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## Thirty Years of Swan Surveys at Tetlin National Wildlife Refuge (1985-2015)

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# Thirty Years of Swan Surveys at Tetlin National Wildlife Refuge (1985-2015)

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## INTRODUCTION

Trumpeter swans (*Cygnus buccinator*) are the largest waterfowl species native to North America. They were once widespread across the continent but populations declined dramatically during the 1600-1800's when swan skins and feathers were highly prized and hunting decimated populations. In 1935, only 69 individuals were known to exist (Mitchell and Eichholz 2010) but unrecorded populations were likely present in the more remote regions of Alaska and Canada.

Beginning in 1968 and every five years since 1975, the US Fish and Wildlife Service (USFWS) Division of Migratory Bird Management (MBM) has led a continent-wide census of trumpeter swans. Trumpeter swan numbers have steadily increased since survey efforts began (Conant et al. 2002, Groves 2012, Schmidt et al. 2009). In 1968, 3,722 trumpeter swans were counted nation-wide and the population has grown exponentially at 6.2% per year through 2010, when  $46,225 \pm 1,172$  (SE) trumpeter swans were counted. Over half of the continental population breeds in Alaska ( $25,347 \pm 1,010$ ).

Trumpeter swans are a relatively new arrival to Tetlin NWR and the Upper Tanana River Valley (UTV). In the 1950's and 1960's tundra swans (*Cygnus columbianus*), not trumpeters, were reported near Tetlin village (Yocum 1963). The first aerial surveys in 1980 documented just one pair of swans with four cygnets outside the community of Delta Junction. An additional 9 adults were documented along the upper Tanana River (MBM unpubl data). Outside of the UTV, the nearest breeding trumpeter swans were 51 km southwest in the Copper River valley and also in the Yukon Territory and the Lower Tanana River Valley (Doyle unpubl report).

Since those first surveys, the UTV trumpeter swan population has continued to increase, as it has throughout Alaska. Beginning with the 2010 survey, Alaska MBM altered the survey design from a complete census to a stratified random sample. This was in response to the observed population recovery (Groves 2012, Schmidt et al. 2009), funding constraints and shifting management priorities. However, Tetlin NWR staff continued to census the refuge and adjacent areas of interest (Tetlin AOI). This is the first comprehensive summary of trumpeter swan populations on Tetlin NWR to date.

Objectives:

1. Estimate abundance of trumpeter swans in four social group categories (flocked adults, single adults, paired adults without cygnets, paired adults with cygnets) within the Tetlin AOI
2. Document changes in adult trumpeter swan abundance within the Tetlin Area of Interest.
3. Document changes in trumpeter swan production (# broods, brood size, # cygnets) within the Tetlin AOI

## STUDY AREA

Tetlin National Wildlife Refuge is located in east/central Alaska and borders the Yukon Territory, Canada to the east and Wrangell-St. Elias National Park and Preserve to the south. It is characterized by a mosaic of boreal forest, glacial rivers and extensive lakes and wetlands.

The Tetlin NWR study area includes a subset of 1:63,360 scale USGS quadrangle maps (quads) that cover all suitable habitat within Tetlin NWR and adjacent areas along the Tanana River (Figure 1). This is the Tetlin Area of Interest. The Tetlin AOI includes 15 quads: Tanacross A2, A3, A4, B4, B5, B6 and Nabesna B1, B2, C1, C2, C3, D1, D2, D3 and D4 (Table 1). Not all units were surveyed in all years.

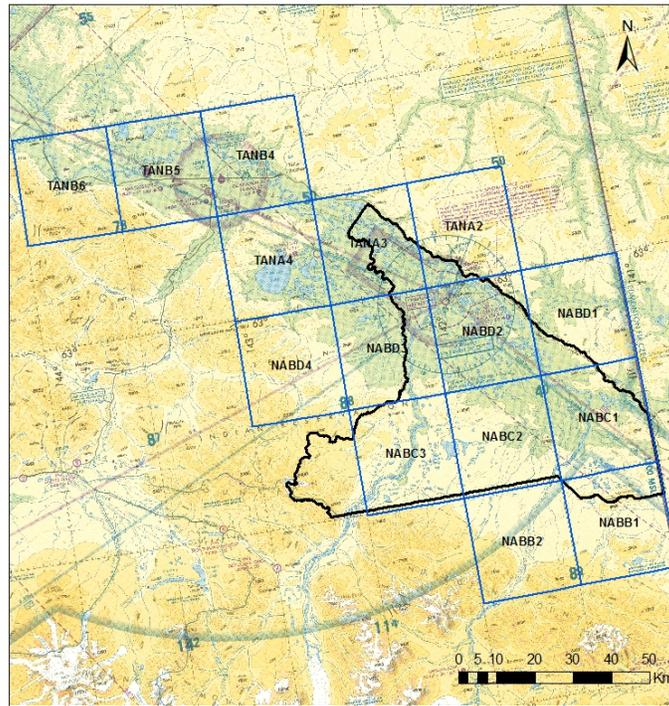
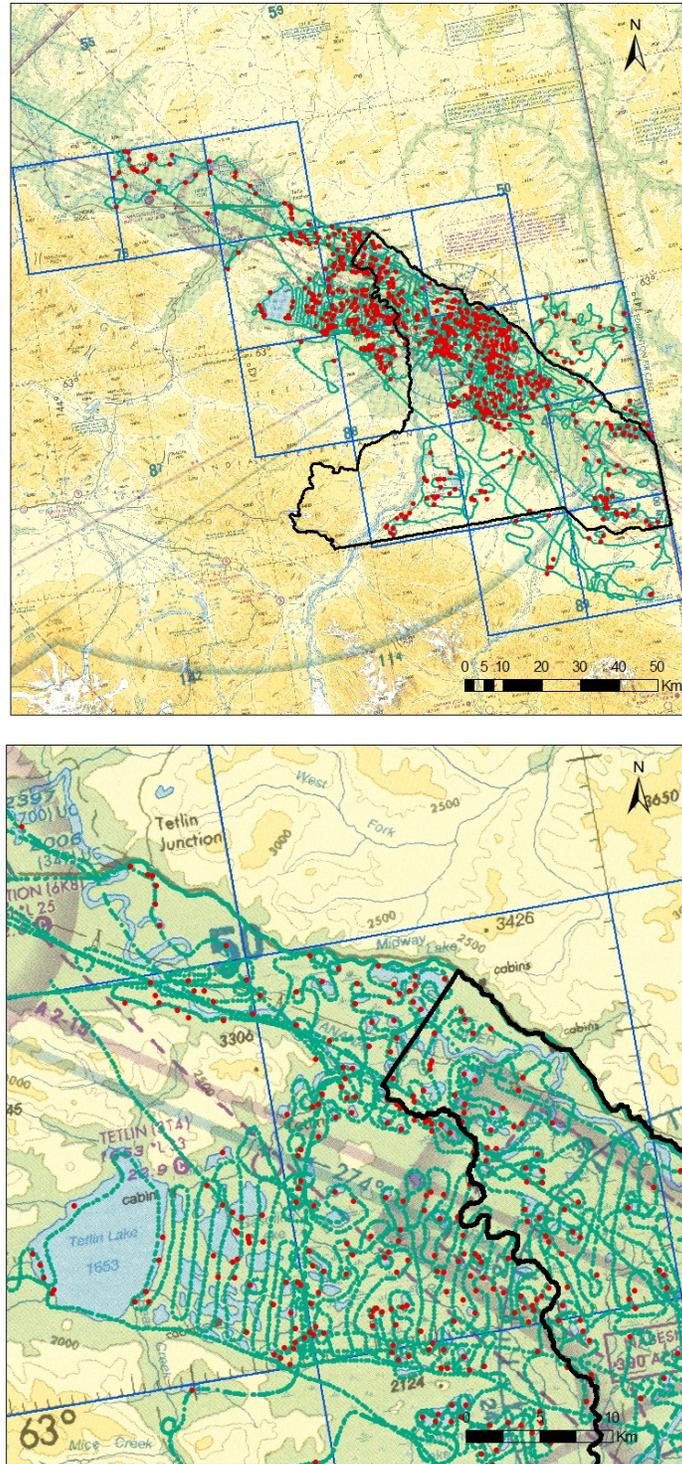
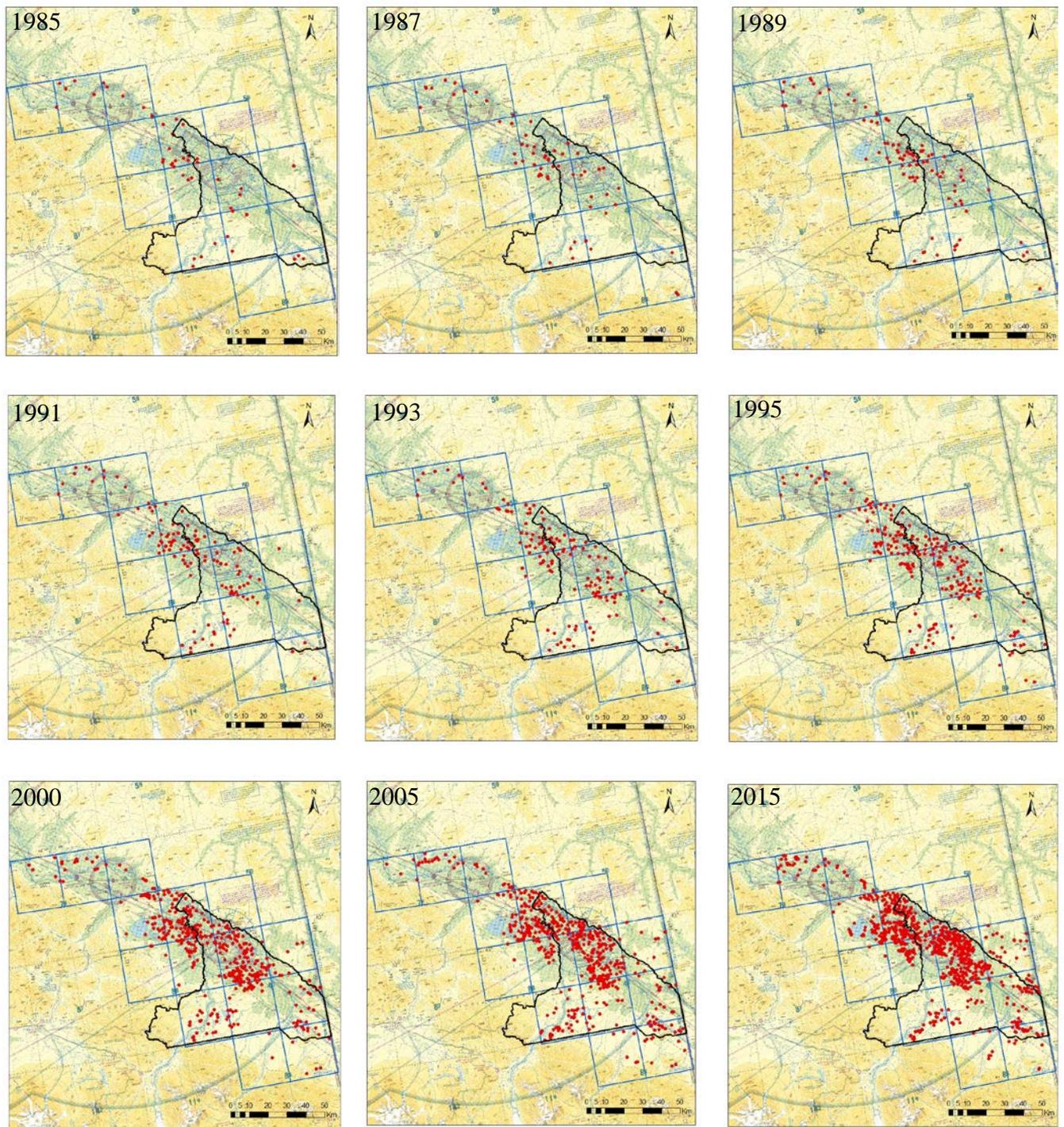


Figure 1. The 15 USGS quadrangle maps (blue boxes) included in the Tetlin NWR (black outline) area of interest for the 2015 trumpeter swan survey.



**Figure 2.** Example of flight track lines (green) and observations (red dots) of trumpeter swans recorded during the 2015 trumpeter swan aerial survey within the Tetlin NWR (black outline) area of interest (blue boxes). Each observation is either a single swan, single with cygnet(s), pair, pair with cygnet(s) or flock.



**Figure 3. Trumpeter swan observations during aerial surveys in nine years within the Tetlin NWR (black outline) area of interest (blue boxes). Each red dot indicates a swan observation. Each observation is either a single swan, single with cygnet(s), pair, pair with cygnet(s) or flock.**

**Table 1. Total number of adult Trumpeter Swans detected within the Tetlin NWR area of interest (n = 15 quads), 1985-2015. Blank cells indicate that a quad was not surveyed.**

Quad	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	2000	2005	2010	2015	Total
NABESNA B1	6	8	7	8	6	8	9	12	16	14	13	25	46	55	42	275
NABESNA B2	0		0	2	0	0	0	0	0	0	3	3	10	10	13	41
NABESNA C1	0	1	0	2	2	2	1	13	11	17	17	48	57	83	86	340
NABESNA C2	6	7	6	11	8	13	22	22	32	27	17	67	82	95	53	468
NABESNA C3	11	8	10	8	9	17	31	20	24	22	36	45	79	66	49	435
NABESNA D1	1	0	0	1	0	0	1	1	3	0	2	20	42	39	45	155
NABESNA D2	7	17	21	17	36	20	48	49	53	69	128	278	348	460	611	2162
NABESNA D3	6	20	22	13	28	23	22	35	32	38	44	63	67	117	115	645
NABESNA D4	0					0		2	4	2	1	7	4	6	4	30
TANACROSS A2	0	0	3	3	0	2	2	7	7	9	11	18	29	39	32	162
TANACROSS A3	43	23	27	44	53	72	102	109	68	93	109	211	337	378	494	2163
TANACROSS A4	0		15	11	12	26	48	27	18	22	90	87	100	69	298	823
TANACROSS B4	7	4	8	5	10	8	10	7	9	12	18	18	32	28	25	201
TANACROSS B5	8	6	14	10	16	12	11	10	14	18	15	24	65	108	125	456
TANACROSS B6	2	2	0	0	2	2	2	2	0	0	0	9	8	14		43
# Quads Surveyed	15	12	14	14	14	15	14	15	15	15	15	15	15	15	14	217
Total Swans	97	96	133	135	182	205	309	316	291	343	504	923	1306	1567	1992	8399

## **METHODS**

Survey methods were consistent with statewide methods (Groves 2012). Pilot/observer teams flew all potential swan habitat within listed quads including wetlands, lakes, ponds and rivers (Figure 2). Observed swans were recorded as either single swans, singles with cygnets, pairs, pairs with cygnets or flocks. Observers recorded data onto paper datasheets or on laptop computers and marked GPS coordinates for each individual or group.

For the 2015 survey, two pilot/observer teams in fixed-wing aircraft flew between August 10 – September 1. Tetlin NWR pilot and manager Shawn Bayless and observer Samuel Klimas surveyed 7 quads: Tanacross A2, B4, B5 and Nabesna B2, C2, C3 and D4. Migratory Birds Program pilot Brad Shults and observer Allison Williams surveyed Tanacross A3, A4 and Nabesna B1, C1, D1, D2 and D3 (n=7). Tanacross B6 was not surveyed.

All data were compiled and sent to Deborah Groves with MBM and stored in their database. Data for all quads encompassing the Tetlin AOI collected from 1985-2015 are included in this report.

## **RESULTS**

### **Survey Effort & Swan Distribution**

All 15 quads within the Tetlin AOI were surveyed in 9 of 15 survey years (Table 1). The lowest effort was in 1986, when 12 quads were surveyed.

Quads Nabesna D2 and Tanacross A3 have recorded the greatest number of adult swans, with over 2000 swans per quad recorded since 1985 (Figure 3, Table 1). These areas support a dense array of lakes, ponds and wetlands and include portions of the Chisana, Nabesna and Tanana rivers. Land ownership in these quads is a mosaic of federal, state and tribal lands.

Other notable quads include Tanacross A4 and Nabesna D3 with 823 and 645 adult swans recorded, respectively. These quads are located mostly outside of the Tetlin NWR administrative boundary on Tetlin tribal lands.

### **Survey Results**

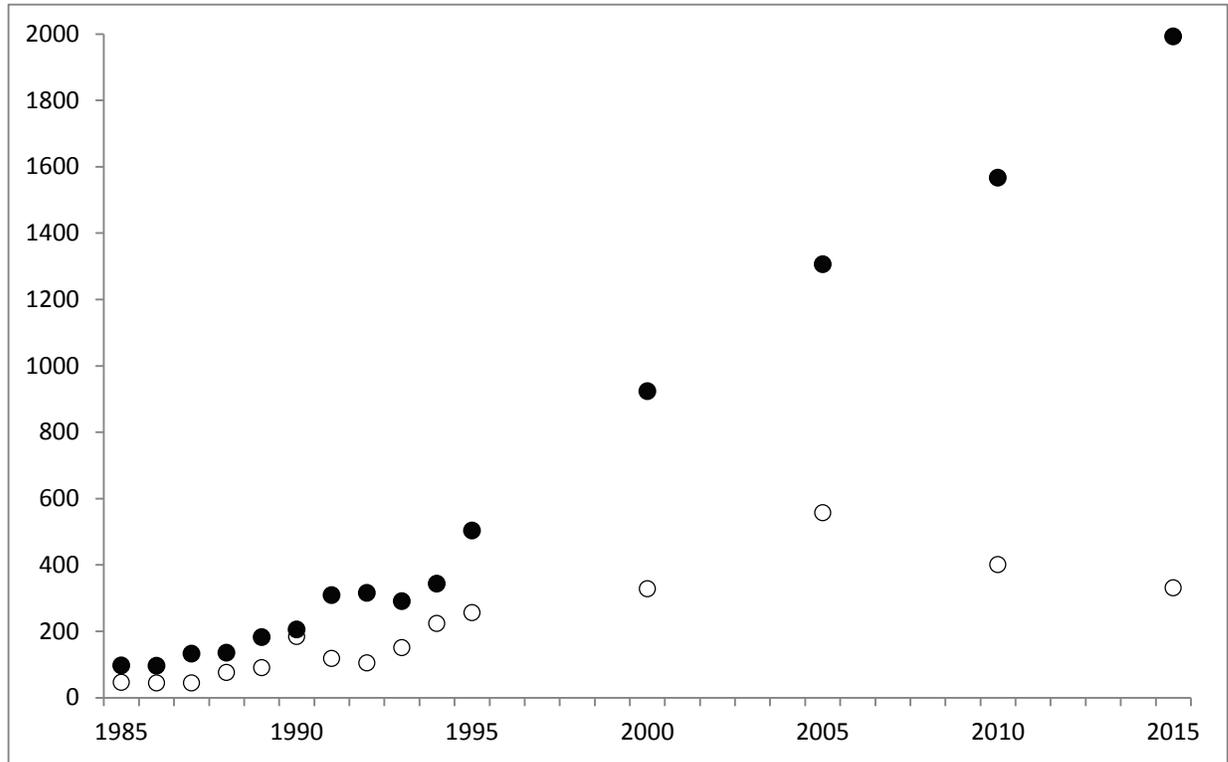
The 2015 survey recorded the greatest number of adult swans within the Tetlin AOI since surveys began in 1985 (Tables 1 & 2). Paired adults (942 swans) made up the greatest proportion of adult swans followed by flocked adults (727) and paired adults with a brood (230). The population of adult swans has increased by 27% since 2005 and 94% since 1985. The population of paired adults with a brood has increased by 89% since 1985 but decreased by 1% since 2010. In contrast, flocked adults have increased by 90% and 121% since 1985 and 2010, respectively. In addition, the number of single adult swans has decreased by 23% since 2010.

The proportion of adult swans with broods peaked in 1990, when 41% of adults were observed with cygnets; 2015 was the lowest year on record with 12% of adult swans observed with a brood.

The total number of observed broods (n = 147) and cygnets (n = 557) peaked in 2005 and has been dropping since then (Figure 4, Table 3). Between 2010 and 2015, the number of broods and cygnets decreased by 1% and 21%, respectively. 2015 also saw the lowest observed brood size at  $2.8 \pm 1.4$  (SD), as compared to 1990, which had  $4.4 \pm 1.3$  cygnets per brood.

**Table 2. Total number of adult trumpeter swans within the Tetlin NWR and adjacent area of interest, 1985-2015.**

Year	Flocked Adults	Paired Adults without Nest or Brood	Paired Adults with Brood	Paired Adults with Nest	Single Adult	Single Adult with Brood	Total Adults	% of Adult Swans with a Brood
1985	34	26	26		11		97	27%
1986	29	36	22		9		96	23%
1987	38	64	24		7		133	18%
1988	28	52	38		17		135	28%
1989	45	72	50		15		182	27%
1990	35	74	84		12		205	41%
1991	128	96	68		17		309	22%
1992	90	132	66	2	25	1	316	21%
1993	37	168	76		10		291	26%
1994	81	124	114		24		343	33%
1995	150	186	134		34		504	27%
2000	235	430	190		63	5	923	21%
2005	378	592	292		43	1	1306	22%
2010	329	886	232		115	5	1567	15%
2015	727	942	230		88	5	1992	12%
<b>Total Birds</b>	<b>2364</b>	<b>3880</b>	<b>1646</b>	<b>2</b>	<b>490</b>	<b>17</b>	<b>8399</b>	
% change since 1985	90%	97%	89%		90%		94%	
% change since 1995	79%	80%	42%		61%		75%	
% change since 2010	121%	6%	-1%		-23%	0%	27%	



**Figure 4. Total number of adult Trumpeter Swans (solid symbols) and cygnets (open symbols) counted on the Tetlin NWR and adjacent area of interest, 1985-2015. Not all map quads within the area of interest (n=15) were surveyed every year (see Table 1).**

**Table 3. Total broods, total number of cygnets and average brood size of trumpeter swans on Tetlin NWR and within the adjacent area of interest; 1985-2015.**

Year	Total Broods	Total Cygnets	Average Brood Size ± SD	Range
1985	13	46	3.5 ± 0.9	( 2 - 5 )
1986	11	44	4.0 ± 1.3	( 2 - 6 )
1987	12	44	3.7 ± 1.7	( 1 - 6 )
1988	19	76	4.0 ± 1.6	( 1 - 7 )
1989	25	90	3.6 ± 1.4	( 1 - 6 )
1990	42	184	4.4 ± 1.3	( 1 - 7 )
1991	34	118	3.5 ± 1.8	( 1 - 8 )
1992	34	105	3.1 ± 1.3	( 1 - 5 )
1993	38	151	4.0 ± 1.7	( 1 - 7 )
1994	57	224	3.9 ± 1.5	( 1 - 7 )
1995	67	256	3.8 ± 1.4	( 1 - 7 )
2000	100	328	3.3 ± 1.6	( 1 - 9 )
2005	147	557	3.8 ± 1.5	( 1 - 10 )
2010	121	401	3.3 ± 1.6	( 1 - 11 )
2015	120	331	2.8 ± 1.4	( 1 - 6 )
% change since 1985	89%	86%		
% change since 1995	44%	23%		
% change since 2010	-1%	-21%		

## DISCUSSION

The trumpeter swan population within the Tetlin AOI has increased exponentially since survey efforts began in 1985 and reached a new record level in 2015. However, the growth rate may soon slow as swans saturate available wetland habitats and the population reaches carrying capacity, as indicated by the following:

First, a growing proportion of the adult population is not breeding successfully. The proportion of adults with a brood has decreased steadily in recent years, from a peak of 33% in 1994 to 12% in 2015. In addition, the number of flocked adults has increased exponentially since that time, suggesting that either breeding efforts are failing or birds are spending summer seasons flocked with other non-breeding birds.

Second, reproductive output is slowing. 1990 was one of the most productive years on record (greatest brood size 4.4 cygnets/brood, greatest proportion of adults with a brood, 41%; Tables 2 & 3). Since then, brood size and the proportion of adults with broods has decreased. In addition, the total number of broods and cygnets peaked in 2005 and has decreased in the subsequent two surveys. Decreases in the number of broods could indicate that available breeding habitat is occupied (i.e., new broods cannot be produced because recruitment is zero). In addition, decreases in brood size could be attributed to

any number of factors not necessarily related to growth of the swan population (nutrition, predation, female body condition, etc.).

Population growth and reproductive output in waterfowl is influenced by many things, including, but not limited to, immigration/emigration, recruitment, intra- and inter-specific competition and events on migratory routes and wintering areas. More study is needed to better understand the mechanisms behind the growth and reproduction of Tetlin NWR's trumpeter swan population and potential intra-specific competition for resources. In the meantime, Tetlin NWR will continue to work with MBM and other partners to monitor trumpeter swan abundance and production via quinquennial surveys within the Tetlin AOI.

### **ACKNOWLEDGEMENTS**

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