AERIAL SURVEY OF EMPEROR GEESE AND OTHER WATERBIRDS IN SOUTHWESTERN ALASKA, SPRING 2012

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July 2013

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Abstract: The 32nd consecutive spring aerial emperor goose survey was conducted from 25 to 27 April. The survey area includes coastline and estuarine habitats from Goodnews Bay to Wide Bay, including the north and south sides of the Alaska Peninsula. The total of 67,588 emperor geese observed was down 8.9% from the 2011 count of 74,166 and up 3.3% from the long-term average (65,419, 1981-2011). The current management index (recent 3-year average) is 68,772 (down 10.6% from the previous 3-yr average of 76,892). Other species of emphasis included Pacific brant and Steller's eider with observed populations of 77,983 and 60,652, respectively. The survey was flown in a amphibious Quest Kodiak (N736) at 45m (150 feet) ASL and 175km/hr (95kts).

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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 (YKD) 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. Earlier survey timing in recent years precedes the arrival of emperor geese on the YKD so the survey is now begun in southern Kuskokwim Bay and includes primary staging sites south and west along the north side of the Alaska Peninsula. Coverage along the south side of the Alaska Peninsula emphasizes known emperor goose staging areas and omits other habitats where birds have not been observed staging during previous surveys. A 3-year moving average of survey totals is used as the population index for management in accordance with the Pacific Flyway Emperor Goose Management Plan (2006). These data also assess annual and long-term variation in seasonal migratory phenology and determine trends in distribution and habitat use for emperor geese and associated species.

METHODS

The survey was flown from 25-27 April within the core portion of 143 shoreline/estuarine segments (Mallek and Dau 2000; Figure 1). Aircraft panel electronic map displays along with 1:500,000 aeronautical and 1:63,360 topographical maps are used to define segments and navigate the survey. Observations of habitat and survey conditions including wind, temperature, sky condition, visibility, ice condition and tide

stage are documented during the survey.

An amphibious Quest Kodiak (N736) flown at a ground speed of approximately 175 km/hr (95 kts) and an altitude of 45m (150 feet) ASL was used. Survey timing is designed to precede the arrival of emperor geese on the Yukon-Kuskokwim Delta. The 2012 survey began on 25 April at Goodnews Bay (Segment 18; fog prevented counts in segments 14-17), continued on 26 April along the north side of the Alaska Peninsula to Bechevin Bay (Segments 67-68) and was completed on 27 April eastward along the south side of the Alaska Peninsula to Wide Bay (Segment 137). Panel mounted computers received input from the aircraft Global Positioning System (GPS) and saved coordinates for each input of voice recorded observation. Record and transcribe programs were used to process data (J. Hodges, MBM-Juneau).

SURVEY CONDITIONS

Ice and snow conditions in 2012 indicated a delayed cold spring. Sea ice was extensive in Kuskokwim Bay but mostly absent south to Cape Newenham (Table 1) and in nearshore areas of Bristol Bay south to Seal Islands Lagoon (Segment 47). Snow cover in coastal lowlands was extensive north of Cape Newenham and variable elsewhere. Flight conditions were excellent over most of the survey area.

April 25: Goodnews Bay to King Salmon (Segments 18-34): Thin estuarine and offshore fog over Jacksmith and Carter bays (Segments 14-17) prevented surveying those segments but otherwise, conditions were excellent. North to west winds were 5 to 10 knots. Skim ice was present in Kuskokwim Bay and ice was absent in other offshore areas south to King Salmon. Ceilings and visibility were unlimited for the remainder of the area. Ice cover was extensive in most estuaries in southern Kuskokwim Bay and absent in northern Bristol Bay. Estuarine ice cover was: Jacksmith Bay 60%, Carter Bay 90%, Goodnews Bay 80 %, Chagvan Bay 85% and Nanvak Bay 99%. Lakes and ponds were ice and snow covered to Togiak Bay and only ice covered to the south. Snow cover was 100% in lowland habitats adjacent to segments 14-25 and 40-50% in segments 26-34. Air temperatures increased from 39^{o} to 54^{o}F during the day.

April 26: King Salmon to Cold Bay (segments 35-68, 80-85): Survey conditions were excellent. East to northeast winds were 7 to 17 knots and ceilings and visibility were unlimited. Tides were mid-level from Egegik Bay to Seal Islands Lagoon, high in Port Moller/Nelson Lagoon and mid-level in Izembek Lagoon, Bechevin Bay and Morzhovoi Bay. Kinzarof Lagoon and Cold Bay estuaries were at low tide. Estuarine ice cover was: Egegik Bay 2%, Ugashik Bay 95%, Cinder River Lagoon 60%, Port Heiden 50%, Seal Islands Lagoon 30%, Port Moller/Nelson Lagoon 50%, Izembek Lagoon 75%, Bechevin Bay 5%, Morzhovoi Bay 50%, Kinzarof Lagoon 5%. Snow cover was absent in lowland habitats south to Port Moller and 40-50% south to Bechevin Bay. Larger lakes and ponds were ice covered. Air temperatures increased from 39^{o} to 48^{o}F during the day.

April 27: Cold Bay to Wide Bay (Segments 86-137). Ceilings and visibility were unlimited until near Chignik Lagoon when ceilings became 500-1,000 feet overcast.

Winds were calm to less than 5 knots east to Stepovak Bay (Segments 86-102) then south to southeast at 12-20 knots east to Wide Bay (Segment 137). Snow cover in lowland habitats was 5% adjacent to segments 86-93 and up to 20% elsewhere. Canoe Bay was 20% ice covered otherwise estuaries, lakes and ponds were ice free. Air temperatures were from 39-43^{o} F.

RESULTS/DISCUSSION

The 2012 spring survey was completed from 25-27 April. Totals for all species observed are presented by survey segment in Table 2. Extensive sea and estuarine ice along with cold temperatures delayed migration of emperor geese and other species. Most emperor geese were found in traditionally used estuaries along the Bering Sea coast of the central and western Alaska Peninsula; however, larger than average numbers were observed west of Izembek Lagoon and along the south side of the Alaska Peninsula. Observations at Unalaska, in the eastern Aleutian Islands suggested that most emperor geese departed by 28 April, 16 days later than in 2011, confirming a delayed migration (S. Golodoff/R. MacIntosh, pers. comm**.).** At Kodiak Island, the last 2012 sighting was on 5 May while departure was estimated between 3-9 May in 2011 (S. Berns, pers. comm.). First emperor geese were sighted at the Tutakoke River (Yukon-Kuskokwim Delta) on 15 May, 9 days later than in 2011, with a slow influx from 17-22 May and no discernable peak (J. Sedinger, pers. comm.).

Emperor Goose

The 2012 emperor goose spring count (67,588) was 8.9% below the 2011 estimate of 74,166 (Dau and Mallek 2011) (Table 2) and 3.3% above the long term average of 65,419 (1981-2011). The current 3-year average of 68,772 birds is 10.6% below the previous average of 76,892 (2009-2011) (Table 3). Primary staging sites along the north side Alaska Peninsula held 84.8% of birds observed in 2012 versus the long-term average of 91.5% (1981-2011). Below average counts of emperor geese were made from Jacksmith Bay to Cape Pierce (Segments 14-22; n=300 birds; 1981-2011 average 1,336). Above average counts of 4,033 emperor geese made in our westernmost areas Bechevin Bay/Morzhovoi Bay (Segments 67-68/80-81; 1981-2011 average 28) and a record high of 6,656 were observed along the south side of the Alaska Peninsula (Segments 88-137, 1981-2011 average 2,372). Our observations and the late departures reported from Unalaska confirm that migration was delayed; however, we believe peak numbers of emperor geese were in the survey area.

Pacific Brant

We observed a total of 77,983 brant during the 2012 survey (Table 2), of which 75,772 (97.2%) were in Izembek Lagoon and adjacent areas (Segments 60-68, 80-85). The 2012 brant count is 70.3% above the 2011 total of 45,789 and 9.4% above the long-term average of 71,279 (1981-2011). Brant migration was delayed in 2012 which resulted in a below average count of 503 birds at primary staging sites north of Cape Pierce (Segments 14-22; 1981-2011 average 12,882) and along the south side of the Alaska Peninsula

(Segments 88-137: 1,432 birds; 1981-2010 average 2,441). The first brant sighting at the Tutakoke River (Yukon-Kuskokwim Delta) was on 15 May, six days later than in 2011, with peak influx on 18 May (J. Sedinger, pers. comm.).

Steller's Eider

We observed 60,652 Steller's eiders (Table 2), a two-fold increase from the 2011 count of 30,186 and 28.9% above the long-term average of 47,061 (1981-2011). Most were distributed from Port Heiden to Izembek Lagoon (44,831 birds, 73.9% of the total). Steller's eider flock composition was recorded by the right seat observer and 138 of 139 (99.3%) flocks observed were of equal ratios (i.e. adult males versus brown-plumaged birds).

CONCLUSIONS

The trends in annual and 3-year population indices for emperor geese have remained essentially flat for the past 25 years (0.1 and 0.3%, respectively; 1981-2012, Figure 3, Table 3). Fall age ratios (% hatching year birds) are declining at approximately 1%/year. Six of the past 10 years and 15 of 28 total years studied were below the long-term average juvenile age ratio (MBM file data). Declining juvenile survival lowers recruitment of breeding age adults into the population and is an important factor preventing recovery. Low juvenile survival suggests that spring and summer human harvest primarily impacts the more available breeding age adult component of the population. Since recruitment is low and declining and breeding begins at age three, any harvest of adults presents a primary stumbling block to recovery of the population. Harvest reports suggest take is approximately equal to the estimated number of juveniles surviving to their second year (C. Dau, unpublished data). Additive hunting losses due to crippling and incidental take due to misidentification are unknown. Hunting of emperor geese has been illegal since 1986 and harvest continues but magnitude is uncertain (Wolfe and Paige 2002, Naves 2012). Predation, primarily during breeding and brood rearing (Bowman et al. 1997), is also negatively impacting emperor geese.

We believe the two realistic management options for increasing juvenile and adult survival sufficiently to reach population goals are 1) reduce human harvest year-round and 2) lower predation rates during the breeding season. Gosling growth and survival rates appear to be declining on the Yukon-Kuskokwim Delta due to grazing pressure and competition for preferred habitats (J. Schmutz, USGS, pers. comm.). Low growth rates and survival are compounded by high gosling predation rates (Bowman et al. 1997). Additional negative factors during breeding and brood rearing include storm surge flooding, nest loses, increased pond salinity, sedimentation and erosion of nesting habitat. However, emperor geese exhibit high rates of egg production and nest success in most years (Fischer and Stehn 2012) which indicates good potential for population recovery if adequate management procedures are initiated to increase adult and juvenile survival.

Following are our views of problems limiting recovery of the emperor goose population and management options to address them:

1) ***Problem:*** Illegal hunting in spring, summer, fall and winter. Comprehensive harvest surveys are needed in Alaska and Russia to assess temporal and spatial distribution and age composition within the harvest. ***Management option:*** Increase compliance with regulations through outreach and enforcement to reduce take. Expand harvest surveys to accurately measure take.

2) ***Problem:*** Predation during nesting (Fischer and Stehn 2012) and brood rearing (Bowman et al. 1997), as indicated by low productivity, and chronic low survival of juveniles from pre-fledging through winter (Schmutz et al. 1997). ***Management option:*** Predator management options on the YKD should be evaluated for local and area-wide effectiveness in increasing productivity and gosling survival (Bowman et al.1997). Monitoring of age and season specific survival rates should be continued. Increase monitoring of climate-change impacts on quantity and quality of nesting and brood rearing habitats.

3) ***Problem:*** Wintering ecology and survival of emperor geese is poorly understood and very low juvenile survival is indicated. ***Management option:*** Quantify mortality factors during winter and determine if manageable options exist to reduce them. Marking and satellite tracking studies of emperor geese have helped locate possible study sites.

The spring emperor goose survey continues to provide an index to population size and trend as required by the Pacific Flyway management plan (Pacific Flyway Council 2006). This survey should continue and would benefit from complete or partial replicate counts at high density staging sites. Replicate counts may 1) help qualify the accuracy of the population index and 2) provide useful measures of timing and duration of use of most important sites.

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

Lodging and vehicle support provided by Alaska Peninula/Becharof and Izembek NWR's is appreciated. We appreciate assistance from Bob Platte (MBM-R7) for preparation of map presentations for Figures 1 and 2.

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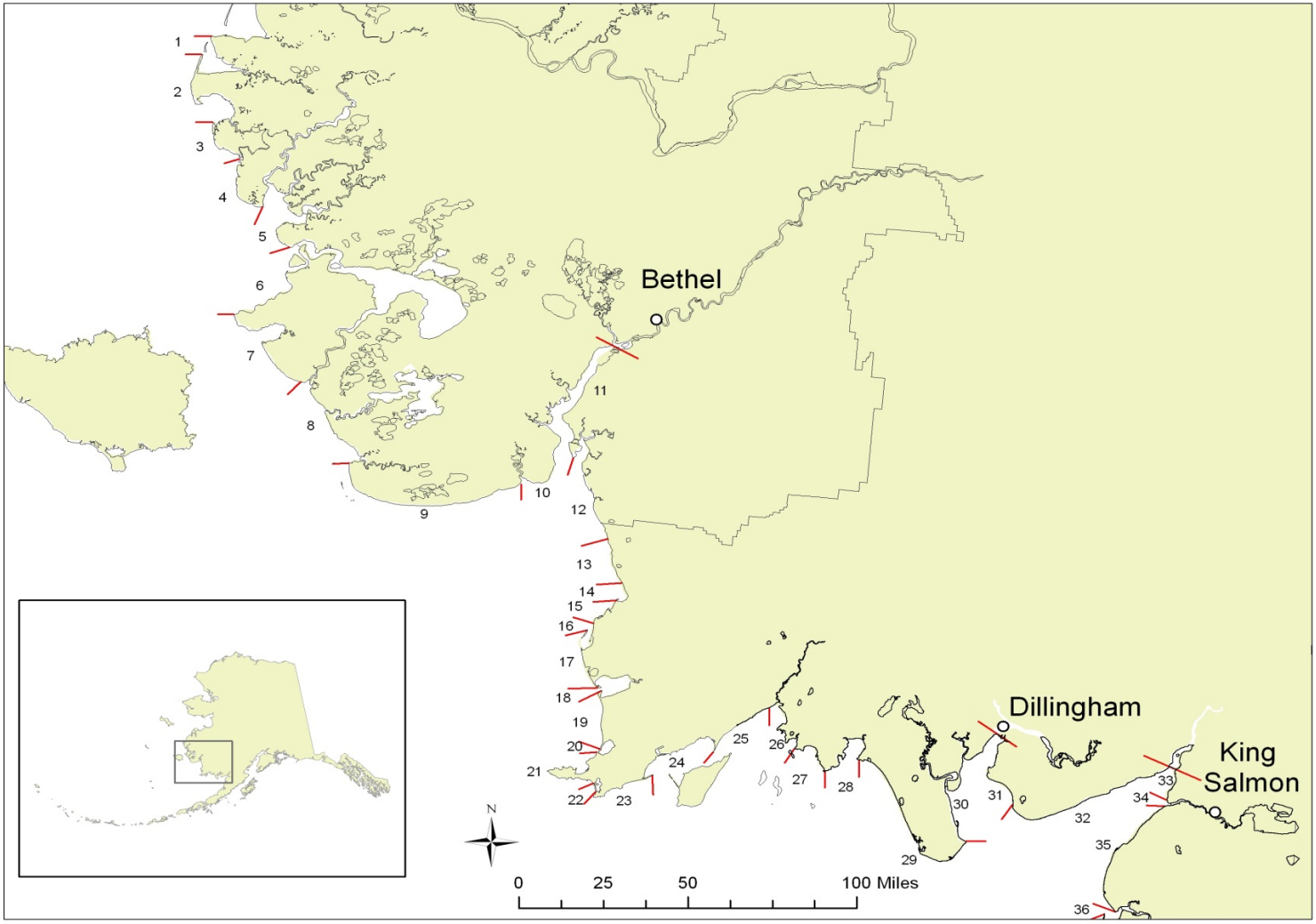

Figure 1. Emperor goose aerial survey segments 1-35, southwest Alaska.

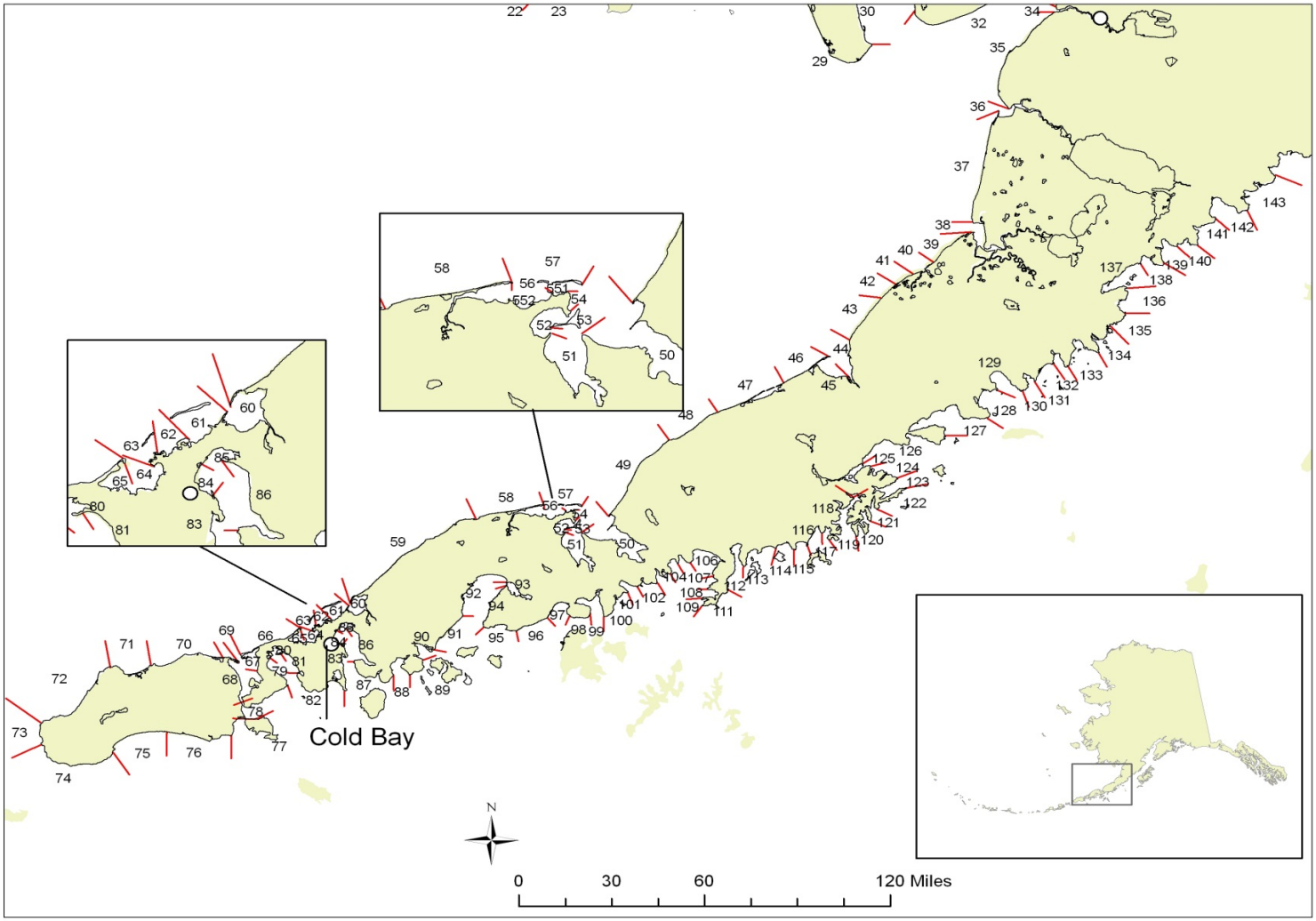

Figure 2. Emperor goose aerial survey segments 35-143, southwest Alaska.

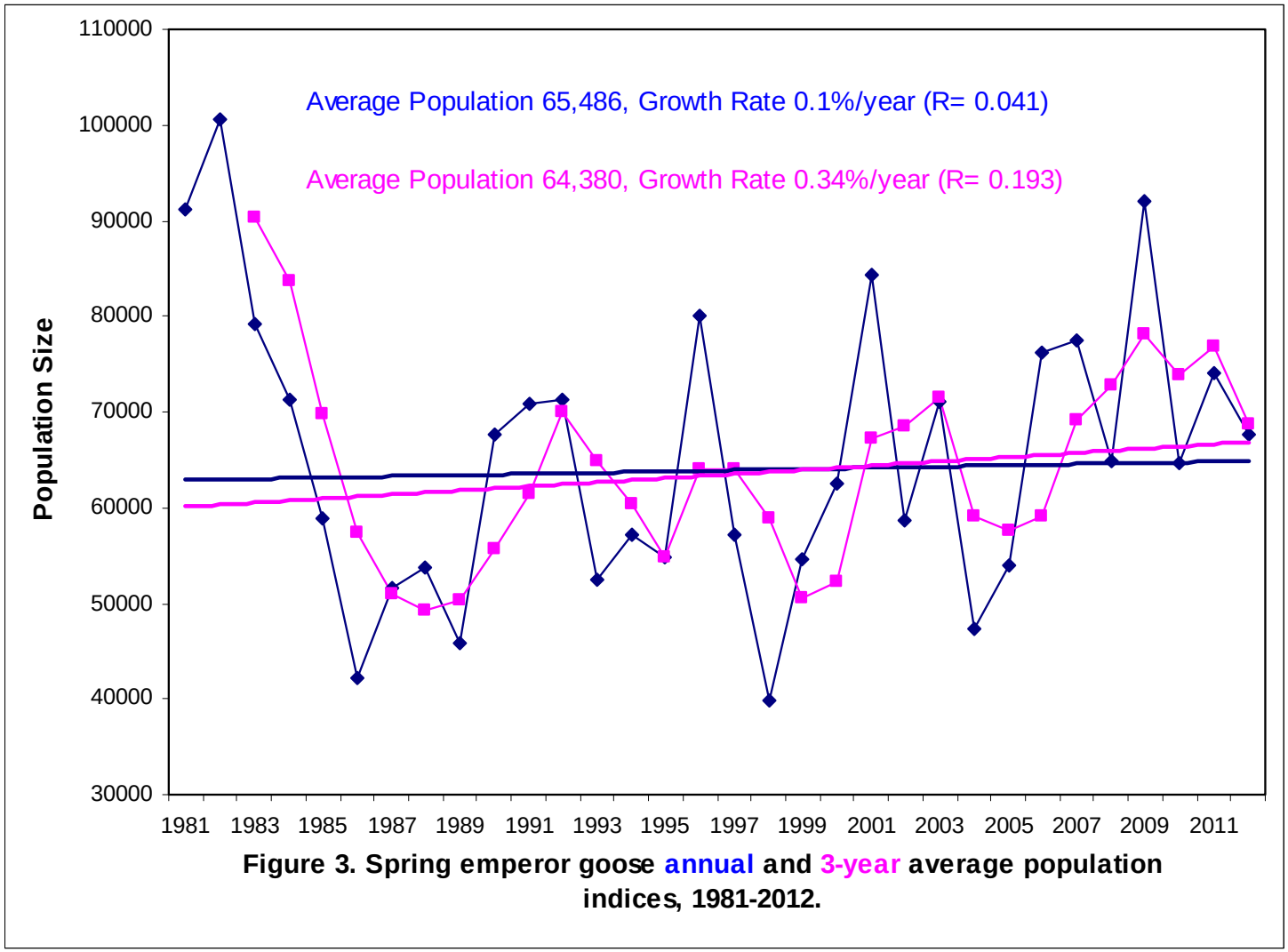

Figure 3. Spring emperor goose annual and 3-year average population indices, 1981-2012.

Table 1. Snow and ice conditions during spring emperor goose survey in southwest Alaska, 25-27 April 2012.

AREA	SNOW COVER[1]	MARINE ICE COVER[2]
Kokechik Bay	NS	NS
Hooper Bay	NS	NS
Hazen Bay	NS	NS
Carter Bay	100	90
Goodnews Bay	100	80
Chagvan Bay	100	85
Nanvak Bay	100	99
Relative Phenology[3]	**Late**	**Late**

[1] Percent snow cover on near-shore freshwater marshes. NS= Not Surveyed.
[2] Percent of marine ice cover in estuary.
[3] Subjective habitat conditions (early, average, late) based on ice and snow cover.

Table 2. Waterbird and mammal observations by segment, southwest Alaska, 25-27 April 2012.

	18	19	20	22	23	24	25	26	27	28	29	32	33	34
American Wigeon														12
Arctic Tern											8	1		
Bald Eagle (Ad)							1		1					
Bald Eagle (Nest)									1					
Beluga														2
Black Brant			500	3										
Black-legged Kittiwake				4750	300		20							
Black Scoter		2				20	10	12	3		74	303		
Canada Goose												16		
Common Eider	1						308				200			
Common Merganser														164
Emperor Goose			300											
Common Goldeneye														97
Greater Scaup	3500	2	100					5		128		469	21	48
Harlequin Duck					15	11	30	54		25				
King Eider	2	10					3			1				
Large Gull	39	10	558	416	87	56	755	2759	86	1990	293	1967	5	832
Long-tailed Duck	144	30	20	3	6	432	2084	146		30	450	79		
Mallard							4	12		114		30		100
Mew Gull	30						660	51		310	1	385	2	110
Northern Pintail						55		33		50	33	58	16	275
Parasitic Jaeger			30											
Pelagic Cormorant	6	14	2		29	3	164	91	377	2				
Pomarine Jaeger							1							
Red-breasted Merganser	8	4	250		10	191	26	893	11	126	24	44	6	539
Red-necked Grebe						3								
Red- throated Loon		4			3	2					2	2		
Lesser Sandhill Crane											4			
Small Gull	32	3	100		13	4	1175	430		439	304	334		
Small Shorebird												50		
Steller's Eider	12100	105	1157	310	28	265	43			5				
Tundra Swan														395
Greater White-fronted Goose												35		59
White-winged Scoter					104	32		9						

Table 2 (continued). Waterbird and mammal observations by segment, southwest Alaska, 25-27 April 2012.

	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
Arctic Tern				20											
Bald Eagle (Ad)			1												
Black-bellied Plover		34													
Black-legged Kittiwake														450	1670
Black Scoter	15	300	275		71	1			67	85	10	2242		1020	5568
Bufflehead															2
Common Eider			2	2								403		50	
Emperor Goose	4	570	100	2		5621		45		4100	3648	70	8411	15	3
Greater Scaup	191	102	50	277		42		65			284				
Harbor Seal										20					
Large Gull	320		178	59	162	51	21	20	56	121	20	67	3654	461	172
Long-tailed Duck	6	7	55		5				53	2				13	3
Mallard								20							
Mew Gull	1466	721	135	427		10						20	310		1
Medium Shorebird	3														
Northern Pintail	150	231	45	72	20	92		40		17	30	6	179		9
Pelagic Cormorant									1						
Red-breasted Merganser	1	27	11	252	28	42					5		1		6
Red- throated Loon	2	3	1		2										
Lesser Sandhill Crane	2	2													
Sabine's Gull													300		
Sea Otter											2				
Small Gull	360		3						8						
Small Shorebird	90	710				2680		200			75	200	300		
Steller's Eider						200		3			1986		2905	120	1440
Tundra Swan								1							
White-fronted Goose	314	110	22												
White-winged Scoter		15													20

Table 2 (continued). Waterbird and mammal observations by segment, southwest Alaska, 25-27 April 2012.

	50	51	52	53	54	551	552	56	57	58	59	60	61	62	63
Bald Eagle (Ad)	2							1		1	3		1		
Bald Eagle (Nest)											1		1		
Black Brant		15				12						5743	9205	424	3170
Black Scoter	128	1160	170			1002		1245	40	855	403	45	195	4	
Common Eider								485							
Common Loon		1													
Common Raven										3	33				1
Emperor Goose	2580	2923	1725	4		10203	707	75	140	25		9945	275	9	1061
Common Goldeneye															2
Greater Scaup		35	500												
Gray Whale										1	11				
Harlequin Duck		3													3
Harbor Seal														170	
Large Gull	20	179	35	6		331	1475	702	565	124	850	2025	1758	1661	638
Long-tailed Duck				4							10				
Mallard														2	
Mew Gull			100					900							
Northern Pintail	35	115										120			
Pelagic Cormorant											1				
R-b Merganser	5	18	85										49		10
Sea Otter	12	6		1				1		1	2	11	1	5	
Small Gull	30		2	105		24		75			18			30	
Small Shorebird		40	520			450		550	325		725	150		75	
Steller's Eider			250			2407	650	3520			97	4737	9957	9817	
White-winged Scoter							1			1	4				

Table 2 (continued). Waterbird and mammal observations by segment, southwest Alaska, 25-27 April 2012.

	64	65	66	67	68	80	81	82	83	84	85	86	88	90
Bald Eagle (Ad)						2		2	1		1		3	
Bald Eagle (Nest)								2					2	1
Black Brant	13330	40985		2263	10	150		40	2		450			755
Black Scoter			40	36	15		15	60	107			53		70
Bufflehead												5		
Common Loon									2			8	1	
Common Murre								2					1	
Common Raven				1				1		1				
Emperor Goose	300	2096	420	775	1620	1425	213	76	393		1053			941
Common Goldeneye													2	4
Greater Scaup														20
Gray Whale		2	8					6						
Harlequin Duck			32	55		10	6	39	114	10	67	560	18	630
Harbor Seal				3		1								2
Large Gull	520	300	54	156	1795	1220	8	93	458	4	592	20	31	345
Long-tailed Duck							5					17		
Mallard						2		2			75			
Mew Gull					100	80								
Northern Pintail						540								
Pelagic Cormorant								1				4	2	
Red-breasted Merganser	76	23		44	5	28	2	10	50	5	30	76	14	57
Sea Otter	75	10		103		4			2					
Small Gull							18							50
Small Shorebird		2700		7	1500							20		
Steller's Eider	5595	2910		5	5				35					
Surf Scoter													15	
White-winged Scoter							8							22

Table 2 (continued). Waterbird and mammal observations by segment, southwest Alaska, 25-27 April 2012.

	91	92	93	97	99	101	102	103	104	105	106	107	112	113	114	115
Bald Eagle (Ad)	1				2		1					6				
Bald Eagle (Nest)		2								1			1	1		
Beluga												1				
Black Brant		75														
Black-legged Kittiwake															650	
Black Scoter	1	625	171		87	8		15		12	39	118			2	
Bufflehead		2			35					10						
Common Loon	3	4	2	3	3	1										
Common Murre		1			11	2			2			1				
Common Raven			1												2	
Emperor Goose		790	370		180	253				95	75	86	688			
Common Goldeneye					18				3		15					
Greater Scaup		10	10													
Harlequin Duck		648	332	17	156	30	109		50	203	113	35	12	60		
Harbor Seal			41		3	203			10			5				
Large Gull	11	167	356	52	163	8	117		20	47	112	92	80	60	6	1
Long-tailed Duck			4		3											
Mew Gull					200						150			1		
Northern Pintail	3	8	140		2		40						2			
Pacific Loon										1						
Pelagic Cormorant	1	6	1				16		3	3	2	3		1	3	
Red-breasted Merganser		110	105		20					2	2	36	98	10		
Red-necked Grebe		2	13			10			1			2				
Red- throated Loon		2														
Sea Otter		12	52													
Small Gull		75	25		40							75	60			
Small Shorebird		3315	1325			10										
Steller's Sealion		1														
Surf Scoter						8										
White-winged Scoter	13	1215	1		39	21				10	4	33		10		

Table 2 (continued). Waterbird and mammal observations by segment, southwest Alaska, 25-27 April 2012.

	116	117	118	125	126	127	128	129	130	131	132	133	134	135	136	137	**Total**
Am Wigeon		1	1														**12**
Arctic Tern																	**29**
Bald Eagle (A)				3	9	16	1	4	4	1	3	9		4	6	3	**95**
Bald Eagle (J)					2	3			1			3			1		**11**
Bald Eagle (N)					1	1				1	1	1					**17**
B-b Plover																	**34**
Beluga																	**3**
Black Brant				450	4	234						1	10			152	**77983**
B-l Kittiwake											1	440			1		**8282**
Black Scoter					26	41	940	342				18		48		264	**18478**
Brown Bear						1						1	1			4	**7**
Bufflehead												20	2				**76**
Canada Goose																	**16**
Common Eider																	**1451**
Common Loon					1	2	1			1	1			1	1		**36**
C Merganser																	**164**
Common Murre																	**20**
Common Raven																	**43**
D-c Cormorant												2					**2**
Emperor Goose				145	75	147	486	425		201		104	83	45	585	882	**67588**
C Goldeneye				8		4		7									**160**
Greater Scaup								200					5			230	**6294**
Gray Whale																	**28**
Harlequin Duck				184	59	90	39	4	7	22	10	79	2		12	120	**4075**
Harbor Seal							1	2						25			**486**
King Eider																	**16**
Large Gull	1	36	197	440	150	350	190	112	95	39	18	52	27	57	231	167	**34634**
Long-tailed Duck																	**3611**
Mallard																	**361**
Mew Gull		2	5	425	2	475								30			**7109**
Med Shorebird																	**3**
Moose						3											**3**
N Pintail				46				30									**2492**
Parasitic Jaeger																	**30**
Pacific Loon																	**1**
P Cormorant			1		9		1	2			1	11		7	6		**774**
Pomarine Jaeger																	**1**
R-b Merganser		10		1	2	11	3	50				2				4	**3558**

Table 2 (continued). Waterbird and mammal observations by segment, southwest Alaska, 25-27 April 2012.

	116	117	118	125	126	127	128	129	130	131	132	133	134	135	136	137	**Total**
R-n Grebe												2					**33**
R-t Loon																	**23**
L S Crane																	**8**
Sabine's Gull																	**300**
Sea Otter					1	2		3	30		1			4		10	**351**
Small Gull				310		180	15	122		94	205	320		10		70	**5158**
Sm Shorebird						85											**16102**
Steller's Eider																	**60652**
Steller's Sealion							1										**2**
Surf Scoter						2	50	45									**120**
Tundra Swan																	**396**
G W-f Goose																	**540**
W-w Scoter					21	10	1					6			22	121	**1743**

Table 3. Spring emperor goose survey data, southwest Alaska, 1981-2012.

YEAR	TOTAL	% CHANGE	3-YR AVG.	% CHANGE	DATES	OBSERVERS	SURVEY AREA
1981	91267				4/23-4/27	R.King/R.Gill/J.Sarvis/C.Dau	Y-K Delta to Wide Bay
1982	100643	0.103			5/2-5/4	R.King/C.Dau/M.Reardon/ B. Reiswig	Kuskokwim Bay to Wide Bay
1983	79155	-0.214	90355		4/25-4/29	R.King/C.Dau/V.Berns/ J.Solberg	Kuskokwim Bay to Wide Bay
1984	71217	-0.1	83672	-0.074	4/26-5/4	R.King/C.Dau/V.Berns/ R.Arment	Kuskokwim Bay to Cape Douglas
1985	58833	-0.174	69735	-0.167	5/12-5/16	R.King/C.Dau	Kuskokwim Bay to Cape Chiniak
1986	42231	-0.282	57427	-0.176	5/4-5/7	"	Nelson Island to Cape Atushagvik
1987	51633	0.223	50899	-0.114	4/30-5/4	"	Hooper Bay to Puale Bay
1988	53784	0.042	49216	-0.033	5/2-5/6	"	Hooper Bay to Cape Chiniak
1989	45800	-0.148	50406	0.024	5/3-5/6	"	Hooper Bay to Portage Bay
1990	67581	0.476	55722	0.105	4/28-5/4	"	Hooper Bay to Portage Bay
1991	70972	0.05	61451	0.103	5/2-5/7	"	Hooper Bay to Puale Bay
1992	71319	0.005	69957	0.138	4/30-5/5	"	Hooper Bay to Cape Kubugakli
1993	52546	-0.263	64946	-0.072	4/30-5/5	"	Hooper Bay to Wide Bay
1994	57267	0.09	60377	-0.07	4/29, 5/2-6	"	Hooper Bay to Wide Bay
1995	54852	-0.047	54888	-0.091	5/3-5/6	"	Hooper Bay to Chignik Lagoon
1996	80034	0.459	64051	0.167	4/27-4/30	"	Hooper Bay to Puale Bay
1997	57059	-0.287	63982	-0.001	4/25-4/28	"	Hooper Bay to Wide Bay
1998	39749	-0.303	58947	-0.079	5/4-5/7	"	Hooper Bay to Wide Bay
1999	54600	0.374	50469	-0.144	4/27-5/1	"	Hooper Bay to Wide Bay
2000	62565	0.146	52305	0.036	4/28-5/3	E.Mallek/C.Dau	Hooper Bay to Chignik Lagoon
2001	84396	0.349	67187	0.285	4/29-5/4	"	Hooper Bay to Puale Bay
2002	58743	-0.304	68568	0.021	5/3-5/6	"	Kuskokwim Bay to Wide Bay
2003	71160	0.211	71433	0.042	4/29-5/3	"	Hooper Bay to Wide Bay
2004	47352	-0.335	59085	-0.173	4/30-5/3	"	Hooper Bay to Wide Bay
2005	53965	0.14	57492	-0.27	4/20-4/23	"	Kuskokwim Bay to Wide Bay
2006	76108	0.41	59142	0.029	4/27-5/2	"	Kuskokwim Bay to Wide Bay
2007	77541	0.02	69205	0.17	4/24-4/29	"	Kuskokwim Bay to Kuiukta Bay
2008	64944	-0.162	72864	0.05	4/29-4/30	"	Naknek to Bechevin Bay
2009	91948	0.416	78144	0.073	5/1-5/3	"	Kuskokwim Bay to Wide Bay
2010	64562	-0.298	73818	-0.055	4/27,5/1-5/2	"	Kuskokwim Bay to Canoe Bay
2011	74166	0.149	76892	0.042	4/27, 4/29-5/1	"	Kuskokwim Bay to Canoe Bay
2012	67588	-0.089	68772	-0.106	4/25-4/27	"	Kuskokwim Bay to Wide Bay