AERIAL SURVEY OF EMPEROR GEESE AND OTHER WATERBIRDS IN SOUTHWESTERN ALASKA, SPRING 2016

By

Heather M. Wilson

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February 2017

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Abstract: We conducted the 35th annual spring aerial emperor goose survey during 22–23 April 2016. This survey has been completed every year since 1981, except 2013, and has served as the primary management index for emperor geese since 1985. The survey design includes coastline and estuarine habitats from the mouth of the Kuskokwim River to Wide Bay, including the north and south sides of the Alaska Peninsula. In 2016, we estimated a population index of 79,348 emperor geese, which was 24% below the 2015 count of 98,155 geese, but 28% above the long-term average (66,871 geese, 1981–2015). The current 3-year average (2014-2016) index is now 85,812 geese (5% above the previous 3-year average of 81,875 geese) and is the highest since 1983. It is also above the threshold for consideration of an open hunting season for emperor geese, as specified in the Yukon Delta Goose Management Plan and the 2006 Pacific Flyway Council Management Plan for Emperor Geese. Pacific brant and Steller's eider indices on the survey were 66,478 and 11,273, respectively.

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INTRODUCTION

The primary objective of the spring emperor goose survey (1981-2016) has been to monitor distribution, abundance, and population trends of emperor geese (*Chen canagica*) and other waterbirds in southwest Alaska, as well as to provide information on variation in seasonal migratory phenology, distribution, and habitat use. Beginning in 1992, the survey was standardized into 143 coastline and estuarine segments covering the southwest coast of Alaska; from Kuskokwim Bay and throughout the Alaska Peninsula. Over time, a 'core' survey area emerged (segments 14 to 137), which comprised the majority of the spring population observations and areas that had been sampled most consistently over the history of the survey (Dooley et al. 2016). Because emperor geese tend to be more concentrated during spring migration than during fall, the spring survey was adopted as the primary management index for emperor geese in 1985 within the Yukon Delta Goose Management Plan. Thereafter, a 3-year moving average of the annual survey became the key population management index for the species (Pacific Flyway Council 2006, Dooley et al. 2016).

METHODS

The 2016 spring emperor goose survey was conducted on 22–23 April along the north side of the Alaska Peninsula from Naknek to Bechevin Bay (Segments 3485; Figs. 1 and 2); a portion of the larger, historical survey area that was determined to be the most useful in assessing population status and trend (Dooley et al. 2016). Over 90% of the observations of emperor geese on the survey are typically seen in this area (Dooley et al. 2016). To maintain consistency with historical indices, the most recent three-year averages from areas outside the northern Alaska Peninsula were added to the total population indices.

The survey platform was an amphibious Cessna 206 (N375F). The aircraft was flown at a ground speed of approximately 175 km/hr (95 kts) and an altitude of 45 m (150 feet) above sea

level and within 200 m of shore. Survey timing was based on reported and observed phenological indices of ice conditions and migration. Survey timing is intended to precede the arrival of emperor geese on the Yukon-Kuskokwim Delta breeding grounds and follows goose departures from the eastern Aleutian Islands and Kodiak Island. Local observers in Kodiak and the eastern Aleutian Islands confirmed that emperor geese had departed wintering sites prior to the start of the survey (R. MacIntosh, S. Golodoff, S. Berns, B. Pyle, R. Corcoran and T. Lee, personal communications).

While flying the survey, electronic map displays were used along with 1:500,000 aeronautical and 1:63,360 topographical maps for navigation. We used laptop computers to receive input from the aircraft Global Positioning System (GPS), which saved coordinates for each input of voice recorded observations. The "Record and Transcribe" program (J. Hodges, USFWS R7 MBM) were used to collect and process observational data. Habitat and survey conditions were recorded during the survey, including wind, temperature, sky condition, visibility, sea and fresh-water ice conditions, and tide stage, consistent with historical survey reporting.

SURVEY CONDITIONS

Climatic and habitat conditions (ice and snow on the landscape) were very mild during the 2016 survey and spring phenology in southwest Alaska was extremely early. Sea and estuarine ice, as well as snow cover were absent throughout the survey areas, and no coastal lakes south of Naknek had remnant ice.

Survey Day 1 (April 22, Segments 34-59, North side of the Alaska Peninsula, King Salmon to Cold Bay): Survey conditions were good, with low tides and a solid (3000 ft AGL) overcast sky over the northern Alaska Peninsula. Winds were northeasterly at 7 knots at Naknek, increasing to 15–20 knots from Ugashik Bay to Cinder River. Air temperatures increased from 40 to 50^{o}F during the day.

Survey Day 2 (April 23, Segments 60-85, the Izembek Lagoon Complex): Survey conditions were fair with low tides along the Bering Sea side of the Alaska Peninsula and mid-high tides along the Pacific side. Skies were clear to scattered with variable wind <5 knots. Air temperature was near 45^{o}F.

RESULTS

Population indices for the emperor geese and the other primary species of interest (Pacific brant and Steller's eiders) are summarized in the text below, as well as in Table 1 and the Appendix. Historical estimates of emperor goose spring population indices (1981-2016) and corresponding 3-year averages are summarized in Table 1, while segment-specific totals for all species observed during the survey are summarized in the Appendix.

Emperor Goose

The 2016 spring emperor goose index was 79,348; 24 % below the 2015 count of 98,155 geese (Table 1), and 28% above the long-term average (1981–2015) of 66,871 geese. Because our

2016 survey covered only the north side of the Alaska Peninsula, we substituted the most recent 3-year averages for areas un-surveyed in 2016. Thus, I calculated the 2016 spring emperor goose count as the sum of three parts: 1) the most recent 3-yr average (2012, 2014, 2015) of counts north of the Alaska Peninsula (Seg 11-33; 553 geese), 2) the sum of the area surveyed in 2016 on side of the Alaska Peninsula from Naknek to Izembek (Segs. 34-85; 73,738 geese), and 3) the most recent 3-yr average (2012, 2014, 2015) of the south side of the Alaska Peninsula; segments 88-137 (5,057 geese). Including the 2016 count, the most recent 3-yr (2014-2016) average of emperor geese is 85,795; 5% above the previous 3-year average (2012, 2014, 2015) of 81,875 geese (Table 1).

Emperor geese were concentrated at historically important staging sites on the north side of the Alaska Peninsula (Segments 34-85) from Egegik Bay to Izembek Lagoon during the 2016 survey. Counts and percentages of the total 2016 survey (79,348) at each of these important staging lagoons were as follows: Egegik (1,979; 2%), Pilot Point/Ugashik (4,596; 6%), Cinder River (12,525, 16%), Port Heiden (25,213, 32%), Seal Islands (9,916; 12%), Port Moller-Nelson Lagoon (18,025; 23%), Izembek Complex (1,484; 2%). Three-year average contributions from segments north of the Alaska Peninsula (553; 1%) and the south-side of the Alaska Peninsula (5,057, 6%), represented less than 7% of the total. No emperor geese were observed on northern Alaska Peninsula segments that were between major lagoons.

Given the mild winter and early spring break-up, the 2016 spring survey was timed slightly earlier than in previous years (2016 start date: 22 April; average historical start date 26 April), to coincide with presence of spring-staging emperor geese on the Alaska Peninsula. Overall observations of departures of emperor geese from wintering areas in Unalaska and Kodiak Island suggested that most geese had departed those areas for the Alaska Peninsula well prior to the start of the 2016 survey (S. Golodoff, R. MacIntosh, and S. Berns, pers. comm.). Although timing of the 2016 survey was the earliest on record, we did observe large flocks of emperor geese flying off-shore to the north (towards the Yukon Delta breeding grounds) from each of the major staging lagoons on the Alaska Peninsula; indicating that our timing may still have been relatively late during an unusually early spring migration.

Pacific Brant

The brant index was 66,478 brant during the 2016 spring survey (Appendix), which is 7% below the long-term (1981–2015) brant average for the survey (71,362). Because the 2016 survey covered only the north side of the Alaska Peninsula, I substituted the most recent 3-year averages for areas un-surveyed in 2016. Thus, I calculated the spring brant index as the sum of three parts: 1) the most recent 3-yr average (2012, 2014, 2015) of segments (1-33) north of the Alaska Peninsula, including Chagvan and Nanvak Bays (12,375), 2) the sum of the 2016 surveyed area (Segments 34-85) along the north side of the Alaska Peninsula (51,467), and 3) the most recent 3-yr average (2012, 2014, 2015) on the south side of the Alaska Peninsula; (segments 88-137; 2,906 brant).

All but 6 of the brant observed on the spring emperor goose survey in 2016 were counted in the Izembek Complex (51,461; 99%). The 2016 Izembek Complex index was 4% below the previous year's index (53,388) and 8% below the long-term (1981–2015) average (55,708).

Steller's Eider

The index of Steller's eiders in 2016 was 11,273 birds (Appendix). The 2016 count was 77% below the long-term average (1981–2015) of 48,283. Because our 2016 survey covered only the north side of the Alaska Peninsula, we substituted the most recent 3-year averages for areas un-surveyed in 2016. Thus, I calculated the spring Steller's eider index as the sum of three parts: 1) the most recent 3-yr average (2012, 2014, 2015) of segments (1-33) north of the Alaska Peninsula (8,169), 2) the sum of the area we surveyed in 2016 (Segments 34-85) along the north side of the Alaska Peninsula (3,093), and 3) the most recent 3-yr average for Steller's eiders (2012, 2014, 2015) on the south side of the Alaska Peninsula; segments 88-137 (11).

DISCUSSION AND MANAGEMENT IMPLICATIONS

The spring emperor goose population indices (annual and 3-year averages) have not resulted in a significant population trend over the history of the survey (1981-2016; 1.006 growth rate, R^2 = 0.13; Table 1, Fig. 3), but the more recent surveys (2005–2015) have indicated an increasing population growth rate (1.028, 95% CI: 1.001-1.055; Dooley et al. 2016). The recent 3-year average count is the highest reported since 1983, and as in 2015, is above the threshold (80,000) for consideration of a legal hunting season for emperor geese, as specified in the Yukon Delta Goose Management Plan and the Pacific Flyway's Management Plan for Emperor Geese (Pacific Flyway Council 2006).

The Flyway Management Plan was revised in 2016 (Pacific Flyway Council 2016) and a new plan was developed specifically addressing subsistence harvest (Alaska Migratory Bird Co-Management Council 2016). Rather than using the spring survey results reported herein, these new and revised plans call for the use of the Yukon-Kuskokwim Delta Coastal Zone Breeding Pair Survey (Swaim et al. 2016) as the most suitable interim management index for harvest decisions, until a model-based population assessment is refined. The interim population objective and closure threshold based on the Yukon-Kuskokwim Delta Coastal Zone Breeding Pair Survey are population indices of 34,000 and 23,000 indicated total birds, respectively. The 2014-2016 average indicated total bird index from the Yukon-Kuskokwim Delta Coastal Zone Breeding Pair Survey was 30,965 (Swaim et al. 2016), well above the new 23,000 population threshold.

While recovery of the population appears to be occurring, reasons for the historically slow growth of emperor geese are still not fully understood. It is possible that mortality associated with continued harvest could be limiting population growth (Dooley et al. 2016) or juvenile mortality and reduced recruitment could be dampening recovery (Schmutz et al. 1997, 2001). Better harvest data and continued surveys/studies will be required to quantify the effects of these factors on the population.

Overall, we believe careful consideration of harvest management is required for emperor geese, including a greater commitment to comprehensive harvest surveys to accurately measure take. Harvest surveys should also collect adequate data to assess temporal and spatial distribution, as well as age composition within the harvest. A better understanding of additive losses from harvest will be critical to understanding effects on population growth (Wolfe and Paige 2002,

Naves 2015, Dooley et al. 2016). Finally, we suggest that increased compliance with regulations should also be sought, along with improved outreach, co-management, and cooperative enforcement.

The findings and conclusions in this article are those of the author(s) and do not necessarily represent the views of the U.S. Fish and Wildlife Service.

AKNOWLEDGMENTS

I thank Dennis Marks for serving as right-seat observer on the 2016 survey and for assisting with preparatory communications and survey logistics. I am also thankful for the continued reporting of emperor goose observations from rural residents in assisting our understanding of phenology and ultimately, timing of the survey. The survey could not be accomplished without the logistical support of Becharof and Izembek NWRs. Thank you to these refuges, as well as the community of Port Heiden (especially Bruce Bishop), who provided help with fuel, lodging, and ground transportation. I thank Michael Swaim for preparing hazard and navigational maps, and Bob Platte (MBM-R7) for creating Figures 1 and 2. Finally, I acknowledge the incredible contribution of Chris Dau in serving as the observer or pilot/observer in every spring emperor goose survey since 1981; with the exception of 2016 (see Appendix). Thank you for your dedication to surveying emperor geese in southwest Alaska Chris!

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The 2016 Spring Emperor Goose survey crew; Dennis Marks (right-front observer) and Heather Wilson (left-front observer/pilot), with Amphibious Cessna-206 N375F.

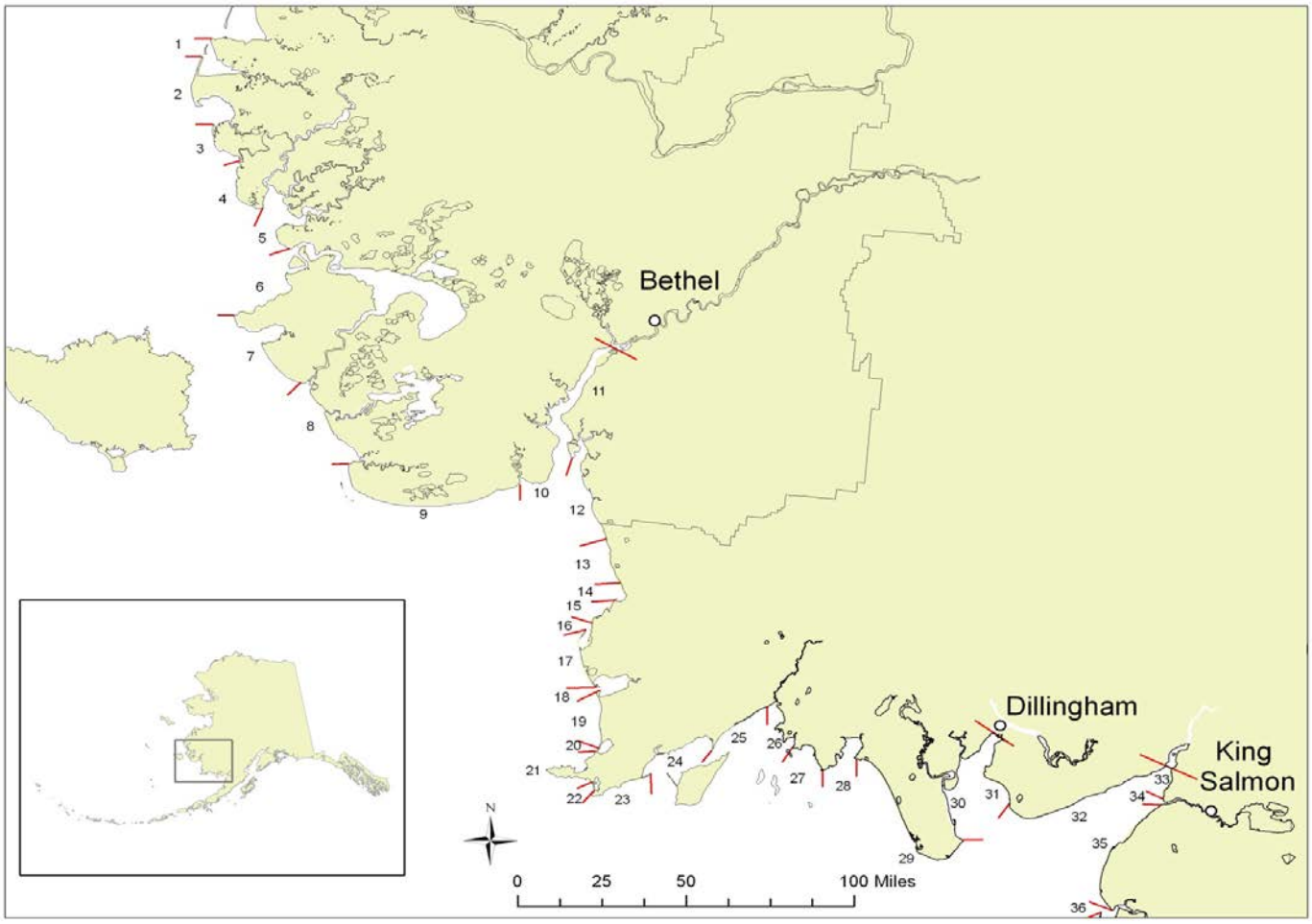

Figure 1. Emperor goose aerial survey segments 1–35, southwest Alaska.

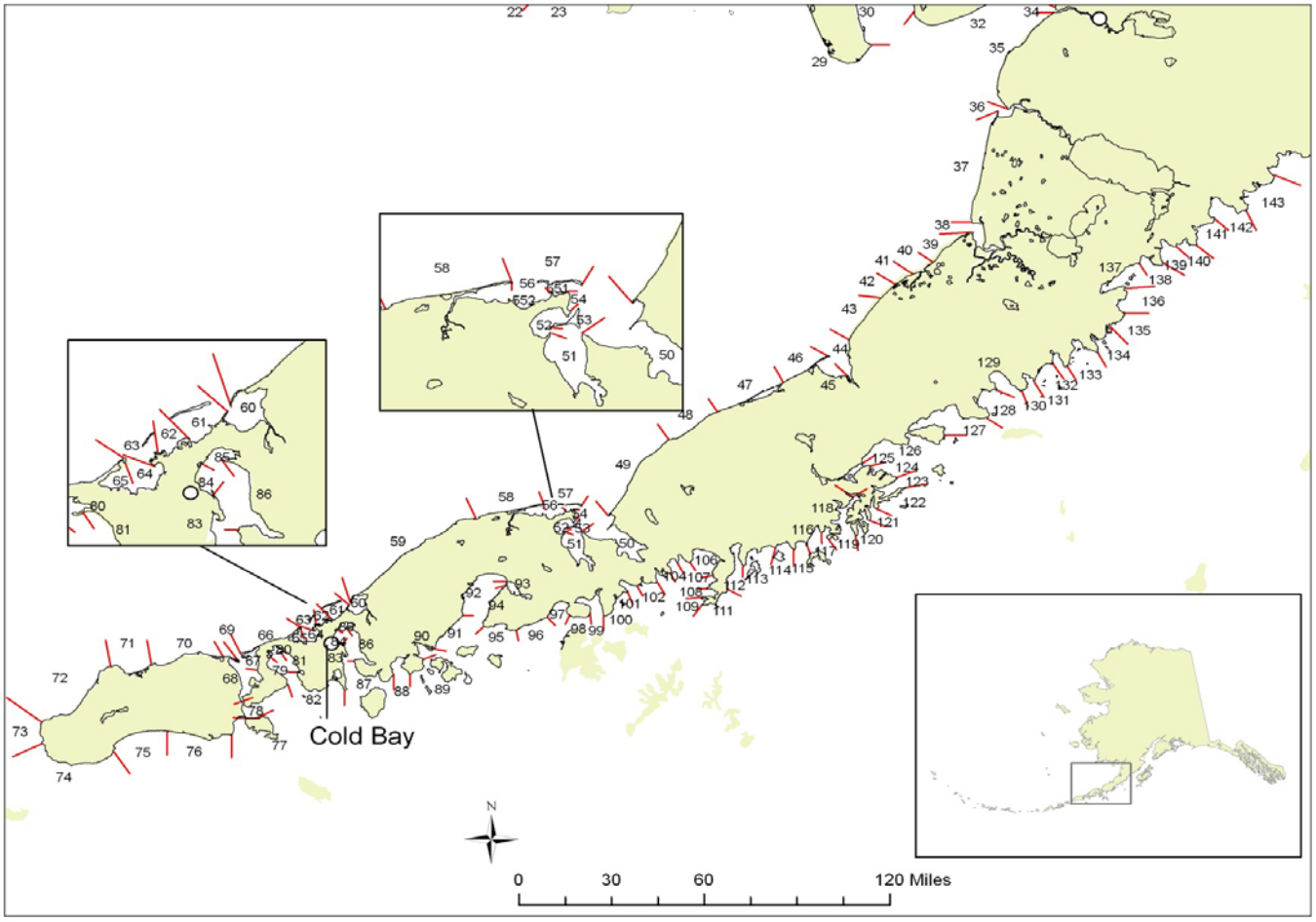

Figure 2. Emperor goose aerial survey segments 35–143, southwest Alaska.

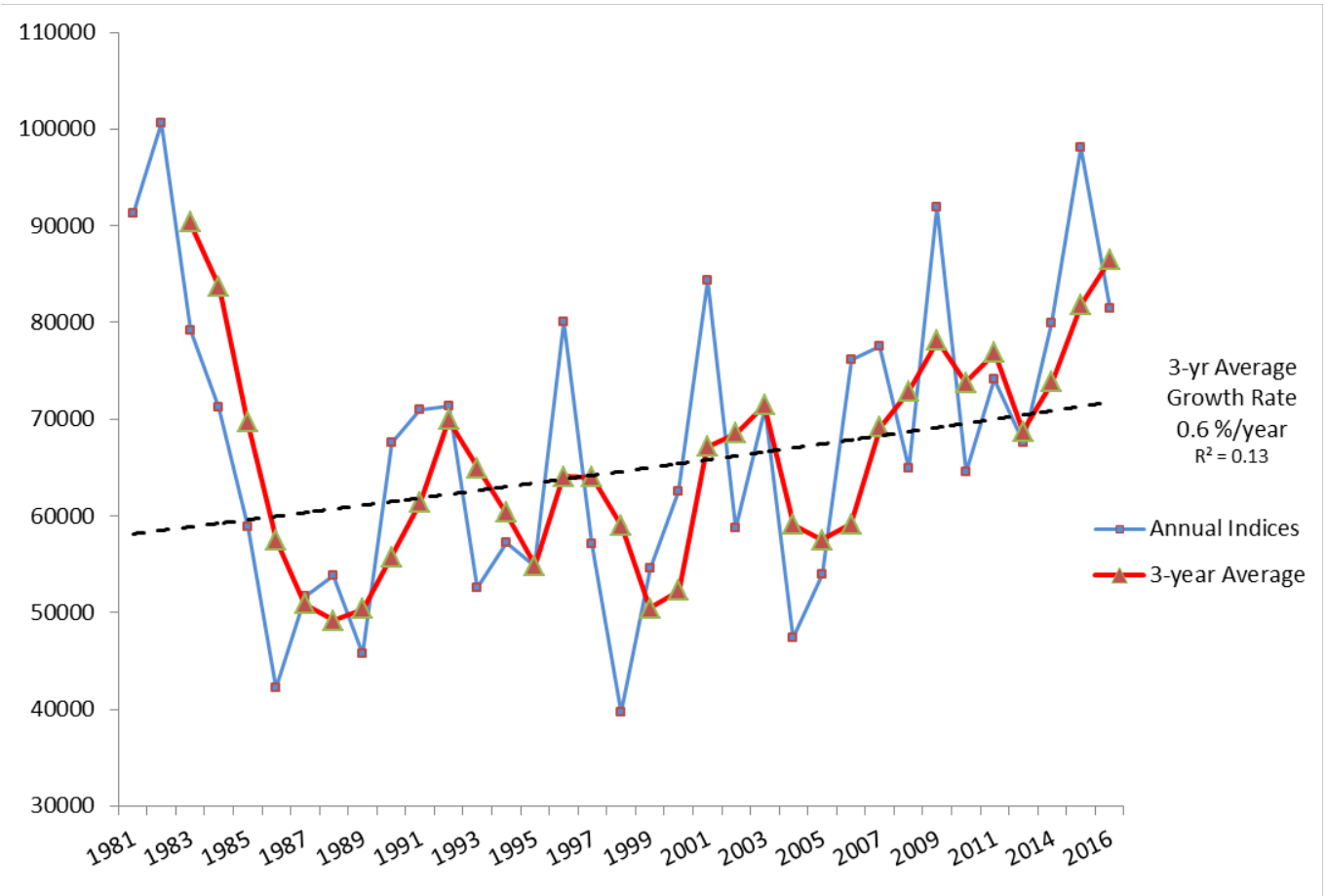

Figure 3. Spring emperor goose annual and 3-year average population indices, 1981-2016. No survey was conducted in 2013. Blue indicates annual indices, red indicates 3-year averages, and dashed line indicates data and trend for 3-year averages.

Table 1. Spring emperor goose survey results, southwest Alaska, 1981- 2016.

YEAR	DATES	POPULATION INDEX	1-YR % CHANGE	3-YR AVG.	3-YR % CHANGE	OBSERVERS	SURVEY AREA	SEGMENT RANGE (TOTAL # COMPLETED)
1981	4/23-4/27	91267				King/Gill/Sarvis/Dau	Y-K Delta to Wide Bay	11-137 (120)
1982	5/2-5/4	100643	9%			King/Dau/ Reardon/Reiswig	Kuskokwim Bay to Wide Bay	11-137 (120)
1983	4/25-4/29	79155	-27%	90355		King/Dau/Berns/Solberg	Kuskokwim Bay to Wide Bay	11-137 (120)
1984	4/26-5/4	71217	-11%	83672	-7%	King/Dau/Berns/Arment	Kuskokwim Bay to Cape Douglas	11-137 (120)
1985	5/12-5/16	58833	-21%	69735	-17%	King/Dau	Kuskokwim Bay to Cape Chiniak	11-143 (133)
1986	5/4-5/7	42231	-39%	57427	-18%	"	Nelson Island to Cape Atushagvik	11-143 (125)
1987	4/30-5/4	51633	18%	50899	-11%	"	Hooper Bay to Puale Bay	11-143 (133)
1988	5/2-5/6	53784	4%	49216	-3%	"	Hooper Bay to Cape Chiniak	11-143 (133)
1989	5/3-5/6	45800	-17%	50406	2%	"	Hooper Bay to Portage Bay	11-143 (133)
1990	4/28-5/4	67581	32%	55722	11%	"	Hooper Bay to Portage Bay	11-143 (124)
1991	5/2-5/7	70972	5%	61451	10%	"	Hooper Bay to Puale Bay	11-143 (125)
1992	4/30-5/5	71319	0%	69957	14%	"	Hooper Bay to Cape Kubugakli	2-139 (127)
1993	4/30-5/5	52546	-36%	64946	-7%	"	Hooper Bay to Wide Bay	1-137 (114)
1994	4/29, 5/2-6	57267	8%	60377	-7%	"	Hooper Bay to Wide Bay	1-137 (110)
1995	5/3-5/6	54852	-4%	54888	-9%	"	Hooper Bay to Chignik Lagoon	3-125 (83)
1996	4/27-4/30	80034	31%	64051	17%	"	Hooper Bay to Puale Bay	2-142 (118)
1997	4/25-4/28	57059	-40%	63982	0%	"	Hooper Bay to Wide Bay	2-137 (114)
1998	5/4-5/7	39749	-44%	58947	-8%	"	Hooper Bay to Wide Bay	Total only/No report
1999	4/27-5/1	54600	27%	50469	-14%	"	Hooper Bay to Wide Bay	16-137 (89)
2000	4/28-5/3	62565	13%	52305	4%	Mallek/Dau	Hooper Bay to Chignik Lagoon	2-125 (95)
2001	4/29-5/4	84396	26%	67187	28%	"	Hooper Bay to Puale Bay	2-142 (110)
2002	5/3-5/6	58743	-44%	68568	2%	"	Kuskokwim Bay to Wide Bay	12-137 (102)
2003	4/29-5/3	71160	17%	71433	4%	"	Hooper Bay to Wide Bay	2-137 (100)
2004	4/30-5/3	47352	-50%	59085	-17%	"	Hooper Bay to Wide Bay	1-137 (110)
2005	4/20-4/23	53965	12%	57492	-3%	"	Kuskokwim Bay to Wide Bay	14-137 (81)
2006	4/27-5/2	76108	29%	59142	3%	"	Kuskokwim Bay to Wide Bay	18-137 (78)
2007	4/24-4/29	77541	2%	69205	17%	"	Kuskokwim Bay to Kuiukta Bay	14-117 (76)
2008	4/29-4/30	64944	-19%	72864	5%	"	Chagvan to Bechevin Bay	20-85 (54)
2009	5/1-5/3	91948	29%	78144	7%	"	Kuskokwim Bay to Wide Bay	14-137 (80)
2010	4/27,5/1-5/2	64562	-42%	73818	-6%	"	Kuskokwim Bay to Canoe Bay	14-93 (62)
2011	4/27, 4/29-5/1	74166	13%	76892	4%	"	Kuskokwim Bay to Canoe Bay	14-137 (93)
2012	4/25-4/27	67588	-10%	68772	-11%	"	Goodnews to Wide Bay	18-137 (90)
2013	**NO SURVEY**							
2014	4/23-25,4/29	79883	18%	73879	7%	Wilson/Dau	Kuskokwim Bay to Wide Bay	14-137 (86)
2015	4/25-4/28	98155	19%	81875	10%	"	Kuskokwim Bay to Wide Bay	14-137 (86)
2016	4/22-4/23	79348	-24%	85795	5%	Wilson/Marks	Naknek to Bechevin Bay	33-85 (43)

Appendix. Waterbird and mammal observations by major lagoons and segment, southwest Alaska, 22-23 April 2016.

		MAJOR LAGOONS and SEGMENTS																																													
		Naknek River		Egegik		Ugashik Bay	Cinder River					Port Heiden		Seal Islands				Port Moller / Nelson Lagoon												Izembek Complex																				
SPECIES	Spp. Code	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	56	57	58	551	552	59	60	61	62	63	64	65	66	67	68	69	80	81	82	83	84	85	TOTAL
Am. Green-winged Teal	AGWT			6		25						10					2																						2		2			**47**
Am. Wigeon	AMWI														6																													**6**
Bald Eagle adult	BAEA	1	3					7		1	2					4		21		4			2	3			9			1	2	4					1		3	3	1	2		1	**75**
Bald Eagle juvenile	BAEJ							1																							1												1	**3**
Pacific Brant	BLBR																										6		2324	355	345	17210	13902	13443		2932	15		900		35				**51467**
Black Scoter	BLSC	4	1617	1642	623	5226	40	634		24	394	1234	351	677	504	1200	6828	580		4876	30	328	150	37	160	6	3835	727	1709	49					6196		70			100	45	10			**39906**
Brown Bear	BRBE																																1				2								**3**
Canada Goose	CAGO			1																															10										**11**
Caribou	CARI																	1																											**1**
Common Eider	COEI					4																		200			300														8			**512**
Common Merganser	COME	155																																											**155**
Common Raven	CORA							6								1								6				25											2					**40**
Double-crested Cormorant	DCCO															41	3													1	1				1					10	9	13			**79**
Emperor Goose	EMGO			1978	1	4596		12525				4990	20223	1500	8416			825					4083	3244	200	3305	6368		1389	45							50							**73738**
Goldeneye spp.	GOLD																																							8					**8**
Greater Scaup	GRSC	4	1138	577	76	77	15	80		40		163	30							915							50		150		10		51					170		2			**3548**
Gray Whale	GRWH				24		2	1			7			1										1				1						8						1			**46**
(Glaucous & Mew)	GULL	6641	1256	621	489	367	170	2179	202	125	579	152	150	825	1120	10110	404	2864	745	335	100	417	1285	210	223	720	1021	1286	498	457	1238	445	57	456	287	181	826	120	1368	117	279	422	15	842	**42204**
Harlequin Duck	HADU		2														50	66	12	30	20							10	66	3	6				8	2			196	65	37	249			**822**
Harbor Seal	HASE	2	4	131		6		80										100					250				200		2	269	1	4		90	304						28		40	**1511**
Jaeger spp.	JAEG				2						1																																	**3**
King eider	KIEI										2													25											40									**67**
Long-tailed duck	LTDU			22	6		50	70																					5				180		900		80						**1313**
Mallard	MALL	2		6		10													2														4			8			10					**42**
Northern Pintail	NOPI		189	1078	12	1256	30	2055		1126		70	370		308					105			50			150	340	20	300	46	450		60	50		2	20		258	9		83			**8437**
Shoveler	NOSH											45																																	**45**
Pacific Loon	PALO												5				2																								6	3	1			**17**
Cormorant	PECO																																								12					**12**
Red-breasted Merganser	RBME	77	28	36	58			77	2		4				20	8	8	18		2	2								14				2	8		2			35	77		13			**491**
Red Fox	REFO																																							1			1			**2**
Grebe	RNGR																																										2			**2**
Loon	RTLO		2	2	25						1																														1				**31**
Sandhill Crane	SACR									2																																			**2**
Sea Otter	SEOT		28	20	1			90				5	205					899	7	542	33		869					3	797	64	35	6	11	43	99	169	113			5	20	13		9	**4086**
Shorebird	SMSH		15	6	60			800		300					2150	137											200		350							8	1800			26		40		200	**6092**
Steller's Eider	STEI			220	5	50				4		232		30	715		31	75					12				1610		53	45			10										1	**3093**
Steller sea lion	STSE																3																		5		2	4			4				**18**
Surf Scoter	SUSC	8																																											**8**
Tundra Swan	TUSW	2	1	2		6										4												2													2			**19**
Walrus	WALR				2000																											170													**2170**
White-winged Scoter	WWSC		57	25	8	6																													900									**996**