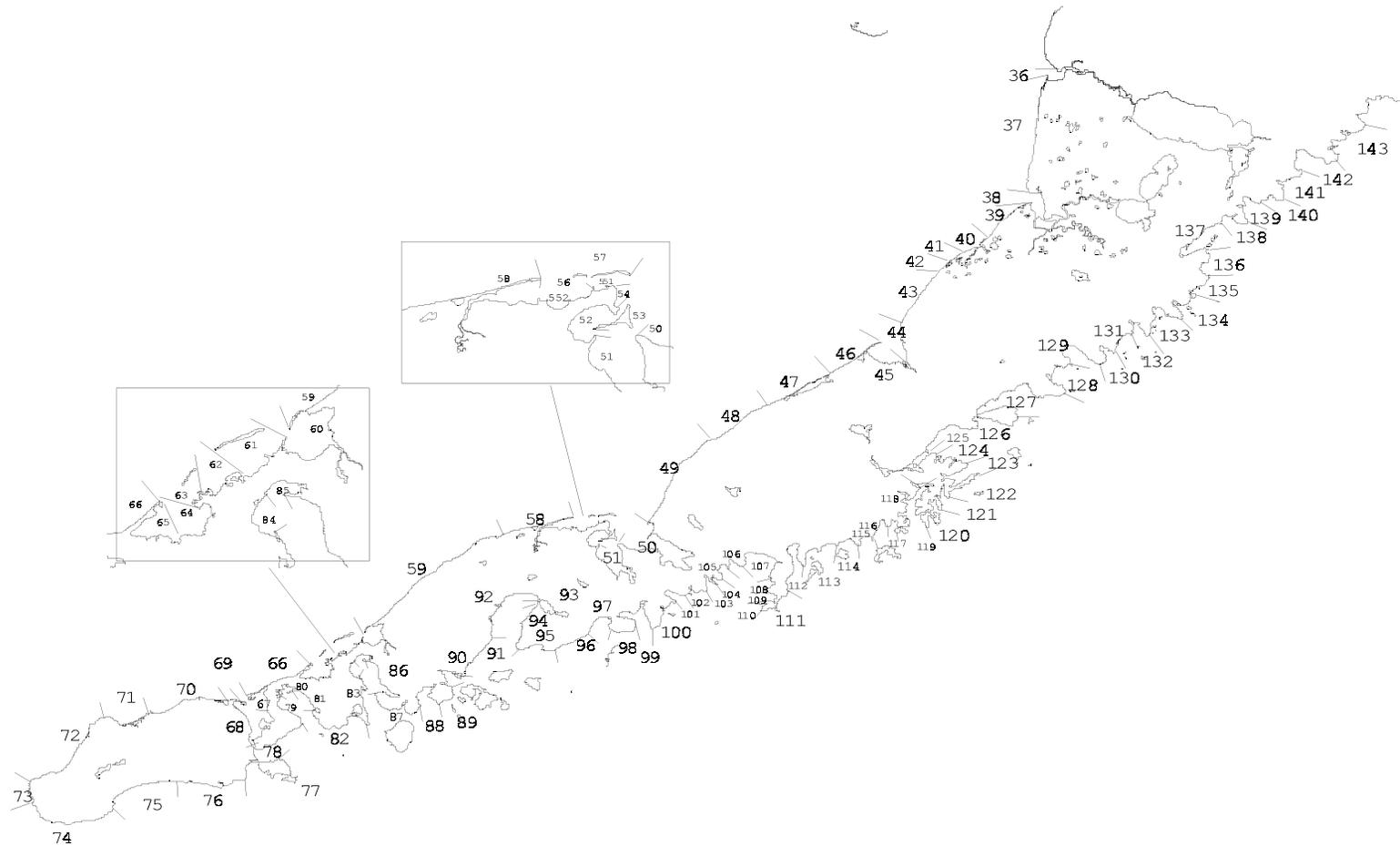


Figure 2. Map of emperor goose aerial survey segments 36-143 in southwest Alaska, 1992-2006.

Table 1. Snow and ice conditions during the spring emperor goose survey in southwest Alaska, 27 April – 2 May 2006.

AREA	SNOW COVER ¹	MARINE ICE COVER ²
Kokechik Bay	-	-
Hooper Bay	-	-
Hazen Bay	-	-
Carter Bay	-	-
Goodnews Bay	100	75
Chagvan Bay	100	95
Nanvak Bay	100	est. 95 (fog)
Relative Phenology³	Late	Early

¹ Percent snow cover on near-shore freshwater marshes.

² Percent of marine ice cover in estuary.

³ Subjective habitat conditions (early, average, late).

Table 2. Waterbird and mammal observations by segment from southwest Alaska, 27 April - 2 May 2006.

SPECIES	18	19	20	24	25	26	27	28	29	30	31	32	33	34	35
Amer. Green-winged Teal															
Amer. Wigeon															
Bald Eagle (ad)				1		3		1	2					1	
Bald Eagle (juv)						5			1						
Beluga Whale												1		15	
Pacific Brant	23		1509	4											
Black-legged Kittiwake						500	200							25	
Black Scoter				28					40	16	38	291	1		25
Bonaparte's Gull															
Bufflehead															
Canada Goose				10		50				129	167				2
Common Eider	4	2	40	12											
Common Goldeneye															
Common Loon															
Common Merganser														24	
Common Murre															
Common Raven						2			12						
Cormarant	1	1	3		9	45	12		1						
Double-crested Cormorant									6						
Emperor Goose			180			40									
Galdwall															
Glaucous Gull	10	5	500	13	25	96	170	8	125	10	21	18	2	72	74
Brown Bear															
Greater Scaup	4			20		20		20	8	192	171	22	95		120
Grey Whale									1						
Harlequin Duck						5		9	2						
Harbor Seal				1		1				1					
King Eider															
Large Gull	45	5	503	26	135	389	227	26	254	198	21	317	2	263	102
Large Shorebird															
Long-tailed Duck	25			8					48	5			21		
Mallard						2		40		28				52	
Mew Gull	2					33	27	20	12	112	348	78		159	872
Northern Pintail				83	142	10		163	96	18	118	145	26	40	112
Pacific Loon				8											
Parasitic Jaeger				1											
Pelagic Cormorant	3	2	4		13	58	13	1	7	1					
Pigeon Guillemot															
Red-breasted Merganser	5			25	41	40		131	73	2	8	8	26	707	
Red-necked Grebe															
Red-throated Loon				3				14	20	1	3	6			8
Sandhill Crane						10			10		1				
Sea Otter															
Small Gull			20	83	304	163	214	1231	551	64	205	710		39	1753
Small Shorebird										55		30			25
Steller's Eider	1133		982	20											
Steller's Sealion															
Surf Scoter															
Tundra Swan	5						34			8		1		6	
White-fronted Goose				5		275			454	66	300	208	137		165
White-winged Scoter				13											

Table 2 (continued). Waterbird and mammal observations by segment from southwest Alaska, 27 April - 2 May 2006.

SPECIES	36	37	38	39	40	41	42	43	44	45	46	47	48	49
Amer. Green-winged Teal														
Amer. Wigeon			10											
Bald Eagle (ad)	1			1		2						1		
Bald Eagle (juv)														
Beluga Whale														
Pacific Brant												2		
Black-legged Kittiwake														22
Black Scoter	180	295	1351	37	36	12	4	10	373	923	101	174	675	492
Bonaparte's Gull							11							
Bufflehead														
Canada Goose									2	3		120		
Common Eider					25									
Goldeneye	4													
Common Loon														
Common Merganser														
Common Murre														
Common Raven								1			1	1		
Cormarant														
Double-crested Cormorant														
Emperor Goose	2835	39	3431		3973	4639			6393	21429		11827		
Galdwall														
Glaucous Gull	213	2	546	1	34		26		356	301	1	908	3	14
Brown Bear													2	
Greater Scaup	760		899		1				2	300				
Grey Whale													2	3
Harlequin Duck														
Harbor Seal					200					2252		1020		
King Eider				250					2400					330
Large Gull	784	70	593	38	34	46	50	61	654	301	354	1611	232	409
Large Shorebird														
Long-tailed Duck	2		5		15				20		15		310	463
Mallard	8		2			2			55	170		125		
Mew Gull	8	44	626	1	25		7		345	464	5	2000	1	
Northern Pintail	108		2804		1464	98			440	4510		2660		
Pacific Loon														
Parasitic Jaeger			1											
Pelagic Cormorant														7
Pigeon Guillemot														
Red-breasted Merganser	2	2												
Red-necked Grebe				6							1			17
Red-throated Loon	12	47	9	6	1									
Sandhill Crane	12				2									
Sea Otter		1		1	201				1	511		3		3
Small Gull	662	45	515	47		783	26		135		295	230	10	1145
Small Shorebird	10	200	400		200	1890	145			6300		1300		
Steller's Eider	40			20	350	2				5060		4400	20	340
Steller's Sealion														
Surf Scoter			1											
Tundra Swan														
White-fronted Goose	177													
White-winged Scoter			1				4		3		4			

Table 2 (continued). Waterbird and mammal observations by segment from southwest Alaska, 27 April - 2 May 2006.

SPECIES	50	51	52	53	54	551	552	56	57	58	59	60	61
Amer. Green-winged Teal													
Amer. Wigeon													
Bald Eagle (ad)		2				1	2	4	2	5	4	3	1
Bald Eagle (juv)			1			1	2	2		4	1		1
Beluga Whale													
Pacific Brant	50		110			252	75					5255	27568
Black-legged Kittiwake													
Black Scoter	131	314	7572	881	627	600	8126	1048		630	1114		
Bonaparte's Gull													
Bufflehead													
Canada Goose													
Common Eider							3	140					
Goldeneye	2												
Common Loon	1												
Common Merganser													
Common Murre													
Common Raven										1			
Cormarant													
Double-crested Cormorant													
Emperor Goose	2470					5	4853	5960	60	616		2348	250
Galdwall													
Glaucous Gull	2227	24	111	960	4	774	9551	5400	164	20	139	622	777
Brown Bear													
Greater Scaup			75			150	30						
Grey Whale	3								2	1	10		
Harlequin Duck											4		2
Harbor Seal	1						250	1100	1		141		
King Eider							450			25	20		
Large Gull	2459	330	278	1406	135	932	12376	7620	1006	122	691	705	782
Large Shorebird													
Long-tailed Duck			580						35	1077	35		
Mallard			5				85					99	90
Mew Gull		300	12	20		34					50	900	250
Northern Pintail		40	255			464	1100	85				470	50
Pacific Loon										1	2		
Parasitic Jaeger											2		
Pelagic Cormorant	2										2		
Pigeon Guillemot	1												
Red-breasted Merganser	23		7	3	10			4		5	22	9	16
Red-necked Grebe	26									25	58		1
Red-throated Loon										1			
Sandhill Crane													
Sea Otter	363	24	12	172	3		8	244	7		45	7	7
Small Gull	109	90	575	125		176	14	255	160		445	255	
Small Shorebird	125		510				1400	800	20		212	2500	
Steller's Eider	700			345			1300	6870		102	177	700	3635
Steller's Sealion													
Surf Scoter													
Tundra Swan													
White-fronted Goose													
White-winged Scoter													

Table 2 (continued). Waterbird and mammal observations by segment from southwest Alaska, 27 April - 2 May 2006.

SPECIES	62	63	64	65	66	67	68	80	81	83	84	85	86	88
Amer. Green-winged Teal														
Amer. Wigeon														
Bald Eagle (ad)	2	6	1	4				2	1	4			2	1
Bald Eagle (juv)		1	3	2						1				
Beluga Whale														
Pacific Brant	1755	8800	16125	10538		1635	107	360		222		360		34
Black-legged Kittiwake							5							
Black Scoter	10		20	45	377	23	40	20	82	26	5		68	71
Bonaparte's Gull														
Bufflehead														
Canada Goose														
Common Eider														
Goldeneye				4		4		190				60		
Common Loon												4	9	3
Common Merganser														
Common Murre							2							
Common Raven							1			1				
Cormarant						1	1		1					
Double-crested Cormorant														
Emperor Goose		110	6	160					55	90		30	35	
Galdwall														
Glaucous Gull	728	827	1274	798	152	335	1039	772	104	306	31	330		9
Brown Bear														
Greater Scaup			8	20				12						
Grey Whale														
Harlequin Duck		3	8	5	23	13	10	2	27	4	54	10	499	171
Harbor Seal	250		70			150							1	
King Eider														
Large Gull	1006	940	1832	958	212	1032	1243	1208	150	360	43	633	23	34
Large Shorebird														
Long-tailed Duck					1									
Mallard				20				58						
Mew Gull							5							
Northern Pintail				485				375		170		20		
Pacific Loon														
Parasitic Jaeger														
Pelagic Cormorant		32			3	1	1		1	2				3
Pigeon Guillemot														
Red-breasted Merganser		7	21	49	3	63	40	166	9	8	3	117	32	17
Red-necked Grebe					8	1							6	3
Red-throated Loon														
Sandhill Crane														
Sea Otter	127	350	27	20	2	64				3	50	11	51	
Small Gull				8	103	8	15	55	7	6	21	47	3	8
Small Shorebird		100		2		50		200		1		550		
Steller's Eider			1780	1458			3			23		800		
Steller's Sealion														
Surf Scoter														
Tundra Swan														
White-fronted Goose														
White-winged Scoter										3			4	

Table 2 (continued). Waterbird and mammal observations by segment from southwest Alaska, 27 April - 2 May 2006.

SPECIES	90	91	92	93	97	99	101	102	107	112	113	114	115	116	117	118
Amer. Green-winged Teal													3			
Amer. Wigeon																
Bald Eagle (ad)		1	4	2				1	2		4	3				
Bald Eagle (juv)				4												
Beluga Whale																
Pacific Brant	1460	16	131			35							15			
Black-legged Kittiwake											1	43		100		
Black Scoter	80	38	710	635	20	76	95	210	15	30	207	40	20			60
Bonaparte's Gull																
Bufflehead	20					10										5
Canada Goose																
Common Eider																
Goldeneye																55
Common Loon	1	6		5	4	10	2		1	1	3					
Common Merganser																
Common Murre						9	2									
Common Raven																
Cormarant	1			1							1					
Double-crested Cormorant																
Emperor Goose		10	335						45	380						
Galdwall																
Glaucous Gull	307	11	92	117	2	7	2	9	14	6	76	14			75	9
Brown Bear	1				2	1							2			
Greater Scaup										15						30
Grey Whale																
Harlequin Duck	241	3	25	336	15	136	28	10	52	30	5	2			44	23
Harbor Seal	3			21					75							
King Eider			325													
Large Gull	590	53	206	180	2	62	20	18	75	196	104	100	33	35	79	22
Large Shorebird																
Long-tailed Duck																
Mallard										145				2		
Mew Gull				130		220				250						
Northern Pintail	12	12		185						225						
Pacific Loon									1							
Parasitic Jaeger																
Pelagic Cormorant	1			1							3	2				
Pigeon Guillemot															1	
Red-breasted Merganser	127	32	124	1109		129	5	9	40	728	3	57	10		23	73
Red-necked Grebe		2	1	212		2				5	5		2			4
Red-throated Loon				2					1							
Sandhill Crane																
Sea Otter	12		32	23												
Small Gull	10			308	135		30	24	158	8	7	7	28	83		6
Small Shorebird				105					45							
Steller's Eider				90												
Steller's Sealion								1								
Surf Scoter		10							80	25				15		
Tundra Swan									4							
White-fronted Goose																
White-winged Scoter					5			22	10		12					

Table 2 (continued). Waterbird and mammal observations by segment from southwest Alaska, 27 April - 2 May 2006.

SPECIES	125	126	127	137	Grand Total
Amer. Green-winged Teal		35			38
Amer. Wigeon			5	4	19
Bald Eagle (ad)		10	9	4	100
Bald Eagle (juv)		1		1	31
Beluga Whale					16
Pacific Brant	2275	73	274	1138	80201
Black-legged Kittiwake					896
Black Scoter	1049	467	400	1246	32330
Bonaparte's Gull					11
Bufflehead		6			41
Canada Goose					483
Common Eider					226
Goldeneye			4		319
Common Loon		2	4	3	59
Common Merganser					24
Common Murre					13
Common Raven		1		3	24
Cormarant	4	1			83
Double-crested Cormorant					6
Emperor Goose		59	310	3135	76108
Galdwall				4	4
Glaucous Gull	87	153	210	692	32915
Brown Bear			4	3	15
Greater Scaup	880		129	1340	5323
Grey Whale					22
Harlequin Duck	539	118	209	135	2802
Harbor Seal				3	5541
King Eider			45	255	4100
Large Gull	118	210	461	757	49587
Large Shorebird				50	50
Long-tailed Duck	102				2767
Mallard	10				998
Mew Gull	2100			150	9610
Northern Pintail	230		84	495	17794
Pacific Loon	2	1		1	16
Parasitic Jaeger				1	5
Pelagic Cormorant	5	2		37	207
Pigeon Guillemot	2				4
Red-breasted Merganser	840	15	34	17	5079
Red-necked Grebe	7		11		403
Red-throated Loon					134
Sandhill Crane					35
Sea Otter	44	70	33	30	2562
Small Gull	424	100	398	183	13613
Small Shorebird		2		50	17227
Steller's Eider	45				30395
Steller's Sealion					1
Surf Scoter		6			137
Tundra Swan					58
White-fronted Goose					1787
White-winged Scoter		55		3	139

Table 3. Spring Emperor Goose Survey, Southwest Alaska, 1981-2006.

YEAR	DATES	POPULATION SIZE		3-YEAR AVG.	% CHANGE	OBSERVERS
		NUMBER	% CHANGE			
1981	4/23-4/27	91267				R.King/C.Dau
1982	5/2-5/4	100643	10			"
1983	4/25-4/29	79155	-21	90355		"
1984	4/26-5/4	71217	-10	83672	-7	"
1985	5/12-5/16	58833	-17	69735	-17	"
1986	5/4-5/7	42231	-28	57427	-18	"
1987	4/30-5/4	51633	22	50899	-11	"
1988	5/2-5/6	53784	4	49216	-3	"
1989	5/3-5/6	45800	-15	50406	2	"
1990	4/28-5/4	67581	48	55722	11	"
1991	5/2-5/7	70972	5	61451	10	"
1992	4/30-5/5	71319	<1	69957	14	"
1993	4/30-5/5	52546	-26	64946	-7	"
1994	4/29, 5/2-6	57267	9	60377	-7	"
1995	5/3-5/6	54852	-4	54888	-9	"
1996	4/27-4/30	80034	46	64051	17	"
1997	4/25-4/28	57059	-29	63982	<-1	"
1998	5/4-5/7	39749	-30	58947	-8	"
1999	4/27-5/1	54600	37	50469	-14	"
2000	4/28-5/3	62565	15	52305	4	E.Mallek/C.Dau
2001	4/29-5/4	84396	35	67187	28	"
2002	5/3-5/6	58743	-30	68568	2	"
2003	4/29-5/3	71160	21	71433	4	"
2004	4/30-5/3	47352	-33	59085	-17	"
2005	4/20-4/23	53965	14	57492	-3	"
2006	4/27-5/2	76108	41	59142	3	"

Table 4. Primary staging sites and proportions of emperor geese from the 2006 aerial survey of southwest Alaska in comparison to long-term averages.

Location (Segment/s)	2006	1981-2005
	Number (%)	Number (Avg. % Total)
Yukon-Kuskokwim Delta (1-10)	NA	NA
Kuskokwim Bay (11-17)	NA	NA
Chagvan Bay/Nanvak Bay (20, 22)	180 (<1)	1281 (2)
Egegik Bay (36-37)	2874 (4)	839 (1)
Ugashik Bay (38)	3431 (5)	1521 (3)
Cinder River Estuary (39-43)	8612 (11)	6463 (11)
Port Heiden (44-45)	27822 (37)	19111 (31)
Seal Islands Lagoon (46-47)	11827 (16)	7596 (12)
Port Moller/Nelson Lagoon (50-54, 56-58, 551-552)	13964 (18)	18189 (29)
Izembek Lagoon (60-65)	2874 (4)	3008 (4)
Pavlof Bay (91-92)	245 (<1)	261 (<1)
Ivanof Bay (112)	380 (<1)	431 (<1)
Chignik Bay (125)	59 (<1)	226 (<1)
Wide Bay (136-137)	3135 (4)	1059 (2)

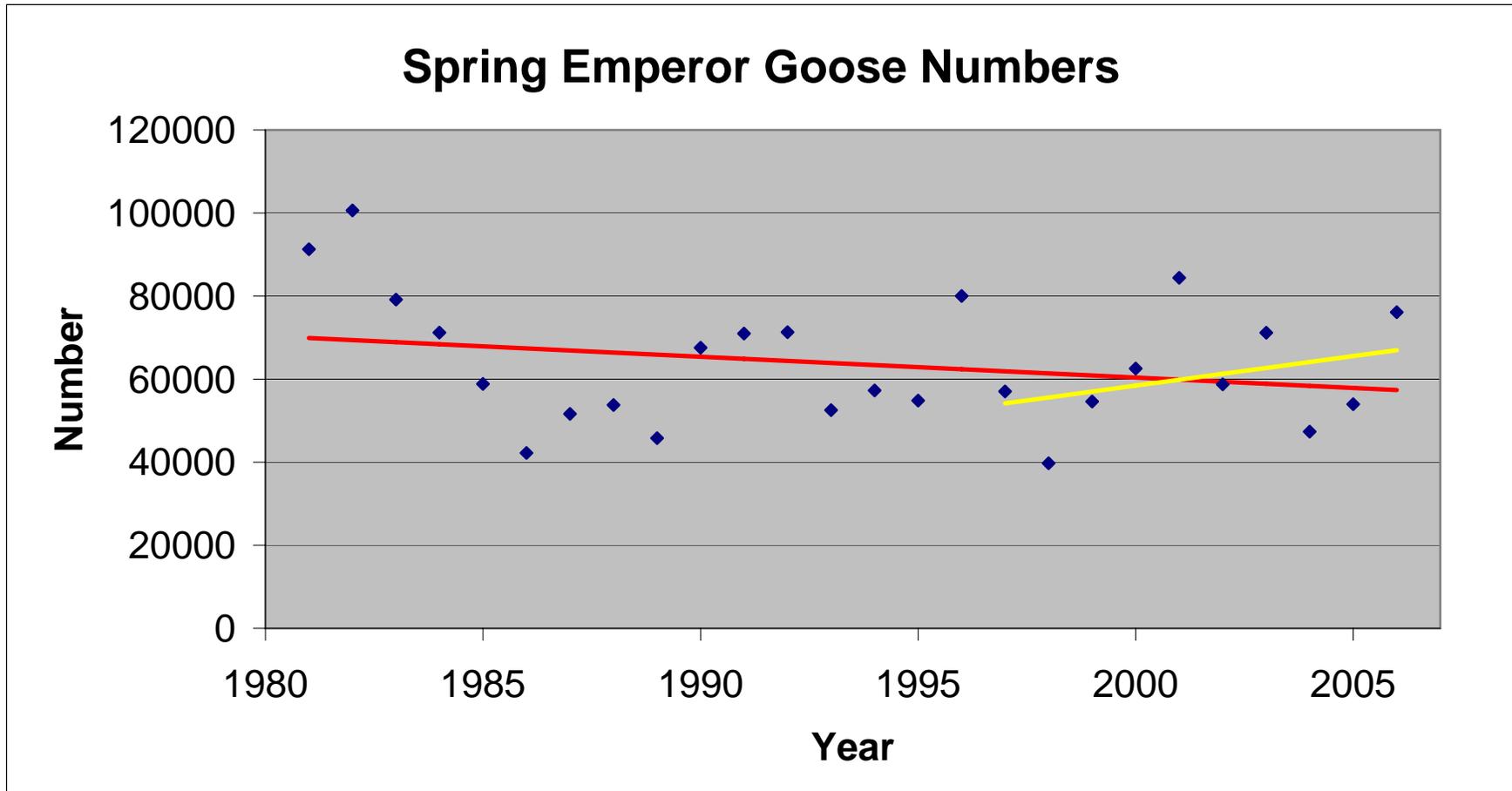


Figure 3. Spring emperor Goose numbers 1981-2006 (blue). Trend information was derived from simple linear models. Twenty-six year trend (1981-2006, red): mean = 63,647, slope = -502, $p = 0.216$, mean annual growth rate = -0.788%. Ten year trend (1997-2006, yellow): mean = 60,570, slope = 1,423, $p = 0.367$, mean annual growth rate = 2.350%.