U.S. Fish & Wildlife Service

Tree Swallow Nest Box Monitoring, Bethel, Alaska, 2023

Kyra Neal, Bryan Daniels, Laurel Devaney, Emma Niven, Carl Nilson,

Yukon Delta National Wildlife Refuge
Bethel, Alaska
2023

The mission of the National Wildlife Refuge System is to administer a national network. of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Keywords:

Aerial insectivore; Banding; Bethel, Alaska; Nest box Monitoring; *Tachycineta bicolor*; Tree Swallow

Disclaimers: 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. The use of trade names of commercial products in this report does not constitute endorsement or recommendation for use by the federal government. Much of the standard procedures for the Bethel Tree Swallow Nest Box monitoring project were duplicated from the 2018 study. The methods and background remain the same in this paper as in the 2018 report.

TABLE OF CONTENTS

List of Tables

List of Figures

Tree Swallow Nest Box Monitoring, Bethel, Alaska, 2023

U.S. Fish and Wildlife Service, Yukon Delta National Wildlife Refuge, P.O. Box 346, Bethel, AK, 99559

ABSTRACT

Aerial insectivores' populations have been on a downward trend. Studying factors like; demographic vitality rates, phenology, interannual variability and long-term population fluctuations of species such as Tree Swallows (*Tachycineta bicolor*), could enhance understanding of this population's decline. Currently, data on Tree Swallow nesting ecology is limited in for the region of Western Alaska.

In 2017, Yukon Delta National Wildlife Refuge had the opportunity to reconstruct population dynamics for Tree Swallows in Bethel, Alaska. The Tree Swallow community outreach project joined the Alaska Tree Swallow Nest Monitoring network to better communicate the trends of Tree Swallows across the state. Comprehensive data was collected in 2017 and 2018. Limited observations were made in 2021 that could not derive results. In 2023, the study was completed again but due to limited staff availability, the data collected was not as thorough data as 2018. The scope of our results in 2023 are derived from 32 observed nest boxes.

The nest box occupancy rate was 88 percent (28 out of 32) in 2023. The mean clutch size was 5 ± 0.27 eggs per nest, with an average clutch completion date of June 10th. Out of the 28 occupied boxes, 21 boxes had successfully fledged at least one chick; resulting in a nesting success of 75%. We successfully banded a total of 121 swallows consisting of 20 females, 11 males, and 90 chicks. Future monitoring efforts will continue to expand our research and understanding of breeding parameters, contributing population trends, and continue our successful community involvement outreach project as staffing allows.

Key words: Alaska, aerial insectivores, Bethel, Tree Swallows, population declines

INTRODUCTION

Aerial insectivores (nighthawks, nightjars, swifts, swallows and some species of flycatchers) are experiencing widespread population declines, up to 70% in some species (McCracken 2008, Nebel et al. 2010). Although members of this group differ in many life history traits, they all specialize in capturing insects while in flight. Several causes for population declines have been proposed including climate change, resultant changes in insect prey availability and abundance (Stenseth and Mysterud 2002, Jones and Cresswell 2010), and habitat modification and loss (Robinson et al. 1995, Murphy 2003). The widespread use of agricultural pesticides that reduce insect abundance (Benton et al. 2002) can be toxic to insectivores (Longcore et al. 2007). Many aerial insectivores are also long distance migrants, which is a high risk strategy, and they may face considerable hazards or experience harmful energy depletions along their migratory pathways (Taylor and Anderson 1973, Sillett et al. 2002, Newton 2007). Michel et al. 2015 found that populations of certain aerial insectivores are declining as a result of large-scale but complex, species- and region-specific environmental conditions (e.g. climate, land use), while a single primary cause of aerial insectivore declines as a whole appears unlikely.

Because of concerns about aerial insectivores, Boreal Partners in Flight (BPIF), an organization of professional ornithologists operating in Alaska and far western Canada that functions as a regional working group for International Partners in Flight, decided to focus greater efforts on swallow research and created the Alaska Swallow Monitoring Network. The Tree Swallow (*Tachycineta bicolor*) was selected as a favorable aerial insectivore species to study due to their tolerance for human disturbance, willingness to use man-made nest boxes, fidelity to their nest sites, continent-wide range, and the fact that there is already a large body of research to build upon. This species can serve as a model for better understanding challenges facing more sensitive taxa that are less tolerant of disturbance and in greater decline and can also serve as a bio indicator for contamination and impacts of climate change.

Although Tree Swallows are one of the most studied birds in the world, there is currently very little Tree Swallow nesting information for western Alaska. The main scientific goal of our study is to establish a Tree Swallow nest box monitoring program in Bethel, Alaska as part of a larger monitoring network across the state to better understand the challenges facing aerial insectivores, investigate the impacts of climate change on boreal birds, and obtain insights on breeding ecology and population trends of Tree Swallows in Alaska.

A second goal of this project is to provide outreach and education about bird ecology and conservation. Community involvement in refuge projects on the Yukon-Kuskokwim Delta is generally limited due to the remoteness of field study sites. Tree Swallow nest box monitoring, however, fits well with a more urban setting due to their willingness to use man-made nest boxes and their high tolerance of human disturbance. This project gives us the opportunity to involve local students, community residents, Friends of Refuges volunteers, and refuge staff in

meaningful scientific research, and provides a focal point for learning about avian conservation. The experiences and learning opportunities of this project may also help people understand how climate change may impact their way of life on the Yukon-Kuskokwim Delta.

The objectives of this project are to:

1. Monitor nest box occupancy, nesting phenology (arrival date, clutch initiation date, hatch date, fledging date), and nesting success (clutch size, hatching rate, overall nest success) at ≥ 30 nest boxes per year in Bethel for ≥ 3 consecutive breeding seasons.

2. Capture, band, and recapture nesting adults at ≥ 30 nest boxes per year to monitor return rates, site fidelity, and, if sample size is adequate, adult survivorship. If personnel resources allow, band chicks to monitor natal site fidelity.

3. Annually, recruit 1-2 students and one or more citizen scientists to assist with nest box monitoring (May-July).

4. Use the Tree Swallow project as an example for educating others about science, avian ecology and conservation, and the potential impacts of climate change through the use of oral presentations, classroom visits, written articles or reports, and field trips.

5. Contribute data to the statewide database for the Alaska Swallow Monitoring Network to be used for comparisons of nesting phenology and reproductive success across the state and the continent.

STUDY AREA

Our study area is located within the city of Bethel, Alaska, on the northwestern edge of the Tree Swallow's breeding range and the western edge of the boreal forest region (Figure 1). The climate of the region is subarctic with strong seasonality − severe winters and cool, brief summers. During the summer, average high temperatures are 62°F, average low temperatures are 42°F, and precipitation is most frequent and at greatest levels during the summer months (US Climate Data 2023).

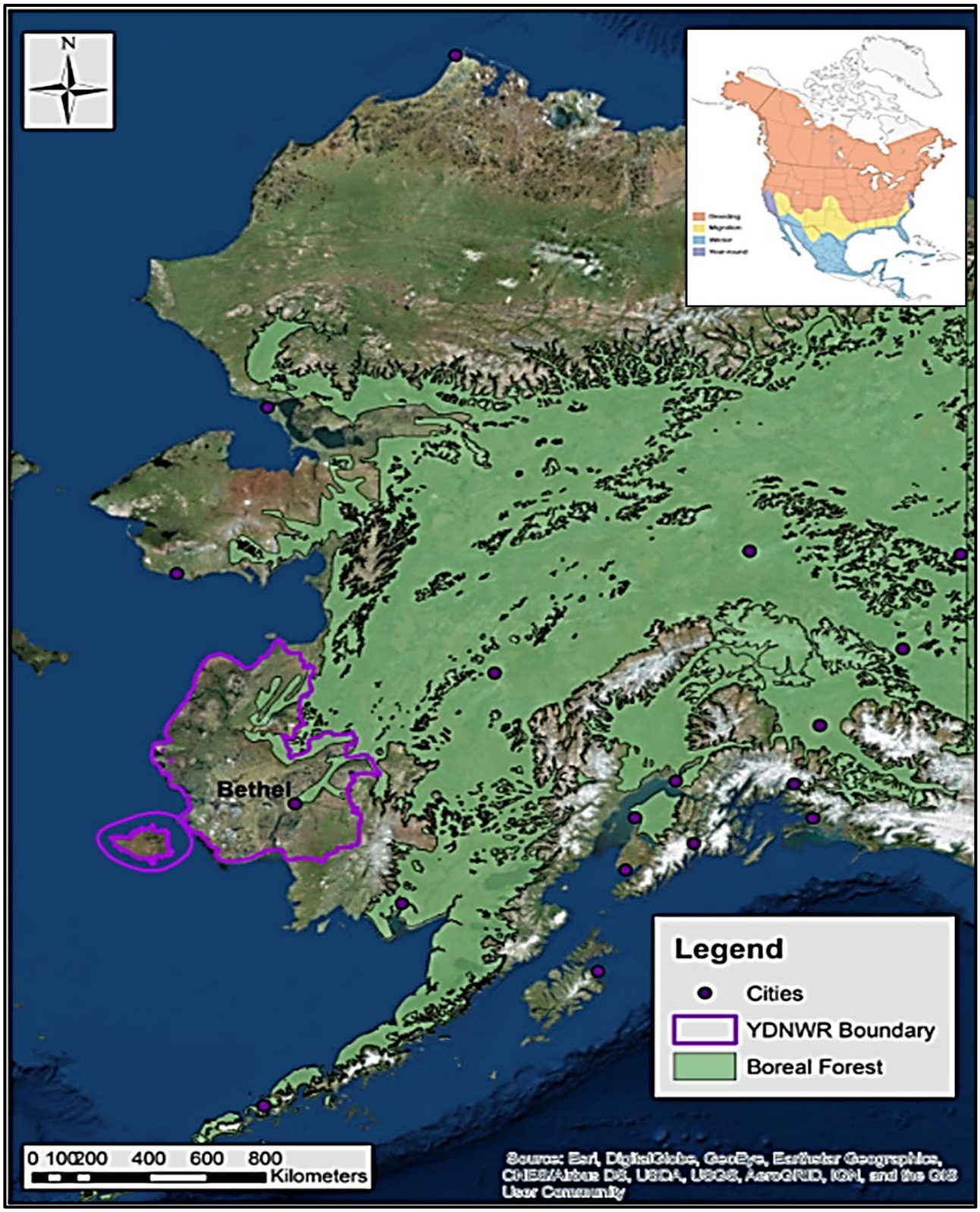


Figure 1. Extent of Boreal Forest in Alaska and on Yukon Delta NWR (Brandt 2009). The inset map shows the swallow breeding range across North America in orange.

Bethel, Alaska, 99559

Bethel is located on the alluvial plain of the Kuskowkim River. It is within the zone of discontinuous permafrost (Ferrians 1965), and vegetation is dominated by tundra, primarily moist sedge tundra in the uplands and wet sedge tundra along sloughs and pond margins (Doolittle et al. 1990). In the past several decades, the community of Bethel has become shrubbier and the number of boreal species of birds breeding in the area has expanded. Species that have either established a breeding presence or increased in number include: Hudsonian Godwit, Merlin, Northern Shrike, Lincoln's Sparrow, Yellow-rumped Warbler, Dark-eyed Junco, Rusty Blackbird, Solitary Sandpiper, and Northern Goshawk (B. McCaffery personal communication). Tree Swallows are cavity nesters, so their breeding distribution usually coincides with tree line (Winkler et al. 2011). However, cavity nest sites are limited and the establishment of nest boxes north and west of tree line has successfully attracted pioneering individuals in some areas. The use of swallow nest boxes is widespread and well established among the villages of the Yukon-Kuskokwim Delta and many currently exist in a variety of shapes and sizes in Bethel. Consequently, Tree Swallows are a common breeding species in Bethel and, presumably, of some interest to the general public.

The city of Bethel is the largest community in western Alaska with a population of 6,273 (as of the 2021 Census), and it serves as a hub city for the villages of the Yukon-Kuskokwim Delta region. It is also the home for the headquarters of the Yukon Delta National Wildlife Refuge. This makes Bethel an ideal base for conducting wildlife studies that allow refuge staff to regularly interact with the public.

USFWS and community volunteers set up nest boxes around town in 2017, mostly on property owned by the Refuge but also included other properties where community members were willing to host boxes that could be monitored as part of our program. Our study area encompassed 126 km^2 (Figure 2) and has room for including additional boxes in the future.

NEST BOX LOCATIONS 2023

Figure 2. Tree Swallow Nest Box Locations in Bethel, AK

Methods

Box Installation and Monitoring

In 2023 all boxes were reused from the initial project in 2017, as well as the ones added in 2018 and 2021. Boxes in 2017 were built by a local Boy Scout troop to the specs of the Alaska Swallow Monitoring Network protocol (page 18). Minimal fixes like new nails and better mounting were added to existing boxes in 2023. A standardized box was needed to allow nest parameters to be compared without introducing additional variables of box shape and size. The nest box design included a hinge for opening for the contents to be examined (Figure 3). Boxes were attached to trees, metal poles, wooden posts, deck railings, or walls in our study area. In previous years boxes were installed on private residences. Due to staff turnover, we did not have

contacts or relationships with the private residence owners, those boxes were unchecked. Boxes monitored in 2023 were on Fish and Wildlife Residences and Stan Corp's home and shop. Thirty-two nest boxes were monitored, with locations of nest boxes shown in Figure 2. Geographic coordinates of nest box locations are on page 13 (Table 1).

Nest monitoring followed the protocols of the Alaska Swallow Monitoring Network, which are included in the project's study plan (Sowl 2018). Monitoring of the boxes began in early May before swallows began building their nests. Key dates to be obtained from monitoring included clutch initiation, onset of incubation, hatch date, and fledge date. Reproductive parameters that were obtained from monitoring included clutch size, brood size, and nesting success. The schedule for checking nests varied according to nesting phenology and was usually every third day, dependent on staff availability. Nests were not checked during the incubation period to avoid disturbing the birds and possibly causing nest abandonment. After fledging, boxes were cleared of nesting material in preparation for the following year.

Figure 3 Standard nest box checks, Bethel, Alaska,

Adult Capture and Banding

Adult Banding

Tree Swallows were banded to collect data on return rates, site fidelity, and survivorship. Adults were captured in the nest box. Females are targeted for capture during late incubation (after day 8) or soon after the chicks hatch as they will sit very tight on the nest and can be trapped simply by walking up to the box, covering the hole, and gently removing the bird through the side door. Males are targeted for capture during the early brood-rearing period (up to about day 5). Usually both adults can be captured at this time as it is a time of intensive feeding for the chicks. A trap door is set up at the hole of the box using a piece of cardboard with a rock taped to one side. The trap door is taped to the inside of a box above the entrance hole and propped up with a piece of stiff grass. Upon entry, the swallow will knock the grass over, causing the door to close and trapping the swallow in the box. The box is monitored until the trap is triggered, at which time a bander approaches the box and carefully opens the side door and reaches in to pick up the adult. The trap is then reset and monitored to capture the second adult of a mated pair while the first

Figure 7. The primary feathers on this chick have broken sheath, indicating that the chick might be ready for banding. A band leg gauge is also used to determine is a chick is ready for banding.

adult is being banded. If the trap doesn't trip upon the swallow's entry to the box another method that was used was waiting for the swallow to enter the box, covering the entry hole with the trap and proceeding to use the side panel to capture the adult.

Swallows were banded with a standard aluminum Federal leg band (size 1) on the right tarsometatarsus. Birds were classified according to age and sex, and assessments were made of fat depositions, molt, and feather wear. A selection of this data can be found on (page 15 and 16) Measurements were taken to the nearest millimeter of culmen, wing chord, and flat wing. Mass was measured in grams using an electronic scale (Figure 5). After banding, adult swallows were held for up to twelve minutes in a cotton drawstring bag, while waiting for its mate to be trapped. If the weather was cool and damp, the banded swallow was held for a lesser period, depending on conditions. Attempts were made to capture the second adult on another day. Banding data was recorded on banding sheets (page 15 and 16)

Figure 4. Community involvement learning about adult and chick banding.

Figure 5. Tree swallow chick being weighed Bethel, Alaska.

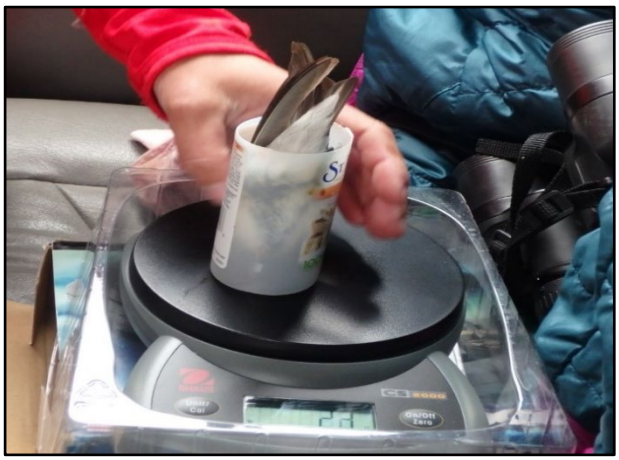


Figure 6. Weighing an adult Tree Swallow in a plastic cup on an electronic balance.

Chick Banding

Chicks are measured and banded to study growth rates and look at natal site fidelity. Chicks are banded at approximately 9-12 days of age. Because growth rates can be influenced by environmental conditions and insect availability, developmental landmarks were used to determine if chicks are ready to receive a band. The ideal time to band is when the primary feathers are breaking through their sheaths (Figure 5) and legs have lengthened and become scaly. A leg gauge was used to determine if the legs of the chick have slimmed down and lengthened enough for banding with a size 1 band. Chicks that were ready for banding were taken out of the box, placed in a cotton bag with other chicks, taken to the banding location (usually inside of a vehicle), and banded. Morphometric measurements were taken for culmen, flat wing, longest exposed primary, fat deposits and mass. The banding and measuring of chicks were done quickly, because they are extremely sensitive to the weather conditions and to minimize stress to the parents.

Analysis

Data was recorded on field data sheets and later entered into a Microsoft Excel spreadsheet. Means were calculated for morphometric measurements and important phenology dates. All means are presented as ± standard error.

RESULTS

Nest Box Monitoring

The nest boxes were monitored from 15 May 2023 - 18 July 2023, 64 days. Twenty-eight of the 32 nest boxes were occupied for a nest occupancy rate of 88 percent. Twenty-one of 28 boxes had active and completed clutches, a success rate of 75 percent. Breeding chronology, clutch size, hatching success, and fledging success for each active nest are in included in Table 2.

The earliest clutch was initiated on 23 May and the latest on 10 June 2023, with a range of 19 days for clutch initiation. Mean clutch completion was 10 June ±1.21 days (n=28). The mean number of days per incubation period was 14 ± 0.53, with a range of 9 to 21 days (n=25). The mean hatch date was 24 June ±1.18 with a range from 3 June to 8 July (n=25). The mean

fledging date was 12 June ±1.44 (n=21), with the earliest nest fledging on 2 July and the latest on 18 July.

A total of 146 eggs were laid and 75 percent (109) of those eggs hatched. Mean clutch size was 5 ± 0.27 eggs per nest (n = 28; range = 1- 8 eggs). Mean number of chicks per nest was 4 ± 0.43. Of the 109 hatchlings, 90 percent (99) grew to chicks and successfully fledged, with a mean of 3.54 ± 0.46 fledglings per nest. Out of 28 occupied boxes, 21 boxes successfully completed clutches, and 21 boxes successfully fledged at least one chick, giving a 75 percent nest success rate.

Figure 8. Tree Swallow incubating

The date data from many boxes is incomplete due to lack of staff availability, resulting in a high standard error for fledge, hatch, and clutch initiation dates. The estimates in these results are based off the data collected, referenced in table 2.

Table 1. Tree Swallow nest box location and occupancy in Bethel, Alaska*

Box #	Location	Latitude (N)	Longitude (W)	Occupied 2017	Occupied 2018	Occupied 2023
1	FWS HQ	60.78904	161.77959	Y	Y	Y
2	FWS HQ	60.78916	161.77924	Y	Y	Y
3	FWS HQ	60.78931	161.77914	N	Y	N
4	FWS HQ	60.78872	161.77993	Y	Y	Y
5	FWS HQ	60.78931	161.78033	Y	Y	Y
6	1729 Wildlife Lane	60.78303	161.80250	Y	Y	Y
7	1727 Wildlife Lane	60.78290	161.80354	Y	Y	Y
8	1725 Wildlife Lane	60.78324	161.80394	N	Y	Y
9A	Hangar Lake	60.80293	161.72758	N	Y	N/A
9 (N11)	1727 Wildlife Lane	60.78294	161.80348	Y	Y	Y
10	156 Blackberry Rd	60.78981	161.81080	Y	Y	Y
11	150 Blackberry Rd	60.78957	161.81103	Y	Y	Y
12	223 Blackberry Rd	60.79331	161.80907	Y	Y	Y
13	9350 Ayaginar Rd	60.80778	161.82567	Y	Y	Y
14	9543 Ayaginar Rd	60.80811	161.82568	Y	Y	Y
15	124 H-Marker Lake	60.79779	161.82117	Y	Y	N/A
16	FWS HQ	60.78908	161.77994	Y	Y	N/A
17	9439 Noel Polty, Kasayuli	60.76882	161.87828	Y	N	Y
18	9439 Noel Polty, Kasayuli	60.76926	161.87854	N	Y	N/A
19	Hangar Lake	60.80285	161.72743	Y	Y	Y
20	Hangar Lake	60.80297	161.72762	N	N	N
21	Wildlife Lane	60.78352	161.80314	Y	Y	Y
22	Wildlife Lane	60.78381	161.80340	Y	Y	Y
23	Highway	60.79529	161.76015	N	N	Y
24	Highway	60.79540	161.76024	Y	Y	N
25	1218 Uivik	60.80752	161.80578	N	N	Y
26	1218 Uivik	60.80742	161.80557	Y	Y	N
27	405 Napakiak Dr	60.79442	161.78055	N	N	N/A
28	405 Napakiak Dr	60.79442	161.78068	Y	Y	N/A
29	9436 Tundra Ridge	60.80842	161.82114	Y	Y	N/A
30	9543 Ayaginar Rd	60.80811	161.82568	N/A	Y	Y
31	1218 Uivik	60.80742	161.80533	N	Y	Y
32	158 A Hoffman	60.78363	161.79710	N/A	Y	N/A
33	1725 Wildlife Lane	60.78336	161.80415	N	Y	Y
35	225B Akiak Dr	60.79334	161.77968	N/A	N/A	N/A
34	223C Akiak DR	60.79334	161.77968	N/A	Y	N/A
37	921 6th Ave			N/A	N	N/A
36	921 6th Ave			N/A	N	N/A
38	460 6th Ave	60.79776	161.76648	N/A	Y	N/A
39	460 6th Ave	60.79776	161.76648	N/A	N/A	N/A
40	Wildlife Lane	60.78334	161.80261	N/A	Y	Y
41	Wildlife Lane	60.78350	161.80226	N/A	Y	Y
42	9350 Ayaginar Dr.			N/A	Y	N/A
43	124 H-Marker Lake	60.79779	161.82117	N/A	Y	N/A
44	9543 Tundra Ridge	60.80798	161.82596	N/A	Y	Y
45 (N5)	156 Blackberry Rd	60.78986	161.81071	Y	Y	Y
42A	9350 Ayaginar (Tundra Ridge)	60.80765	161.82590	N/A	Y	Y
42B	9350 Ayaginar (Tundra Ridge)	60.80765	161.82590	N/A	N/A	Y

*Occupation data for 2017 was pulled from the tree swallow hard drive. 2018 data was sourced from 2018 Bethel Tree Swallow Report and cross referenced with the original data sheets.

	2017	2018	2023
# of Boxes Monitored	33	45	32
# of Boxes Occupied	23	38	28
Percent of Boxes Occupied	70%	84%	88%

Table 2. Breeding phenology, clutch size, and nest fate of Tree Swallow found using boxes in Bethel, Alaska, 2023

Box #	Clutch Completion Date	Incubation Date	Hatch Date	Incubation Pe	Fledge Date	# eggs	# hatched	# fledge	Success
1	6-Jun	5-Jun	19-Jun	14	13-Jul	7	7	7	YES
2	29-May	28-May	12-Jun	16	6-Jul	6	6	6	YES
4	6-Jun	5-Jun	22-Jun	17	2-Jul	6	6	6	YES
5	13-Jun	12-Jun	27-Jun	15	10-Jul	5	5	4	YES
6	10-Jun	9-Jun	25-Jun	16	8-Jul	6	5	5	YES
7	13-Jun	12-Jun	1-Jul	11	18-Jul	6	5	5	YES
8	7-Jun	6-Jun	17-Jun	11	2-Jul	5	5	5	YES
9	8-Jun	7-Jun	20-Jun	13	30-Jul	6	6	6	YES
10	8-Jun	7-Jun	23-Jun	16	14-Jul	8	8	8	YES
11	16-Jun	15-Jun	29-Jun	14	18-Jul	5	2	2	YES
12	9-Jun	8-Jun	22-Jun	14	12-Jul	7	6	6	YES
13	8-Jun	7-Jun	-	-	-	1	0	0	NO
14	24-Jun	23-Jun	8-Jul	15	-	5	0	0	NO
17	8-Jun	7-Jun	22-Jun	15	13-Jul	4	3	3	YES
19	19-Jun	18-Jun	27-Jun	9	7-Jul	5	5	3	YES
21	30-May	29-May	12-Jun	15	24-Jul	5	5	0	NO
22	14-Jun	13-Jun	26-Jun	13	13-Jul	5	2	3	YES
23	2-Jun	2-Jun	-	-	-	4	0	0	NO
25	7-Jun	6-Jun	20-Jun	14	-	6	0	0	NO
30	11-Jun	10-Jun	24-Jun	14	-	5	5	5	YES
31	5-Jun	4-Jun	25-Jun	21	10-Jul	6	5	5	YES
33	16-Jun	17-Jun	26-Jun	9	18-Jul	6	3	3	YES
41	7-Jun	-	-	-	-	2	0	0	NO
40	14-Jun	13-Jun	27-Jun	14	9-Jul	6	3	3	YES
44	16-Jun	15-Jun	28-Jun	13	12-Jul	6	4	4	YES
45	25-Jun	24-Jun	3-Jul	10	-	3	3	0	NO
42A	14-Jun	13-Jun	28-Jun	15	13-Jul	5	5	5	YES
42B	13-Jun	12-Jun	28-Jun	16	13-Jul	5	5	5	YES
Total				350		146	109	99	% Success=75
Mean	10-Jun	9-Jun	24-Jun	14	12-Jul	5	4	3.54	
Std Error	1.21	1.25	1.18	0.53	1.44	0.27	0.43	0.46	

Adult Capture and Banding

Adult swallows were captured at each nest box from 3 - 5 July 2023. A total of 31 adults were captured (31 females; Table 3, and 11 males; Table 4). Females' morphological means were 116.65±.83 mm for wing chord, 5.26±.08 mm culmen length, Mass of 20.95±.39 grams, and fat score of 3.15±.15. Male morphological means were larger, with 120.45±1.23 mm wing chord, 5.21±.12 mm culmen length, mean mass of 20.95±.48 grams, and a fat score of 2.7±.26.

Table 3. Banding Data of Female adult Tree Swallows in Bethel, Alaska, 2023.

Band Number	Banding Year	Banding Month	Banding Day	Age	How Aged	Sex	How Sexed	Remarks	Banded Leg	Wing Chord	Culmen Length	Bird Weight	Fat Score
281100974	2023	07	03	AHY	PL	F	BP	Box 4	R	122	5.2	20.8	3
281100988	2023	07	03	AHY	PL	F	BP	Box 1	R	117	5.6	20.6	3
281100989	2023	07	03	AHY	PL	F	BP	Box 5	R	119	5.5	22.1	4
281100990	2023	07	03	SY	PL	F	BP	Box 45	R	114	5.6	21.5	4
281100991	2023	07	03	AHY	PL	F	BP	Box 11	R	118	5	24	3
281101000	2023	07	03	AHY	PL	F	BP	Box 12	R	112	5.7	19.8	3
160106704	2023	07	03	AHY	PL	F	BP	Box 17	R	116	5.7	19.6	3
160106706	2023	07	03	AHY	PL	F	BP	Box 07	R	114	5.1	20.7	3
160106713	2023	07	03	AHY	PL	F	BP	Box 08	R	116	5.8	20.8	2
160106720	2023	07	03	AHY	PL	F	BP	Box 09	R	122	4.9	22.2	3
160106723	2023	07	03	AHY	PL	F	BP	Box 23	R	114	5.5	23.4	4
160106724	2023	07	03	SY	PL	F	BP	Box 40	R	114	5.5	23	3
160106733	2023	07	04	AHY	PL	F	BP	Box 42A	R	110	5.2	20.4	3
160106734	2023	07	04	AHY	PL	F	BP	Box 14	R	115	4.5	23.8	4
160106736	2023	07	04	AHY	PL	F	BP	Box 30	R	115	5.4	17.8	4
160106745	2023	07	04	AHY	PL	F	BP	Box 19	R	116	5	20.3	3
160106747	2023	07	04	AHY	PL	F	BP	Box 33	R	116	4.5	21.6	3
160106749	2023	07	05	AHY	PL	F	BP	Box 25	R	125	5.3	18.6	2
160106750	2023	07	05	SY	PL	F	BP	Box 42B	R	116	5.1	18.5	2
160106758	2023	07	05	AHY	PL	F	BP	Box 10	R	122	5	19.4	4
Mean										116.65	5.26	20.95	3.15
Std Error										0.83	0.08	0.39	0.15

Table 4. Banding Data of Male Adult Tree Swallows in Bethel, Alaska, 2023

Band Number	Banding Year	Banding Month	Banding Day	Age	How Aged	Sex	How Sexed	Remarks	Banded Leg	Wing Chord	Culmen Length	Bird Weight	Fat Score
160106705	2023	07	03	AHY	PL	M	CL	Box 17	R	125	4.6	22.4	2
160106712	2023	07	03	AHY	PL	M	CL	Box 07	R	118	4.8	18.5	3
160106721	2023	07	03	AHY	PL	M	CL	Box 09	R	122	5.3	21.8	2
160106722	2023	07	03	AHY	PL	M	CL	Box 22	R	115	5.5	20.9	2
160106725	2023	07	03	AHY	PL	M	CL	Box 41	R	125	5.1	23.4	4
160106732	2023	07	04	AHY	PL	M	CL	Box 42A	R	114	5.7	21.1	
160106735	2023	07	04	AHY	PL	M	CL	Box 30	R	116	5.6	20.3	3
160106741	2023	07	04	AHY	PL	M	CL	Box 44	R	124	5.5	22.3	3
160106746	2023	07	04	AHY	PL	M	CL	Box 5	R	120	5.5	21.2	2
160106748	2023	07	04	AHY	PL	M	CL	Box 6	R	123	5.1	20.4	2
160106751	2023	07	05	AHY	PL	M	CL	Box 42B	R	123	4.6	18.2	4
Mean:										120.45	5.21	20.95	2.7
Std Error:										1.23	0.12	0.48	0.26

Chick Banding Data

Ninety-one Swallow chicks were banded from 20 of the 28 active boxes. Chick morphological measurements were: longest broken primary was 14.67± .80mm, mean culmen length of 4.66±.04 mm, mean mass of 21.97±.34 grams, and a fat score of 3.97±.13 (Table 5).

Table 5. Tree Swallow Chick Banding Data in Bethel, Alaska, 2023

Band Number	Banding Year	Banding Month	Banding Day	Age	Sex	Remarks	Banded Leg	Culmen Length	Bird Weight	Fat Score	Longest Broken Primary
281100975	2023	07	03	L	U	Box 4	R	4.7	24	4	12.7
281100976	2023	07	03	L	U	Box 4	R	4.3	24.4	4	14.4
281100977	2023	07	03	L	U	Box 4	R	4.1	21.4	5	15.8
281100978	2023	07	03	L	U	Box 4	R	5.1	24.1	5	16.3
281100979	2023	07	03	L	U	Box 4	R	4.9	23.1	5	12.9
281100980	2023	07	03	L	U	Box 4	R	4.6	23.7	4	15.2
281100981	2023	07	03	L	U	Box 1	R	4.7	20.3	4	6.1
281100982	2023	07	03	L	U	Box 1	R	5.5	22.5	5	10.6
281100983	2023	07	03	L	U	Box 1	R	4.4	23.8	4	8.1
281100984	2023	07	03	L	U	Box 1	R	4.9	24.1	5	8.8
281100985	2023	07	03	L	U	Box 1	R	5	23.9	5	8.2
281100986	2023	07	03	L	U	Box 1	R	4.5	22.9	4	10.3
281100987	2023	07	03	L	U	Box 1	R	4.2	21.3	5	10.6
281100992	2023	07	03	L	U	Box 10	R	4.6	20.3	4	4.1
281100993	2023	07	03	L	U	Box 10	R	4.9	20.7	5	11.1
281100994	2023	07	03	L	U	Box 12	R	4.8	20.9	4	9.1
281100995	2023	07	03	L	U	Box 12	R	4.5	21.8	3	11.1
281100996	2023	07	03	L	U	Box 12	R	4.5	21.9	3	14.2
281100997	2023	07	03	L	U	Box 12	R	5	21.5	5	6.1
281100998	2023	07	03	L	U	Box 12	R	4.5	20.5	4	11.5
281100999	2023	07	03	L	U	Box 12	R	4.9	24.3	5	8.2
160106701	2023	07	03	L	U	Box 17	R	4.9	25	4	9
160106702	2023	07	03	L	U	Box 17	R	4.8	24.9	5	11.1
160106703	2023	07	03	L	U	Box 17	R	4.3	24.9	6	12
160106707	2023	07	03	L	U	Box 8	R	4.9	26.1	5	23.7
160106708	2023	07	03	L	U	Box 8	R	5.2	25.6	6	27.2
160106709	2023	07	03	L	U	Box 8	R	4.6	27.6	4	27
160106710	2023	07	03	L	U	Box 8	R	5.2	25.9	5	25.8
160106711	2023	07	03	L	U	Box 8	R	5.6	27	5	28
160106714	2023	07	03	L	U	Box 9	R	4.6	27.6	5	20.8
160106715	2023	07	03	L	U	Box 9	R	4.9	25	4	19.3
160106716	2023	07	03	L	U	Box 9	R	4.5	24.5	4	15.9
160106717	2023	07	03	L	U	Box 9	R	4.1	25.3	4	15.5
160106718	2023	07	03	L	U	Box 9	R	4	25.4	4	23.6
160106719	2023	07	03	L	U	Box 9	R	4.6	23.2	4	12
160106726	2023	07	04	L	U	Box 31	R	5	25.6	4	29.5
160106727	2023	07	04	L	U	Box 31	R	5	24.1	4	24.9
160106728	2023	07	04	L	U	Box 31	R	5.3	26.5	5	23.6
160106729	2023	07	04	L	U	Box 31	R	5.1	22.7	5	21.9
160106730	2023	07	04	L	U	Box 31	R	5	24	5	27.7
160106731	2023	07	04	L	U	Box 31	R	5	23	4	30.5
160106737	2023	07	04	L	U	Box 44	R	5.3	26.3	5	9.1
160106738	2023	07	04	L	U	Box 44	R	5.2	24.8	5	11.1
160106739	2023	07	04	L	U	Box 44	R	4.7	27.4	4	13.1
160106740	2023	07	04	L	U	Box 44	R	4.6	24.9	5	13.1
160106742	2023	07	04	L	U	Box 19	R	4.6	20.8	4	-
160106743	2023	07	04	L	U	Box 19	R	5	23.4	4	-
160106744	2023	07	04	L	U	Box 19	R	4.8	22.4	4	-
160106752	2023	07	05	L	U	Box 10	R	4.7	22.2	4	13.7
160106753	2023	07	05	L	U	Box 10	R	4.5	23.3	5	13.9
160106754	2023	07	05	L	U	Box 10	R	4.5	19.4	5	14

160106755	2023	07	05	L	U	Box 10	R	4.1	17.5	5	10.6
160106756	2023	07	05	L	U	Box 10	R	4.7	18.4	4	16.2
160106757	2023	07	05	L	U	Box 10	R	4.7	21.3	5	9.7
160106759	2023	07	05	L	U	Box 33	R	4.6	25.3	5	13
160106760	2023	07	05	L	U	Box 33	R	4.3	23.2	4	10.5
160106761	2023	07	05	L	U	Box 33	R	4.8	24.6	4	9.6
160106762	2023	07	05	L	U	Box 33	R	4.2	22.8	5	7.5
160106763	2023	07	05	L	U	Box 33	R	4.1	24.2	4	11.3
160106764	2023	07	05	L	U	Box 6	R	4.7	22.5	5	10
160106765	2023	07	05	L	U	Box 6	R	4.2	25.1	5	7.1
160106766	2023	07	05	L	U	Box 6	R	4.6	21.7	5	8.9
160106767	2023	07	05	L	U	Box 6	R	4.5	22.4	5	7.8
160106768	2023	07	05	L	U	Box 6	R	4.6	22.5	5	9.7
160106769	2023	07	07	L	U	Box 22	R	4.6	24	5	8.5
160106770	2023	07	07	L	U	Box 22	R	4.4	22	4	9.9
160106771	2023	07	07	L	U	Box 22	R	4.4	23	5	3
160106772	2023	07	07	L	U	Box 40	R	4.4	21	5	6.4
160106774	2023	07	07	L	U	Box 40	R	4	22	5	3.2
160106775	2023	07	07	L	U	Box 40	R	4.5	21	4	8.2
160106776	2023	07	10	L	U	Box 11	R	4.6	19	3	-
160106777	2023	07	10	L	U	Box 11	R	4.3	18	2	24.5
160106778	2023	07	10	L	U	Box 42A	R	4.4	18	3	-
160106779	2023	07	10	L	U	Box 42A	R	5.1	16	2	-
160106780	2023	07	10	L	U	Box 42A	R	5.3	18	2	35.3
160106781	2023	07	10	L	U	Box 42A	R	4.3	18	3	-
160106782	2023	07	10	L	U	Box 42A	R	5.5	20	2	-
160106783	2023	07	10	L	U	Box 42B	R	4.8	16	2	22.3
160106784	2023	07	10	L	U	Box 42B	R	4.3	16	1	16.8
160106785	2023	07	10	L	U	Box 42B	R	4.7	15	3	19.8
160106786	2023	07	10	L	U	Box 42B	R	4.5	15	2	17.3
160106787	2023	07	10	L	U	Box 42B	R	5.1	15	2	19.8
160106788	2023	07	10	L	U	Box 30	R	4.8	16	2	-
160106789	2023	07	10	L	U	Box 30	R	5	19	2	-
160106790	2023	07	10	L	U	Box 30	R	4.7	19	2	-
160106791	2023	07	10	L	U	Box 30	R	5.2	15	1	-
160106792	2023	07	10	L	U	Box 30	R	4.6	20	1	-
160106793	2023	07	11	L	U	Box 5	R	3.5	19	2	17
160106794	2023	07	11	L	U	Box 5	R	3.4	17	2	16.4
160106795	2023	07	11	L	U	Box 5	R	4.2	19	2	21.6
160106796	2023	07	12	L	U	Box 7	R	4	17	2	20.1
Mean			05					4.66	21.97	3.97	14.67
Std Error			0.30					0.04	0.34	0.13	0.80

Discussion

Comparing 2018 data to 2023, clutch initiation dates had a shorter window of 19 days in 2023 when compared to 28 days of 2018 (Sowl 2019). Mean hatch date was much later in 2023, at 24 June compared to 16 June in 2018 (Sowl 2019). Tree Swallow breeding commences much later in Bethel when compared to states with warmer climates.

Few potential nest predators exist in Bethel, but likely nest predators include weasels, magpies, shrikes, and the occasional cat. Nest failure is more likely to be caused by cold, wet weather

when nestlings can develop hypothermia or starve due to the greater difficulty of adults finding food during those conditions.

During this study, we lost all chicks in (Box 45) and most of the chicks likely died of starvation. The summer was very wet and cold with many day periods of sustained rain showers, presumably making foraging difficult for parents. Another chick (Box 5) died; an adult died in (Box 22) before the pair laid any eggs. This pair must have found a different mate as the box successfully fledged 3 chicks.

Future Recommendations

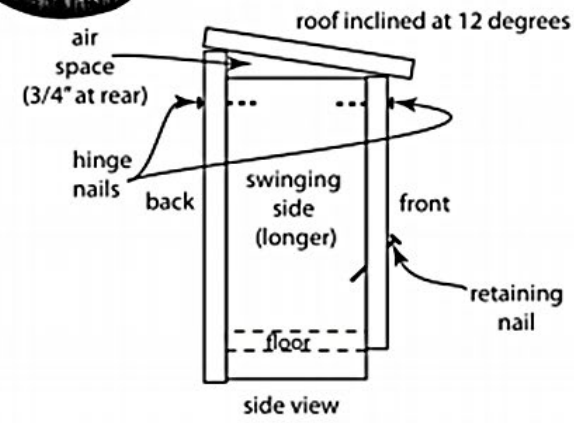
Staff Members dedicated to nest box monitoring, a trainer who has done the Bethel monitoring project in the past. More frequent visits to nest boxes.

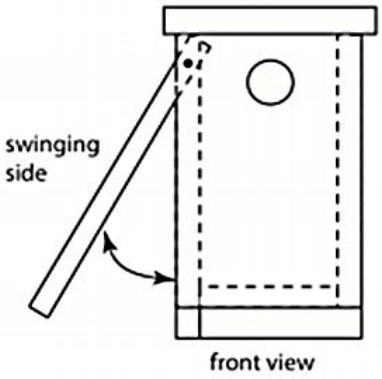
Acknowledgements

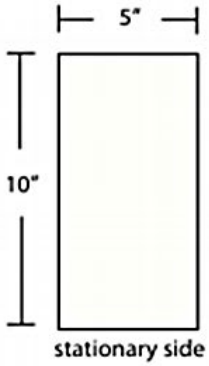
Thanks to Laurel Devaney for being our bander and providing her expertise on Tree Swallow Nest Box Monitoring. Thanks to Bryan Daniels, Waterfowl Biologist at Yukon Delta for his time and expertise. Thank you to seasonals Carl Nilson and Emma Niven for being the primary nest box monitors swallow boxes.

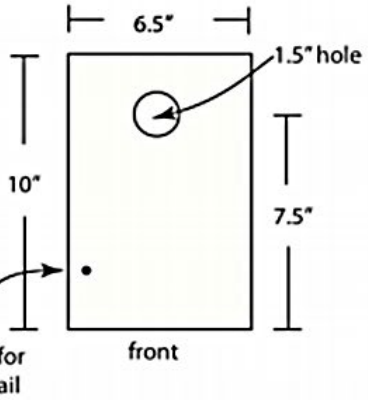
ALASKA SONGBIRD INSTITUTE

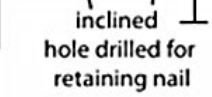
Tree Swallow (*Tachycineta bicolor*)
Nest Box Plans

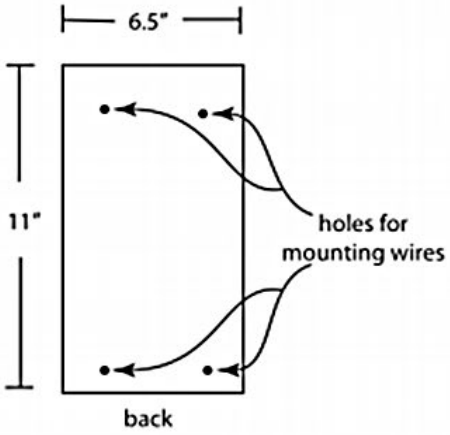


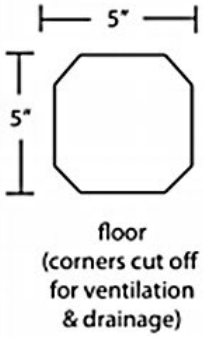


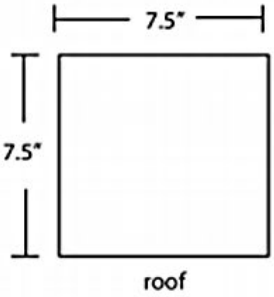












REFERENCES

Benton, T. G., D. M. Bryant, L. Cole, and H. Q. P. Crick. (2002). Linking agricultural practice to insect and bird populations: a historical study over three decades. Journal of Applied Ecology 39:673-687.

Brandt, J. P. (2009). The extent of the North American boreal zone. Environmental Reviews 17(NA): 101-161. Shape file downloaded from: URL: www.nrcan.gc.ca/forests/boreal/14252. Accessed January 2018.

Doolittle, J. A., M. A. Hardisky, and M. F. Gross. (1990). A ground-penetrating radar study of active layer thicknesses in areas of moist sedge and wet sedge tundra near Bethel, Alaska, U.S.A. Arctic and Alpine Research 22(2):175-182.

Dunn, P. O., K. J. Thusius, K. Kimber and D. W. Winkler. (2000). Geographic and ecological variation in clutch size of Tree Swallows. Auk 117 (1):215-221.

Ferrians, O.J., Jr., compiler. (1965). Permafrost map of Alaska. U.S. Geological Survey Miscellaneous Geologic Investigations, Map I-445 (reprinted 1981).

Jones, T., and W. Cresswell. (2010). The phenology mismatch hypothesis: are declines of migrant birds linked to uneven global climate change? Journal of Animal Ecology 79:98–108.

Longcore, J. R., T. A. Haines, and W. A. Halteman. (2007). Mercury in Tree Swallow food, eggs, bodies, and feathers at Acadia National Park, Maine, and an EPA Superfund Site, Ayer, Massachusetts. Environmental Monitoring and Assessment 126:129–143.

McCracken, J. (2008). Are aerial insectivores being "bugged out?" BirdWatch Canada 42:4-7.

Michel, N. L., A. C. Smith, R. G. Clark, C. A. Morrissey, and K. A. Hobson. (2015). Differences in spatial synchrony and interspecific concordance inform guild-level population trends for aerial insectivorous birds. Ecography 39:774–786.

Murphy, M. T. (2003). Avian population trends within the evolving agricultural landscape of eastern and central United States. Auk 120:20-34.

Nebel, S., A. Mills, J. D. McCracken, and P. D. Taylor. (2010). Declines of aerial insectivores in North America follow a geographic gradient. Avian Conservation and Ecology 5:1.

Newton, I. (2007). Weather-related mass-mortality events in migrants. Ibis 149:453–467.

Robinson, S. K., F. R. Thompson, III, T. M. Donovan, D. R. Whitehead, and J. Faaborg. (1995). Regional forest fragmentation and the nesting success of migratory birds. Science 267:1987-1990.

Sillett, T. S., and Holmes, R. T. (2002). Variation in survivorship of a migratory songbird throughout its annual cycle. Journal of Animal Ecology, 71:296–308.

Sowl, K. M. (2018). Study Plan for Monitoring the Productivity and Survivorship of Tree Swallows (*Tachycineta bicolor*) in Bethel, Alaska. Unpublished study plan, Yukon Delta National Wildlife Refuge, Bethel, Alaska.

Sowl, K. M. (2019) Snow, P. Carl, J., Samson, C., Stein, V., and Rogers, A.N. 2019 Tree Swallow Nest Box Monitoring, Bethel, Alaska 2018. Non-Game Program Report 2019-01 Yukon Delta National Wildlife Refuge, U.S. Fish and Wildlife Service Bethel, Alaska USA.

Stenseth, N. C., and A. Mysterud. (2002). Climate, changing phenology, and other life history traits: nonlinearity and match–mismatch to the environment. Proceedings of the National Academy of Sciences 99:13379-13381.

Taylor, W. K. and B. H. Anderson. (1973). Nocturnal migrants killed at central Florida TV tower; autumns 1969-71. Wilson Bulletin 85(1) 42-51.

U.S. Climate Data. (2023). *Weather averages bethel, Alaska*. Temperature - Precipitation - Sunshine - Snowfall. https://www.usclimatedata.com/climate/bethel/alaska/united-states/usak0028

Winkler, D. W., K. K. Hallinger, D. R. Ardia, R. J. Robertson, B. J. Stutchbury, and R. R. Cohen. (2011). Tree Swallow (*Tachycineta bicolor*), version 2.0. In The Birds of North America (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. URL: https://doi.org/10.2173/bna.11