

BIRD USE SURVEY OF A SMALL BOTTOMLAND WOODED HABITAT
IN THE DYEA MANAGEMENT UNIT
OF KLONDIKE GOLD RUSH NATIONAL HISTORICAL PARK

September 2020



prepared by:

C. E. Furbish
Taiya Environmental Consulting
P.O. Box 1076
Skagway, AK 99840

prepared for:

Klondike Gold Rush National Historical Site
Natural Resources Division
PO Box 517
291 Second Avenue
Skagway, AK 99840

EXECUTIVE SUMMARY

Bird use was described within a small bottomland tract adjacent to the Taiya River in Klondike Gold Rush National Historical Park during spring and early summer, 2020. Data were primarily collected through a "dawn chorus" survey which targeted breeding songbirds. Forty-six (46) species were observed using the survey site. No federal or state threatened or endangered birds were found. However, 29 species had some level of conservation concern with the State of Alaska and/or bird conservation organizations. One bird, the Chestnut-backed Chickadee, was identified as *under threat* due to overall high vulnerability for population decline by Partners in Flight, a coalition of 150 government agencies and non-government organizations.

The two most numerous birds found in the site were American Robin and Orange-crowned Warbler; gregarious breeding songbirds adapted to habitat edges and human disturbance. A total of 28 breeding birds used the site, the majority were species that have established associations with a particular habitat type. Of those, 11 species have a strong preference for woodland interior habitat, and 5 species have a strong preference for woodland edge habitat. The overall bird species diversity at the site is produced by the combined presence of birds associated with interior habitat or edge habitat, and generalist birds that do not have a strong habitat preference.

The quality of woodland interior habitat at the site includes physical elements of edge habitat, largely due to the relatively small size of the site, the presence of hard edges on two sides (road and river), and softer edges within the site (campsites, ponds). Some breeding birds known to have a strong interior or edge habitat preference were found in patterns that matched their habitat preference, indicating that they discriminated interior vs. edge at the scale of the site.

However, other breeding birds known to have a strong habitat preference did not occur in expected patterns. Some birds with a strong preference for edge habitat were found throughout the site, indicating that they may experience the site as one large edge. Conversely, some birds with a strong preference for interior habitat were found in inconsistent patterns, indicating that interior vs. edge at the scale of the site was not the dominant factor affecting their presence. In both cases, specific factors at higher than typical levels, such as nest predation or food quality, could have also contributed to the unexpected patterns.

The presence of birds described as preferring edge habitat throughout the site, and the evidence for edge effects within the interior of the site, could indicate that interior-preference birds at this site may be susceptible to habitat changes that increase edges in relation to the interior.

The roadside hard edge was used by 3 species that were also found within the site, whereas the river hard edge increased bird diversity by attracting 5 species not found elsewhere during the survey period. One, the Mallard duck, was later observed using pond habitat in the middle of the site.

The site has many qualities that benefit bird diversity, including multi-level vegetative structure, a variety of nesting site types, and water features. The high proportion of edge to interior may promote detrimental characteristics, such as increased nest predator access or decreased protection from the elements. Keystone species, especially the Red-breasted Sapsucker, increase food and nesting characteristics that benefit many other bird species.

ACKNOWLEDGMENTS

The author is grateful for the support of others who contributed to this project. Judy Hall Jacobson and Jennifer Rose Larsen offered bird observations for species that would have otherwise been undetected. Marty Byrne and Joel Cusick supplied map background imagery. A proofreader caught errors and improved readability. Mary Hake gave valuable critical review and content suggestions; her much appreciated assistance made this report stronger and clearer.

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	i
ACKNOWLEDGMENTS.....	i
INTRODUCTION.....	1
Site Description.....	1
Objectives.....	3
METHODS.....	3
Design.....	3
Protocol.....	4
RESULTS AND INTERPRETATION.....	5
Objective 1 - Describe bird species and numbers of individual birds using the survey site overall.....	6
Objective 2 - Identify bird species of conservation concern found within the study area.....	8
Objective 3 - Discriminate bird species use of and breeding indications at particular features.....	10
Objective 4 - Describe bird presence within the site in relation to habitat or sub-habitat characteristics.....	16
SUMMARY DISCUSSION.....	21
BIBLIOGRAPHY.....	23
Appendix A. Scientific names and common names of plant species.....	25
Appendix B. Scientific names, common names, and 4-letter codes of bird species.....	26
Appendix C. Field data sheet.....	28

LIST OF FIGURES, MAPS & TABLES

page

1	Map 1.	Dyea Bird Use Survey site
3	Map 2.	Dyea bird survey points and paths
6	Table 1.	Bird species found at survey site
7	Figure 1.	Sum of individuals found within circles by species
9	Table 2.	Bird species having a federal, state or environmental organization conservation status
10	Figure 2.	Count of species using point circles; inner, outer and combination
11	Figure 3.	Number of individuals using point circles; inner, outer and combination
12	Figure 4.	Count of high confidence breeding species by point
13	Table 3.	List of breeding bird species found at survey site
14	Table 4.	Characteristics of breeding birds found at survey site
16	Table 5.	Ranking of survey points by degree of edge effect influence
17	Figure 5.	Four species with expected trends if edge habitat and interior habitat operate at site scale
18	Figure 6.	Four species with unexpected trends if edge habitat and interior habitat operate at site scale
19	Map 3.	Dyea bird survey paths
20	Table 6.	Bird species found along paths

INTRODUCTION

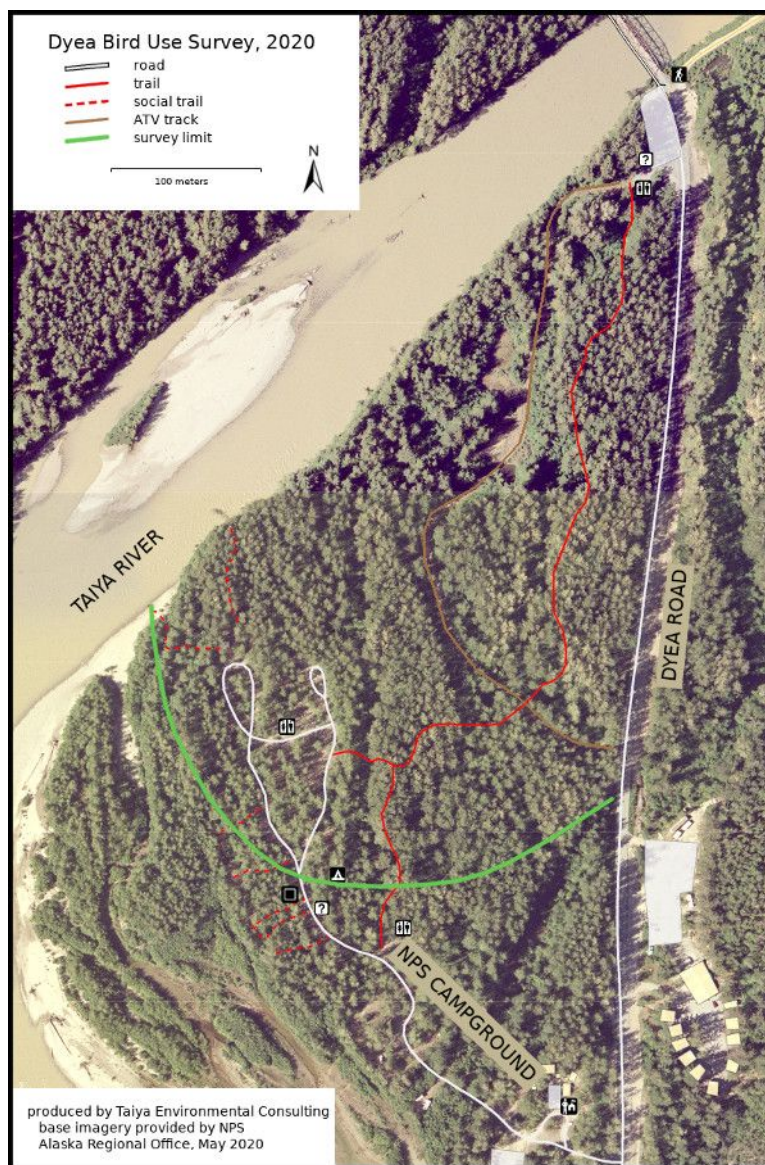
Klondike Gold Rush National Historical Park (KLGO) required natural resource information to inform planning for visitor service improvements at a site adjacent to the Taiya River in Dyea. This survey provides information on bird use of the site overall, and more discriminating information on bird use of particular features within the site, as requested by KLGO.

Site Description

The survey site is a pie-slice shaped wedge about 24 acres in size. It is bounded on one side by the Taiya River, another side by the Dyea Road, and on the third side by an arc that includes about half of the National Park Service (NPS) campground. (Map 1)

The site is a bottomland terrain of flat, low-elevation land built up by sediment deposition near a river. There are numerous remnant river overflow channels and swales within the site. In the northwest corner, some shallow ponds exist along one of the old drainage channels. The Chilkoot trailhead berm and Taiya River bridge have eliminated all but extreme flood overflow events, thus the channels and swales are more likely to be influenced now by groundwater levels and rainwater runoff. In addition, scattered small ponds or wet depressions appear to be “borrow pits” from past human activities. Only one deeper pond shows signs of having continuous standing water year round.

A parking area, toilets and interpretive sign are located at the northern point of the wedge. The NPS campground to the south includes cleared and partially cleared areas for roads, campground parking, campsites, and communal areas. A simple, narrow footpath trail leads from two points in the campground to the northern parking area. An old, unmaintained ATV track is partially revegetated and leads from Dyea Road, through the middle of the site to the northern parking area.



Map 1. Dyea Bird Use Survey Site.

[See Appendix A for scientific names of plant species]

The survey site was characterized as primarily “Black Cottonwood Open Forest” and “Sitka Spruce - Black Cottonwood Open Forest”, each consisting of 25% to 59% canopy cover, during a detailed investigation of landcover classification and plant associations within KLGO completed in 2015. ⁽¹²⁾ Black cottonwood trees dominate the high canopy, with scattered smaller spruce trees and occasional discrete “spruce islands” of several large spruce trees that fully close off the canopy. A well developed shrub understory and a sparse to complete groundcover layer can be found throughout, except in the more continuously wet ponds and swales. Standing and down dead trees are scattered all through the site. Live shrubs or small trees may lean over to grow horizontally near the ground surface in wetter areas. These landcover characteristics provide attractive habitat for wildlife, including birds.



Black cottonwood trees, understory shrubs and groundcover within survey site, 28 May 2020.

photo: C E Furbish (cc) BY ⁽⁸⁾

[See Appendix B for scientific names of bird species]

Observers of birds since prehistoric times have noted that many species are associated with particular habitats. Early scientific studies of these associations investigated relationships among general habitat categories and general bird use categories, such as woodland-edge-habitat or forest-interior-specialist. ^(14, 25, 27) More recent studies have shown that birds select habitats based on many often conflicting and/or interdependent characteristics, such as food density, predator access, nest site availability, within-species and between-species competition, to name just a few. ⁽¹⁷⁾

In addition, timing and scale make a difference. For example, American Redstarts were found to use an area of about 1 acre while incubating eggs, but only about 1/5 acre while feeding chicks. ⁽⁴⁰⁾ These finer relationships are still being described, but have already been useful to explain exceptions to established general bird-habitat associations, and to improve habitat management decisions. ^(4, 30)



American Redstart male. Both male and female redstarts bring food to nestlings and protect and feed fledglings.

photo: Ben Zerante (cc) BY-NC ^(8, 20)

Objectives

- 1) Describe bird use of the overall site including description of species present, seasonal movement pattern, probable breeders, and other characteristics.
- 2) Identify bird species of conservation concern found within the study area.
- 3) Discriminate bird species use of and breeding indications at particular features.
- 4) Describe bird presence within the site in relation to habitat or sub-habitat characteristics.

METHODS

Design

This survey was initiated during the 2020 COVID-19 pandemic. Virus control measures delayed the start date of the survey, with migratory birds already arriving as project objectives were being developed. This resulted in 2 preliminary survey sessions that don't match the main survey sampling design.

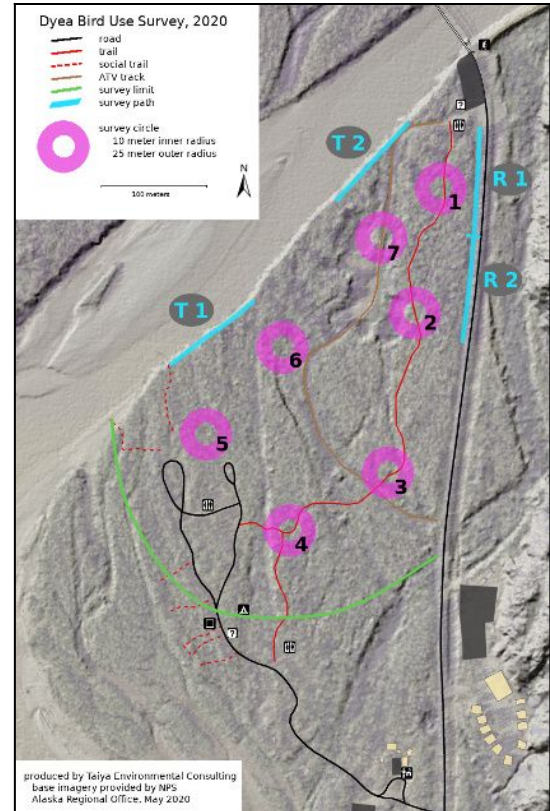
The main survey sampling design was adapted from a common breeding bird methodology used for long-term monitoring of bird populations over broad spatial scales.⁽³⁵⁾ Birds are counted within designated diameter circles at specific points for designated time periods during the dawn chorus time of high territorial defense behaviors, primarily singing. However, our survey site was too small for the standard methods, which use circle diameters and point placement separation distances designed to minimize duplicate counting the same birds.

For our survey, a modified point count method was developed to describe overall bird use of the site, and at particular features as requested by KLGO. No attempt was made to avoid duplicate counting the same birds from point to point. However, effort was made to avoid duplicate counting birds within the point circles.

Circle dimensions were approximated to be small enough for accurate bird detection and identification, and large enough to relate at scale to bird territories during breeding stages. If bird territories were substantially larger than point circles, then a survey session would rarely detect more than 1 breeding bird within the circle.

Circles of 10 and 25 meters radius were selected for this survey. These dimensions relate at acceptable scale for many of our typical breeding songbirds and woodpeckers. For example, Orange-crowned Warblers can have breeding territories of about 15 meters radius.⁽¹⁶⁾ Red-breasted Sapsuckers defend territories from 12 to 45 meters around a nest.^(15, 32) American Redstarts have early breeding territories of about 23 meters radius,⁽¹⁸⁾ and later nesting territories of about 16 meters radius⁽⁴⁰⁾.

The sampling layout included point/circles and paths. (Map 2) Paths were added to capture bird activity along edges.



Map 2. Dyea bird survey points and paths.

Seven points were located within the survey site. Birds were recorded within 3 spatial categories at each point.

-- Inner circle, 0-10 meter radius, used to estimate breeding birds likely defending a nearby nest site. Species designated as breeding if found within inner circle 2 or more times at separate dates.

-- Outer circle, 10-25 meter radius, added to inner circle data to estimate bird use of the point area. Birds recorded in this circle would be more likely to include those with overlapping feeding territories.

-- Beyond 25 meter circle but within site, species included in overall site list if not already found within circles.

Four 100-meter paths were placed at edges: 2 paths were located along the river berm, and 2 along the mowed right-of-way edge of Dyea Road. Birds were recorded within 2 bands: 10 meters in (towards the interior of the site) from the edge, and 5 meters out from the edge.

Breeding behaviors beyond territorial singing were noted if seen anywhere within the site during a survey. Information from incidental observations made within the site but not during a survey were also noted.

Data collection depended upon reliable bird identification skills, primarily by sound, of the data collector. Before the first preliminary survey, the data collector (author) refreshed knowledge of songs and drums of known local birds and the more likely to occur uncommon birds, using the web based "xeno-canto" ⁽³⁹⁾ and "Dendroica" ⁽⁹⁾ tools, and by testing using Dendroica to 90% or better. Weekly review and testing on songs/drums continued throughout the survey period. Identification of the more distinctive calls and other vocalizations was added over the first 3 weeks. In the field, the National Audubon "Merlin" smartphone application ⁽²⁹⁾ was used whenever verification was needed on site.

The methods also depend upon reliable estimation of circle radius distances of 10 and 25 meters, and of 5 to 10 meter path bands. At the first survey point, flags were set up at the inner and outer circle radii from the point to allow the data collector to visually recalibrate at the start of every survey session.

Protocol

[See Appendix C for field data sheet]

Start survey sessions at ½ hour after sunrise, and complete survey 2.0 - 2.5 hours later. Record descriptive weather and site condition.

Collect data in a circuit by starting at point 1, then do points 2 through 5 in sequence. Next do path T1, point 6, point 7, paths T2, R1 and R2. (Map 2)

Birds flying high over canopy are not included unless they land or take off within site.

Points: 10 minutes observation time at each point. Within circles, count each bird seen or heard - try to avoid duplicate counting birds within the circles. Pay particular attention to avoid duplicate counting singing birds that move quickly and are hidden among leaves. Include all birds that are found within circles, do not exclude birds you think may have flown in from a different circle, but can note them as comment. Record presence of species outside of circle but within site.

Paths: 5 - 10 minutes travel time. Record species presence, and occasionally notable numbers, while walking 100 meter paths.

For Taiya River paths [T] the edge is the upland shore berm.

in = uplands, out = shore if present below upland edge + nearshore water

For Dyea Road paths [R] the edge is the treeline.

in = wooded, out = mowed Right of Way shoulder

Between points/paths: record any uncommon species or common species not seen within points/paths. Throughout the survey session, record any breeding behaviors beyond territorial singing.

RESULTS AND INTERPRETATION

Data were collected from three sources within the survey site from 23 April to 31 July, 2020.

- Two (2) preliminary surveys were conducted on 23 April and 30 April. The methodology and layout of collection points/paths for these surveys did not match the main surveys.
- Nine (9) main surveys using the developed design and protocol were conducted weekly from 7 May to 2 July.
- Twenty-one (21) incidental sightings were recorded from 5 June to 31 July. These reports included the author when on site after the dawn chorus, and 2 other people who contributed their observations.

The main surveys and preliminary surveys started about ½ hour after dawn, and were completed within 2.5 hours. At this latitude, a half-hour after dawn occurred as early as 4:10 am.

North American common bird names have been standardized by the American Ornithological Society (AOS), thus can be used in lieu of scientific names. In addition, standardized 4 letter codes have been developed for birds by the AOS. ⁽⁵⁾ Common names, sometimes with 4-letter codes, are used throughout this report.

[See Appendix B for bird scientific names, common names and codes]

Objective 1 - Describe bird use of the overall site – presence, seasonal movement, probable breeders and other characteristics.

Probable breeders and other characteristics are presented in Tables 3 and 4, Objective 3 section. Using data from all sources, 46 bird species were recorded within the survey site. (Table 1) Of these, 44 were identified to species level. Two birds not identified to species were included because they could be narrowed down to a choice between two possibilities that were not otherwise represented in the data. Those bird couplets were Bohemian or Cedar Waxwing, and Merlin or Sharp-shinned Hawk.

Twenty-three (23) migratory bird species were found within the survey site. These birds do not overwinter in Skagway, but come a relatively large distance from elsewhere and are present during their reproductive period. Thirteen (13) resident birds were recorded. These species have relatively small distance seasonal movements, if at all. There were 9 birds categorized as "mixed". Some of these birds overwinter in Skagway, but some come from other places to breed here in the summer. One vagrant bird was found. A vagrant is a bird found in a place that is substantially out of range or out of season for that species.

Table 1. Bird species found at survey site, 23 April to 31 July, 2020.

code	name	seasonal movement type	only found once	code	name	seasonal movement type	only found once
AMDI	American Dipper	<i>resident</i>		MALL	Mallard	migrant	
AMKE	American Kestrel	migrant	X	OCWA	Orange-crowned Warbler	migrant	
AMRE	American Redstart	migrant		PAWR	Pacific Wren	<i>resident</i>	
AMRO	American Robin	migrant		PISI	Pine Siskin	mixed	
ATSP	American Tree Sparrow	migrant	X	PSFL	Pacific-slope Flycatcher	migrant	
BAEA	Bald Eagle	<i>resident</i>		RBNU	Red-breasted Nuthatch	mixed	
BCCH	Black-capped Chickadee	<i>resident</i>		RBSA	Red-breasted Sapsucker	migrant	
BEKI	Belted Kingfisher	mixed		RCKI	Ruby-crowned Kinglet	migrant	
BRCR	Brown Creeper	mixed		RPTsp.	Raptor sp. *	mixed	X
CBCH	Chestnut-backed Chickadee	<i>resident</i>		SPGR	Spruce Grouse	<i>resident</i>	
COME	Common Merganser	mixed		SPSA	Spotted Sandpiper	migrant	X
CORA	Common Raven	<i>resident</i>	X	SOGT	Sooty Grouse	<i>resident</i>	X
COYE	Common Yellowthroat	migrant	X	STJA	Steller's Jay	<i>resident</i>	
DEJU	Dark-eyed Junco	mixed		SWTH	Swainson's Thrush	migrant	
DOWO	Downy Woodpecker	<i>resident</i>		TOWA	Townsend's Warbler	migrant	
GCKI	Golden-crowned Kinglet	mixed		VATH	Varied Thrush	mixed	
HAFL	Hammond's Flycatcher	migrant		WAVI	Warbling Vireo	migrant	
HAWO	Hairy Woodpecker	<i>resident</i>		WXsp.	Waxwing sp. *	vagrant	X
HETH	Hermit Thrush	migrant		WETA	Western Tanager	migrant	
LISP	Lincoln's Sparrow	migrant	X	WISN	Wilson's Snipe	migrant	X
NOGO	Northern Goshawk	<i>resident</i>	X	WIWA	Wilson's Warbler	migrant	
NOWA	Northern Waterthrush	migrant		YEWA	Yellow Warbler	migrant	
NOPO	Northern Pygmy-Owl	<i>resident</i>	X	YRWA	Yellow-rumped Warbler	migrant	

* RPTsp. - raptor species - probably Merlin or Sharp-shinned Hawk

* WXsp. - waxwing species - either Cedar (out of range) or Bohemian (out of season)

Thirty-three (33) bird species were recorded within point circles during the main surveys. (Figure 1) The overall numbers of individuals per species can be interpreted as a rough estimate relative activity combined with the ease of detecting the species. Since data were collected during the dawn chorus of breeding birdsong, the bias against detecting normally quiet, secretive species was minimized for any bird species defending nest territory by song or drumming.

Although these are numeric data, there is high probability of individuals being counted in more than one circle within a survey session, and individuals were certainly recounted over time during different survey sessions. Therefore, quantitative estimates of distribution or abundance using this data set are not appropriate. Figure 1 shows the overall sum of individuals by species found during the main surveys.

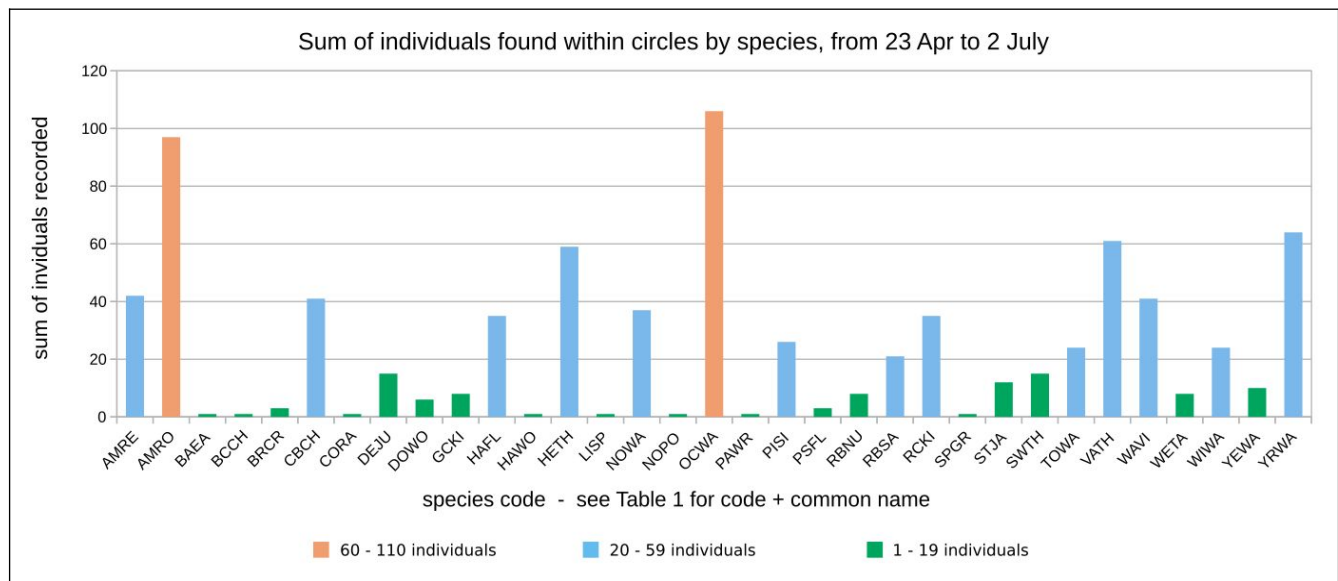


Figure 1. Sum of individuals found within circles by species. (see Appendix B for bird codes and names)

The 2 birds found most often were Orange-crowned Warbler and American Robin. Both are gregarious, animated, generalist species often associated with habitat edges.

Five (5) species usually described as preferring forest or woodland interior habitat ^(7, 27) were among the middle range of numbers of roughly 20 to 60 individuals. Those species were:

AMRE, American Redstart	HAFL, Hammond's Flycatcher	VATH, Varied Thrush
CBCH, Chestnut-backed Chickadee	TOWA, Townsend's Warbler	

These results indicate that at least 5 species normally associated with forest/woodland interior habitat had a substantial presence and were frequent users of the survey site.

Objective 2 - Identify bird species of conservation concern found within the study area.

All species found within the survey site were checked for conservation status with federal, state and non-governmental conservation organizations. Twenty-nine (29) species had some level of conservation concern. (Table 2)

No federal or state listed threatened or endangered (T&E) species were found. No candidate species for T&E status were found. ^(1, 10)

Twenty-six (26) species had some level of conservation concern with the State of Alaska. The Alaska Department of Fish and Game stopped maintaining a list of species of special concern in 2011. Instead, Alaska publishes a Wildlife Action Plan every 10 years designed to guide conservation programs with the goal of preventing species from becoming listed as threatened or endangered under the federal Endangered Species Act. ⁽¹⁾

Three (3) non-governmental conservation organizations were queried for listings of species found within the survey site.

The International Union for Conservation of Nature (IUCN) maintains a red list of Threatened Species designed to assess threats and guide conservation and funding priorities. ⁽²²⁾ No IUCN red listed species were found within the survey site.

Audubon Alaska maintains a watchlist of Alaska birds of conservation concern. Red List birds were assessed as vulnerable and declining, and Yellow List birds were assessed as vulnerable but not declining. In addition, Audubon Alaska lists species of concern due to lesser vulnerability or decline, but with a susceptibility to decline. ⁽³⁶⁾ Three (3) red listed birds were found in the survey site, 4 yellow listed birds were found, and 4 species of concern were found.

Partners in Flight (PIF) is an organization of 150 partner government agencies and conservation organizations throughout the Western Hemisphere engaged in all aspects of landbird conservation. Their most recent report on landbird species vulnerability assessments for the U.S. and Canada was published in 2016. ⁽³¹⁾ Detailed information is provided for each species.

One species listed by PIF was found within the site: the Chestnut-backed Chickadee. PIF evaluations of vulnerability are done at the continental scale. However, Chestnut-backed Chickadees are non-migratory birds with restricted range, thus "continental scale" includes their entire range along the Pacific coast from mid-California to the Kenai peninsula, with some presence in the Rocky Mountain range in northwest USA and southwest Canada. ⁽⁷⁾

Chestnut-backed Chickadees were found to have overall high vulnerability for population decline. This included medium level vulnerability for restricted breeding range, restricted non-breeding range, and threats to breeding range; combined with mild vulnerability for population size and threats to non-breeding range. ⁽³¹⁾

The species is estimated to have experienced 51% population loss over the last 44 years (1970-2014). Furthermore, if present trends continue, these chickadees are estimated to lose 50% of their current population over the next 46 years. The major threats to Chestnut-backed Chickadees were identified as changing forest conditions and urbanization. ⁽³¹⁾



Chestnut-backed Chickadee
photo: James Ianni (cc) BY-NC ^(8, 19)

Table 2. Bird species having a federal, state or environmental organization conservation status.

USA federal ⁽¹⁰⁾ - T&E species: endangered = 0, threatened = 0, candidate = 0

Alaska state ⁽¹⁾ - endangered = 0, threatened = 0

International Union for Conservation of Nature ⁽²²⁾ - red list = 0

code	name	State of Alaska Wildlife Action Plan species of concern ⁽¹⁾	Partners in Flight ⁽³¹⁾	Audubon Alaska, southeast region ⁽²⁸⁾
AMKE	American Kestrel			suspected decline
AMRE	American Redstart	declining, sentinel species		
ATSP	American Tree Sparrow	declining		population decline
BAEA	Bald Eagle	sentinel species, culturally important stewardship species		
BCCH	Black-capped Chickadee	stewardship species		
BEKI	Belted Kingfisher	declining, AK Landbird Plan list		suspected decline
BRCR	Brown Creeper	sentinel species		yellow list, vulnerable
CBCH	Chestnut-backed Chickadee	declining, stewardship species	under threat *	red list, declining
CORA	Common Raven	stewardship species		
COYE	Common Yellowthroat	declining		
DOWO	Downy Woodpecker	stewardship species		
GCKI	Golden-crowned Kinglet	declining		
HAWO	Hairy Woodpecker	stewardship species		yellow list, vulnerable
HETH	Hermit Thrush	stewardship species		
NOGO	Northern Goshawk			yellow list, vulnerable
OCWA	Orange-crowned Warbler	declining		red list, declining
PAWR	Pacific Wren	declining, AK Landbird Plan list State of the Birds report, stewardship species		
PISI	Pine Siskin	declining, AK Landbird Plan list, State of the Birds report		
PSFL	Pacific-slope Flycatcher	declining, stewardship species		
RBSA	Red-breasted Sapsucker	sentinel species, stewardship species		
RCKI	Ruby-crowned Kinglet	stewardship species		
SPSA	Spotted Sandpiper	declining		
SOGH	Sooty Grouse			red list, declining
STJA	Steller's Jay	stewardship species		
SWTH	Swainson's Thrush	declining		
TOWA	Townsend's Warbler	sentinel species, stewardship species		
VATH	Varied Thrush	State of the Birds report, stewardship species		
WIWA	Wilson's Warbler	declining, AK Landbird Plan list stewardship species		population decline
YEWA	Yellow Warbler	declining		yellow list, vulnerable

* see text for details on threat assessment by Partners in Flight

Objective 3 - Discriminate bird species use of and breeding indications at particular features.

General bird use, comparison among points.

Figure 2 shows count of species found in inner and outer circles over the time period of the main survey. Bars indicate the sum of different species detected, a broad indicator of general attractiveness of the point area to birds. This does not mean that the same composition of species occurred at each point, or between inner and outer circles.

For inner circles, the nearly flat blue line indicates about the same number of different species occurred across the points. A less flat, more wavy pattern can be seen when looking at birds found in the outer circle or at the combination of both circles. Since the orange and yellow lines have the same pattern, the birds recorded within the outer circle area had the most influence on the number of species seen in the combined areas of both circles.

The slightly higher numbers of species found at points 2 and 3 may indicate that those areas have a characteristic that is broadly appealing to many different species, such as generally abundant food sources. There could also be combinations of different characteristics that affect particular species differently, or the always present possibility of random effects to show this result.

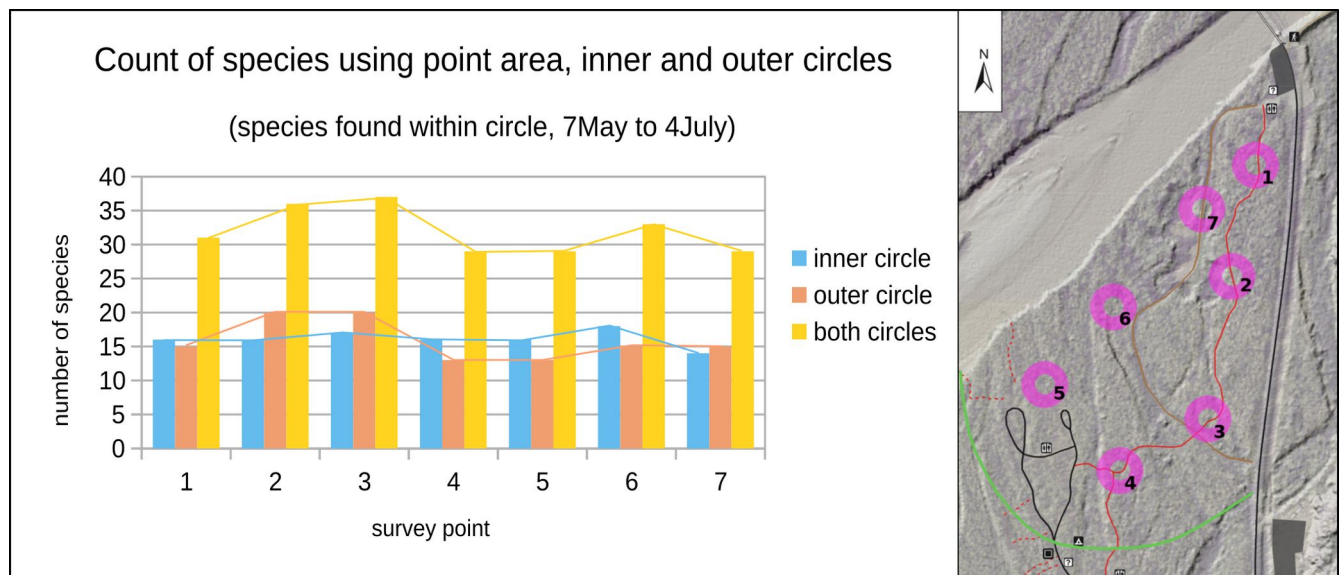


Figure 2. Count of species using point circles; inner, outer and combination.

Figure 3 displays the total numbers of individual birds of any species found within the point circles over the time period of the main survey. In this case, numbers recorded in the inner circles were lowest at points 2 and 3, which shows that although a high variety of species were found there (Figure 2), not that many individuals spent time there during the dawn chorus.

Points 4 and 5 have the highest numbers, indicating that more individual birds spent time using those point areas during the dawn chorus, even though the number of species found there (Figure 2) was low compared to the other points. Since the blue and yellow lines have nearly the same pattern, the birds recorded within the inner circle area had the most influence on the number of individual birds seen in the combined areas of both circles.

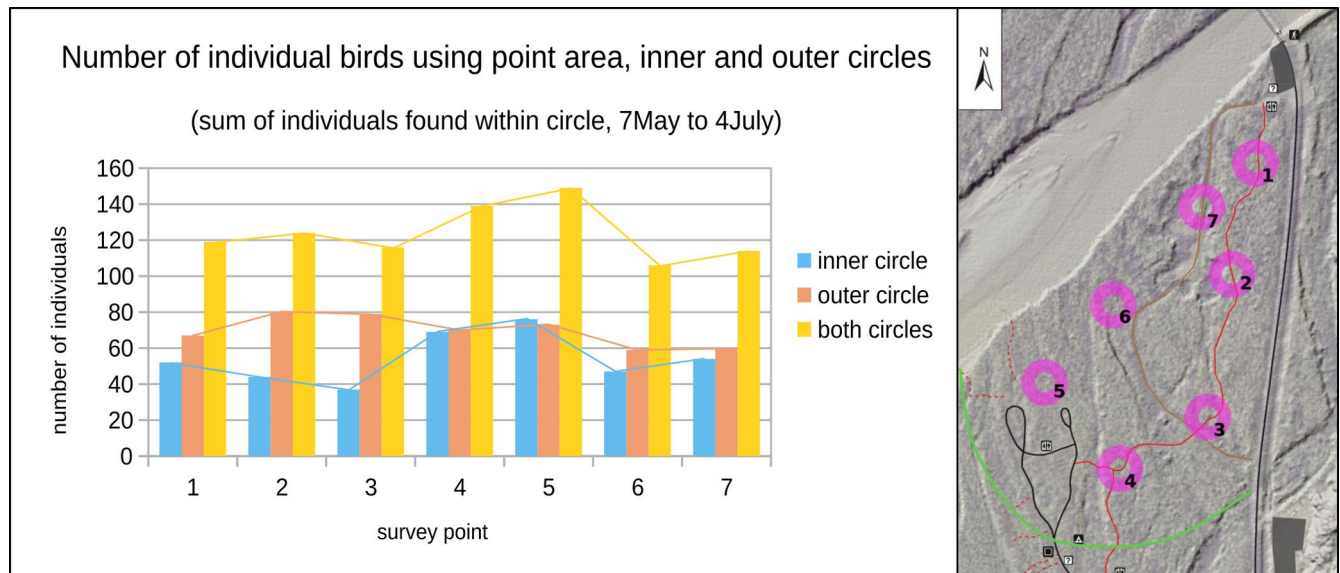


Figure 3. Number of individuals using point circles; inner, outer and combination.



Sooty Grouse hen, seen with chick (not in photo) inside survey site, near camp site #12, not far from point 4, 19 July 2020.

photo: Judy Hall Jacobson (cc) BY-NC ⁽⁸⁾

Breeding indicators, comparison among points.

Species were designated as breeding if found within an inner circle 2 or more times at separate dates. Birds found only once could be nearby breeders, but also could be in the point area for other reasons. Higher confidence of breeding activity associated with the point was achieved by restricting this group to birds found in the same place on more than one date. Figure 4 shows the number of high confidence breeding species at each point over the course of the main survey.

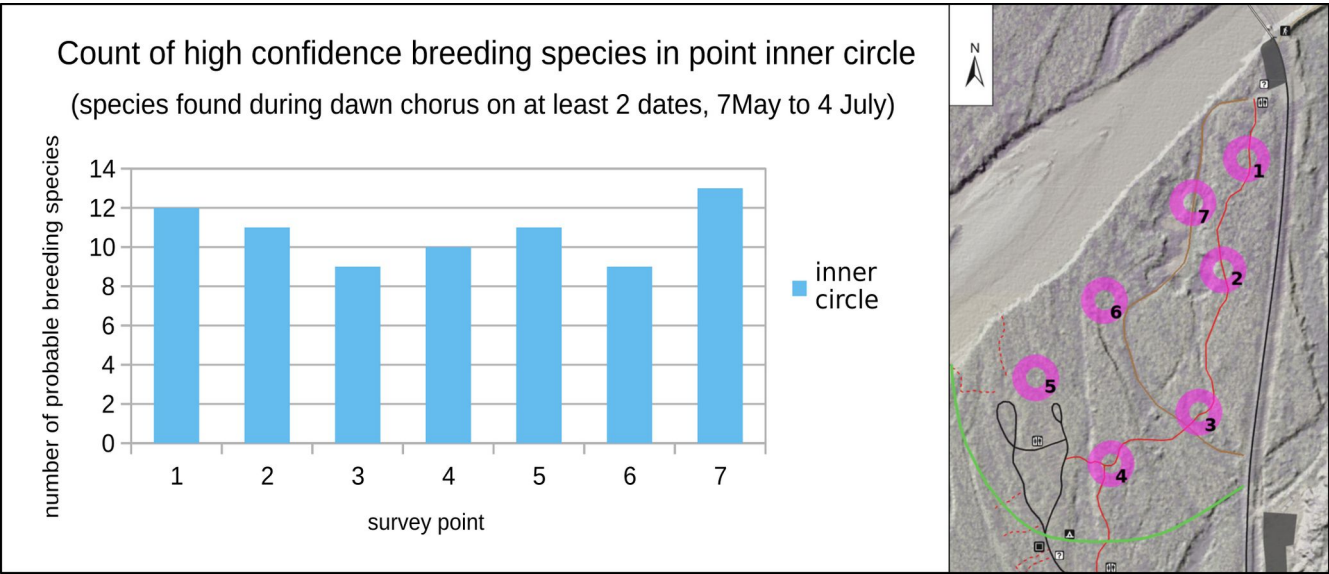


Figure 4. Count of high confidence breeding species by point.

With ranges of 9 to 13 species, every point must be an attractive nesting area to a number of bird species. The highest number of different species was found at point 7. This may be connected with being close to a shallow pond, which gives point 7 a characteristic not found at other points.

Direct observations of breeding behaviors or the presence of chicks or fledglings were added to data on high confidence breeding species from the point circles (Figure 4) to create a list of all likely breeding birds using the survey area.

Our survey found evidence for a total of 28 breeding bird species using the survey site from 23 April to 31 July. Table 3 presents these species by point (within circle or nearby incidental observation), and gives the source of the data.

Immediately following, Table 4 presents characteristics of breeding birds found at the survey site, including habitat preference and nesting type information.

Table 3. List of breeding bird species found at survey site, 23 April to 31 July.

X = birds found at least twice on different dates within inner circle of main surveys
d = direct observations; including pair behaviors, raised crest, nest building, chicks, fledglings
other = within survey site from about 8am to 5pm

code	name	at or near bird point #							direct observation source
		1	2	3	4	5	6	7	
AMDI	American Dipper							d *	main survey
AMRE	American Redstart	X		X	X	X d	d	X	other
AMRO	American Robin	X		X d	X d	X	X	X d	prelim survey, other
BCCH	Black-capped Chickadee			d					main survey
BRCR	Brown Creeper				X d				main survey
CBCH	Chestnut-backed Chickadee		X			X		X	
DEJU	Dark-eyed Junco	X				X d			other
DOWO	Downy Woodpecker				d		d		main survey
GCKI	Golden-crowned Kinglet						X		
HAFL	Hammond's Flycatcher	X	X		X	X	X	X	
HAWO	Hairy Woodpecker							d	prelim survey
HETH	Hermit Thrush	X d	X	X	X	X d		X	other
NOWA	Northern Waterthrush	X	X	X				X	
OCWA	Orange-crowned Warbler	X	X	X	X	X	X	X	
PSFL	Pacific-slope Flycatcher		X						
RBNU	Red-breasted Nuthatch		X						
RBSA	Red-breasted Sapsucker	X			d			X	prelim survey
RCKI	Ruby-crowned Kinglet	X	X			X	d	d	prelim survey
SOGR	Sooty Grouse				d				other
STJA	Steller's Jay			X d					other
SWTH	Swainson's Thrush		d				X d		other
TOWA	Townsend's Warbler		X		X	X	X	X	
VATH	Varied Thrush	d	X		X d	X	d	X d	main survey, other
WAVI	Warbling Vireo				X		X d	X	main survey
WETA	Western Tanager			X					
WIWA	Wilson's Warbler	X	d	X d	d	d	X d	X	other
YEWA	Yellow Warbler		X						
YRWA	Yellow-rumped Warbler	X	X	X	X	X	X	X	

* Newly fledged American Dipper with an active adult seen in branches of horizontal alder overhanging river. While there are no appropriate nesting locations within the site, dippers are included here because the nest must be very close to see a new fledgling barely able to fly. The closest potential nesting site is under the Taiya River bridge.

Table 4. Characteristics of breeding birds found at survey site, 23 April to 31 July.

CODE Common name	migrant	edge use	interior use	attracted to water	nest type	nest location	nest position
AMDI American Dipper	no	high	minimal	exclusive	cup inside woven shell	cliffs, dirt banks, under bridges	6-20 feet above high water
AMRE American Redstart	yes	avoids	prefers	yes	open cup	tree	usually near trunk
AMRO American Robin	yes	uses	some		open cup	tree, structures; ground if necessary	usually on horizontal branches
BCCH Black-capped Chickadee	no	uses	prefers		cavity; natural openings, will excavate, or reuse holes	tree, structures	dead snags or rotten branches
BRCR Brown Creeper	mixed	some	prefers		hammock	tree	behind a loosened flap of bark on a dead or dying tree
CBCH Chestnut-backed Chickadee	no	uses	prefers	yes, along streams	cavity; natural openings, will excavate, or reuse holes	tree	soft rotted trees, stumps, posts, or existing holes
DEJU Dark-eyed Junco	mix	prefers	uses		open cup	ground	under vegetation or other protection
DOWO Downy Woodpecker	no	some	uses		cavity, excavate or reuse holes	tree, usually small diameter deciduous	dead trees or in dead parts of live trees
GCKI Golden-crowned Kinglet	mixed	some	prefers		open cup	tree, prefers conifer	usually close to trunk, protected by overhanging needles
HAFL Hammond's Flycatcher	yes	avoids	prefers		open cup	tree, conifers or deciduous understory	usually on large branch well away from trunk
HAWO Hairy Woodpecker	no	some	uses		cavity	tree, prefers trees with heart rot, living or dead	often in branch or stub not vertical, with entrance hole on the underside
HETH Hermit Thrush	yes	uses	uses	yes, ponds	open cup	ground or low tree	often beneath small conifer trees or shrubs
NOWA Northern Waterthrush	yes	some	uses	yes, swamps, bogs, streams, wetlands	open cup, sometimes protected in hollow	ground	root tangles of fallen trees, vegetation near water, inside streambank nooks
OCWA Orange-crowned Warbler	yes	prefers	uses	yes, riparian	open cup	ground	under vegetation or low in shrubs

CODE Common name	migrant	edge use	interior use	attracted to water	nest type	nest location	nest position
PSFL Pacific-slope Flycatcher	yes	uses	prefers	yes	cavity or protected cup, will reuse holes	tree, cavity, bank, structures	typically 15–20 feet above ground level
RBNU Red-breasted Nuthatch	mixed	some	prefers		cavity; excavate or reuse holes	tree	excavate or reuse existing holes in trees,
RBSA Red-breasted Sapsucker	mixed	uses	uses	yes, riparian	cavity, excavates new every year	tree	in live tree with soft heartwood or dead tree or branch
RCKI Ruby-crowned Kinglet	yes	some	uses		open cup	tree	nest high in trees
SOGR Sooty Grouse	no	prefers	some		open cup	ground	usually under shrubby cover
STJA Steller's Jay	no	uses	uses		open cup	tree, prefers conifer	on horizontal branches close to trunk, high or low
SWTH Swainson's Thrush	yes	some	prefers	yes, streams	open cup	tree in understory	3-10 feet off ground in shady forest
TOWA Townsend's Warbler	yes	avoids	prefers		open cup	tree, prefers tall conifer	on a main limb at an average height of 36 feet
VATH Varied Thrush	mixed	avoids	prefers		open cup	tree, usually conifer in understory	about 10 feet off ground and close to the trunk
WAVI Warbling Vireo	yes	uses	uses	yes, streams, ponds, marshes	open cup	tree, prefers deciduous, or tall shrubs	in outer portions of trees or shrubs, low to high
WETA Western Tanager	yes	uses	uses	yes, wetlands	open cup	tree in open area of canopy	in relatively open areas of the canopy
WIWA Wilson's Warbler	yes	prefers	avoids	yes, streams	open cup	ground	base of tree sapling, willow stem, flowering plant, dense clump of grass, or log
YEWA Yellow Warbler	yes	prefers	avoids	yes, streams and wetlands	open cup	tree, bush	in vertical fork usually up to about 10 feet high, up to 40 feet.
YRWA Yellow-rumped Warbler	yes	some	uses		open cup	tree, prefers conifer	on horizontal branch of conifer, from 4 to 50 feet

web site sources:

American Ornithological Society ⁽⁵⁾
 Cornell University, All About Birds ⁽⁷⁾
 National Audubon Society ⁽²⁸⁾

publication sources:

Coe ⁽⁶⁾
 McWethy ⁽²⁷⁾
 Marzluff ⁽²⁵⁾

Objective 4 - Describe bird presence within the site in relation to habitat or sub-habitat characteristics.

Point circles.

In order to examine bird species for site-wide habitat or smaller sub-habitat influences, the points were ranked according to one of the major habitat factors known to affect breeding birds: edge effects. For this study, hard edges such as road or river were given the most weight, less abrupt edges such as campground areas were given medium weight, and soft edges that occur at sub-habitat openings in the high canopy were given the least weight. The rankings, along with canopy closure and other descriptions, are given in Table 4.

Special note: point 5 was located at the end of the campground and included parts of 2 campsites. Because of COVID-19 restrictions, the campground was closed or had very reduced use during the survey period. Therefore, the impact of edge effect due to human activity at point 5 was less than normal.

Table 5. Ranking of survey points by degree of edge effect influence.

point #	# nearby edge	distance point center to edge (meter)	direction	edge type	sub-habitat opening, mild edge	points ranked by edge influence, 1=highest	high canopy cottonwood % closed	understory 1° shrubs * density	groundcover 1° plants * density	spruce * islands within or nearby
1	3	65	nw	river	small glade in nw part of circle	1	~50	alder, hb-cranbry ro-dogwood thick	pyrola oakfern very thick	0, a few small trees
		65	north	parklot						
		35	east	road						
2	1	50	east	road		4	~50	alder, hb-cranbry ro-dogwood medium	pyrola oakfern medium	3, all or partly within outer circle
3	1	55	east	road	medium glade in center of circle	3	~40	alder, hb-cranbry ro-dogwood thick	pyrola grass thick	2, nearby at edge of outer circle
4	1	45	west	camp site14		7	~50	alder, hb-cranbry very thick	pyrola oakfern medium	2, large at edge of inner circle
5	2	inside	se	camp site15		2	~60	alder, hb-cranbry sparse	pyrola oakfern thick	loose polygon about 40% of wooded area
		inside	west	camp site18						
6	1	50	nw	river		6	~50	alder, hb-cranbry ro-dogwood medium	pyrola oakfern medium	1, large at edge of inner circle
7	1	60	nw	river	west part of circle over pond	5	~30	alder, willow hb-cranbry mixed-spotty with closed alder tunnel	grass, moss pyrola sedge medium	1, loose island at edge of inner circle

* alder = Sitka alder hb-cranbry = high bush cranberry ro-dogwood = red osier dogwood willow = willow sp.
pyrola = pyrola sp. oakfern = oak fern spruce - Sitka spruce grass, moss, sedge = common usage

see Appendix A for plant common and scientific names

The ranked points in order from highest to least edge features from Table 5 were used to look at particular bird species that have been described as having a preference for edge vs. interior habitat.

Figure 5 displays species occurrence patterns typical of what would be expected if habitat preference was strongly linked to habitat type at the spatial scale of the entire survey site. In other words, these distributions indicate that the bird species' preference for edge vs. interior were associated to the ranked points.

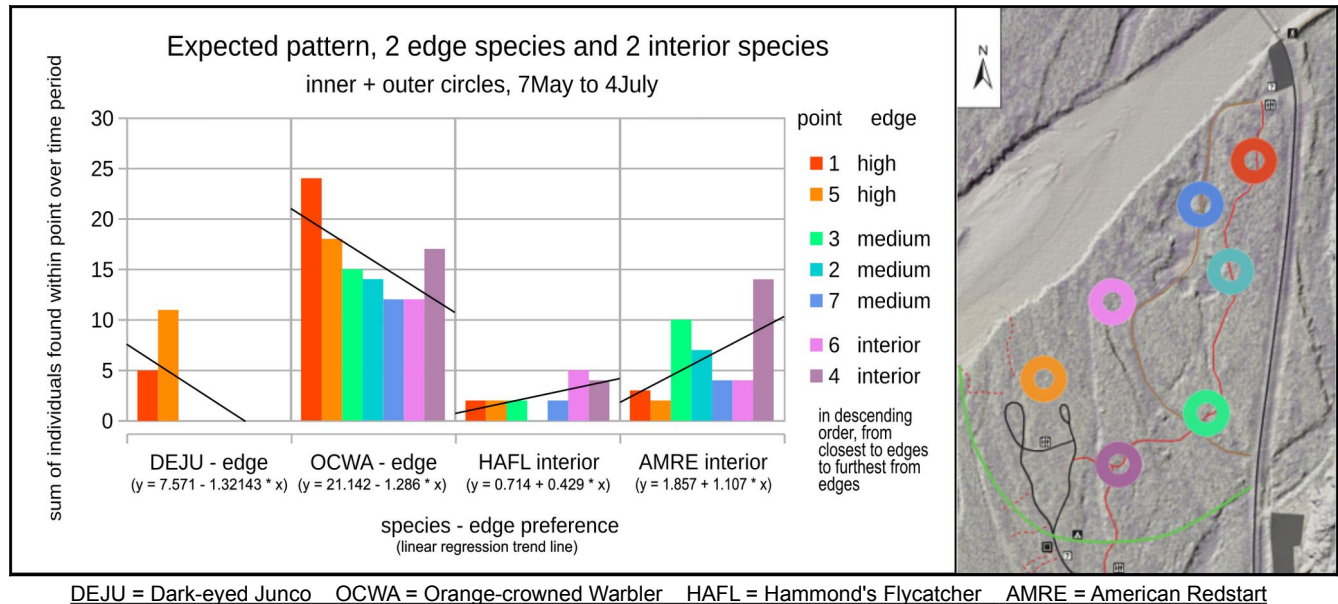


Figure 5. Four species with expected trends if edge habitat and interior habitat operate at site scale.

Species with a preference for edge habitat would be expected to spend more of their time near the edges and less time in the interior. The Dark-eyed Junco showed a strong presence in the 2 points closest to edges, and was not found at all in other points - a very strong effect. The Orange-crowned Warbler was found most at the 2 points closest to edges, and with the exception of point 4, gradually decreased presence at points ranked with lesser edge influence - a consistent effect.

Species with a preference for interior habitat would be expected to show the opposite trend, having a stronger presence in the points furthest from edges. Hammond's Flycatcher shows a mild pattern of interior preference, and American Redstart shows a strong pattern of interior preference.

Not all species showed expected patterns as seen in Figure 5. Unexpected patterns could result if the preference for, or avoidance of, edges for a species operates at a spatial scale substantially larger or smaller than our survey site. In addition, there are many specific habitat characteristics that, if stronger than typical, could overpower the general edge vs. interior habitat preference, such as food density, water access, predator density, parasite loads, suitable nesting sites, within-species and between-species competition. ⁽¹⁷⁾

Figure 6 illustrates some examples of patterns that would not be expected if habitat preference was strongly linked to habitat type at the spatial scale of the survey site.

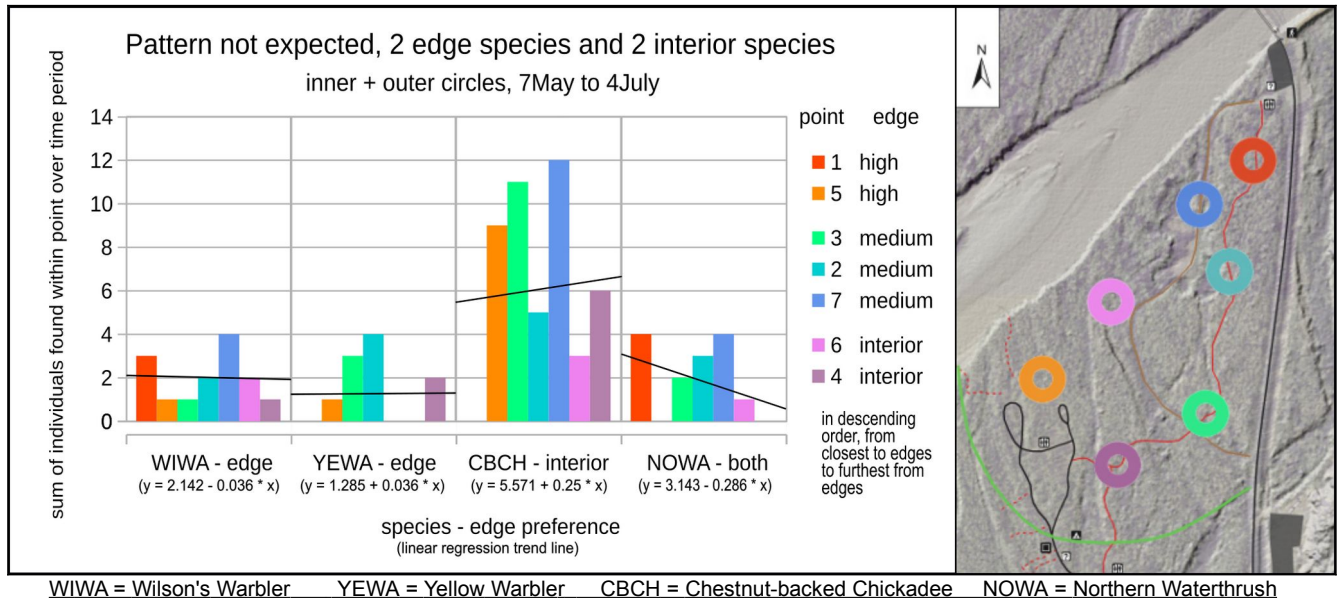


Figure 6. Four species with unexpected trends if edge habitat and interior habitat operate at site scale.

Wilson's Warbler and Yellow Warbler are both described as having a preference for edge habitat. (Table 4) Yet both species show a flat trend pattern in our survey, indicating no consistent preference based solely on edge habitat at the scale of the entire survey site. The Yellow Warbler was reported to have nesting territories of about 17 meters radius ⁽¹⁹⁾ and Wilson's Warbler of about 40 meters radius ⁽³³⁾. Therefore, the apparent lack of habitat preference is not due to a mismatch between the survey site size and the birds' breeding territory size.

Other influences could be operating, such as an unusually high presence of nest predators near the perimeter of the survey site keeping these birds from using their most preferred habitat. A breeding pair of Steller's Jays was detected in the vicinity of point 3 (Table 3). Wilson's Warbler also has an attraction to habitats with water, and the highest numbers of individuals were seen at points 1, 7, 2 and 6, which are the points nearest to the ponds.

The Chestnut-backed Chickadee shows an ascending trend, as would be expected from a species that prefers interior habitat. It was not found at all in point 1, the point with the highest proximity to edges, which fits with edge avoidance. However, if point 1 is not included, the trend line across the other points is the reverse of what would be expected, indicating other factors are influencing these birds besides distance from edges.

The Northern Waterthrush also shows a pattern opposite of what would be expected if preference for interior habitat at the scale of the survey site was the principal factor. Northern Waterthrushes have strong affinity for wet areas with dense ground cover, which is a good description of the sub-habitat in the vicinity of the small ponds at the northeastern end of the survey site. Points 7, 2 and 1 are close to the small ponds.

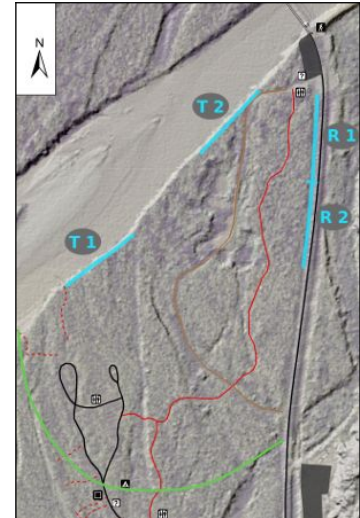
Edge paths.

In addition to bird presence at point/circles, data were collected along paths at two abrupt edges: the Taiya River and Dyea Road. (Table 6)

The number of different bird species found in 10 meter bands along the interior sides of the edge were remarkably similar, with the river paths having 12 and 10 species, and the road paths having 10 and 12 species. Furthermore, out of the total of 16 inner-band species, 10 were found at both river and road paths. These results suggest that birds use the wooded areas approaching the edge similarly, regardless of the presence of river vs. road on the other side.

There were 2 instances of Chestnut-backed Chickadees found in the inner, wooded bands nest to the road. Although this species has a strong preference for interior habitat, it also uses edges for feeding. (Table 4)

The bird species found in the 5 meter bands on the outside of the edge were quite different between the road and river. Three (3) species present in the inner bands were recorded in the outer road bands, whereas 5 species not found in the inner bands were recorded in the outer river bands.



Map 3. Dyea bird survey paths.

Of the outer river species, one songbird water specialist, the American Dipper, was found at both river paths, but more often at the northern path close to the Taiya River bridge. The other river species, Belted Kingfisher, Common Merganser, Mallard, and Spotted Sandpiper, were found at the southern river path closer to the campground and were using gravel/sand shorelines when exposed, or the very near shore waters. A female Mallard and 4 juveniles were later seen dabbling in the deepest pond in the middle of the survey site.



Mallard juveniles, seen dabbling with an adult female and 2 other juveniles, at deepest pond within survey site, 31 July 2020.

photo: C E Furbish (cc) BY ⁽⁸⁾

Table 6. Bird species found along paths, 30 Apr to 2 July.

Number is how many survey sessions (dates) a species was found.

code	name	Taiya River paths				Dyea Road paths			
		T1 - in	T1 - out	T2 - in	T2 - out	R1 - in	R1 - out	R2 - in	R2 - out
AMDI	American Dipper		1		3				
AMRE	American Redstart			1					
AMRO	American Robin	4		4		2	1	2	1
BEKI	Belted Kingfisher		2						
CBCH	Chestnut-backed Chickadee					1		1	
COME	Common Merganser		1						
DEJU	Dark-eyed Junco	1				1	2	2	
DOWO	Downy Woodpecker	1							
GCKI	Golden-crowned Kinglet					1			
HAFL	Hammond's Flycatcher	4						1	
HETH	Hermit Thrush	1		2		2	1	1	1
OCWA	Orange-crowned Warbler	5		2		5		2	
MALL	Mallard		1						
RBSA	Red-breasted Sapsucker	1		2				2	
RCKI	Ruby-crowned Kinglet	2		3		1		4	
SPSA	Spotted Sandpiper		1						
STJA	Steller's Jay							1	
TOWA	Townsend's Warbler	2		1				1	
VATH	Varied Thrush	2		3		1		1	
WAVI	Warbling Vireo	1							
WIWA	Wilson's Warbler			2		4			
YRWA	Yellow-rumped Warbler	2		2		3		1	
	<i>number of species</i>	12	5	10	1	10	3	12	2
species not recorded elsewhere during preliminary or main survey sessions									
AMDI	American Dipper		1		3				
BEKI	Belted Kingfisher		2						
COME	Common Merganser		1						
MALL	Mallard		1						
SPSA	Spotted Sandpiper		1						

SUMMARY DISCUSSION

Forty-four (44) species of birds were documented using the survey site. Species ranged from large-territory predators such as Northern Goshawk and Common Raven sweeping through for a possible meal, to breeding songbirds that set up small nesting territories within the site and produced young without leaving the site.

No federal or state threatened or endangered birds were found. Twenty-nine (29) species were listed as species of concern by the State of Alaska or non-governmental conservation organizations. The Chestnut-backed Chickadee was listed as *under threat* with high vulnerability for decline by Partners in Flight.

The two most numerous birds were American Robin and Orange-crowned Warbler, gregarious breeding songbirds adapted to habitat edges and human disturbance. A total of 28 breeding birds used the site, the majority of them species that have established associations with a particular habitat type. The dominant bird habitats found at the site were forest/woodland interior habitat and woodland edge habitat. Habitat categories serve as a generalization of beneficial and detrimental characteristics such as physical structure, food sources, nesting sites, predator density, parasite load, and competition.

In this survey, some woodland interior species, such as Hammond's Flycatcher and American Redstart, were found more often at points with the strongest interior character, as expected. Some species known to be attracted to edges, such as Dark-eyed Junco and Orange-crowned Warbler, were found more at points closest to edges, as expected. For both types of habitat-preference species, the survey site matched the scale and quality of their habitat preference, and specific detrimental factors were not strong enough to prevent their use of their preferred habitat.

Other species known to have a preference for woodland edges were found throughout the site, without a discernible association to edges. This may indicate that these birds, such as Wilson's Warbler and Yellow Warbler, experience the survey site as if it were a single, large edge. Both species' breeding territories matched the scale of the survey site. These birds could also have been affected by additional factors, such as unusually high predator density pushing them away from site edges, or water features attracting them to the interior.

People can detect the immediate physical effects of edges upon a woodland when they walk from a hot or windy open area into the woods and experience the cooler, calmer conditions under the trees. Measurable changes to temperature, humidity and wind speed occur along a gradient to the interior, and can extend up to 3 times the canopy height in from the edge. ⁽²⁶⁾ From this perspective, the entire survey site is affected to some degree by existing edges.

The complex vegetative structure of the survey site provides numerous attractive features for breeding birds of all kinds, with plentiful shelter and food, especially the insects many birds prefer to feed chicks. Among the breeding birds found at our site, 7 species need or prefer cavities in trees to nest, and the site has abundant standing dead trees used for cavity nesting and for drumming. There are also mixed age-class trees that would include some with heart rot, which makes them good cavity trees.

Five (5) species that prefer to nest in conifer trees were found, and the site has ample scattered spruce islands. Six (6) ground nesting species that need dense cover at ground level were found, and the site has thick forb patches and tangles of downed live and dead shrubs. Twelve (12) species that prefer to be near water or wetlands were found, and the site has a number of small ponds and swales.

There are also features detrimental to nesting birds at the site. Nest predation can cause up to 78% of nest failures in the coastal forests of southeast Alaska. ⁽³⁸⁾ Red squirrels were found to be a dominant nest predator of songbirds in forest stands of similar size to the survey site, with no difference between level of predation near edges and in the interior. ⁽²⁾ Steller's Jays spend up to 95% of their foraging time within 50 meters of edges. ⁽³⁶⁾

Habitat fragmentation can increase predation pressure directly by providing human-associated food to nest predators, or indirectly by removing higher-level predators, such as hawks, marten, fishers or coyotes, that would normally keep nest predators, such as red squirrels and mice, in check. ^(2, 3, 24) Physical changes near edges, such as temperature, wind and humidity, can simply make those areas less comfortable for some birds. ⁽²⁷⁾

Consolidating the information above, the survey site has characteristics associated with edge habitat throughout the site, while the interior of the site does not have full interior character. In larger woodland stands, bird species variety is often higher near edges than in the interior.⁽³⁴⁾ But when stand size gets too small, edge effects increase and bird variety falls as interior-preference species can be displaced from the stand.⁽²⁴⁾ The presence of birds described as preferring edge habitat throughout the site, and the evidence for edge effects within the interior of the site, could indicate that interior-preference birds at this site may be susceptible to habitat changes that increase edges in relation to the interior.

In addition to habitat characteristics within the survey site, the edge interface itself may function to encourage or discourage species diversity. The two abrupt edges, Taiya River and Dyea Road, had similar assemblages of birds using the wooded side of the edge. The road edge did not contribute to species diversity. On the outer side of the road edge, only a few birds with a presence in the woods ventured out to forage in the road shoulder.

The river side outer edge, though, had the opposite influence by attracting species not seen otherwise during the surveys. American Dippers were seen several times at the river's edge. A newly fledged American Dipper being tended by an adult was seen in a fallen alder at the river berm, indicating a nesting site nearby, perhaps under the bridge. Another species, the Mallard duck, was recorded at the river edge, and later a female Mallard with 4 juveniles was found dabbling in the deepest interior pond.

Finally, one species deserves special mention. The Red-breasted Sapsucker is a “double” keystone species. Keystone species modify their habitat in ways that benefit a number of other species. Red-breasted Sapsuckers make this kind of habitat modification not just once, but twice. First, the sap holes they create to feed themselves also provide food to warblers, hummingbirds, red squirrels and bees.⁽³²⁾ Second, they make new nest cavities at least once a year, sometimes more than once per season.⁽²³⁾ Their abandoned nest holes are used by chickadees, small owls, flying squirrels, and even bats.⁽³²⁾ Occasionally their sap holes may contribute to tree death, which at a low level helps keep the canopy from closing and provides dead snags as food and shelter sources for other animals.

During the first preliminary survey session on 23 April, at least 9 sapsuckers were active within the site, with the calling and constant overlapping drumming indicators that breeding territories were being negotiated. Counts were collected differently during the first preliminary survey session, therefore could not be directly compared to later surveys. However, the 23 April observations show that sapsuckers considered the site valuable for nesting.

Our main survey, using methods that focused on specific point areas, found evidence of nearby sapsucker nesting in 3 out of the 7 points. Red-breasted Sapsuckers defend territories from 12 to 45 meters around a nest,⁽¹⁵⁾ and use feeding territories from about 100-150 meters up to 15 acres that can overlap.^(7, 32) Therefore, it is quite plausible that up to 6 to 8 sapsucker pairs nested within the survey site, providing enhanced food sources and prime nesting cavities for a number of other birds, including the Chestnut-backed Chickadee.



Red-breasted Sapsucker checking sap holes, Skagway, Alaska, 15 June 2020.

photo: Kim Burnham (c) with permission

BIBLIOGRAPHY

1. Alaska Department of Fish and Game. 2015. "Alaska Wildlife Action Plan" Juneau
2. Bayne, E. M. and K. A. Hobson. 2002. "Effects of red squirrel (*Tamiasciurus hudsonicus*) removal on survival of artificial songbird nests in boreal forest fragments." *American Midland Naturalist*, 147:72–79.
3. Chalfoun, A. D., et al. 2002. "Nest predators and fragmentation: a review and meta-analysis." *Conservation Biology*, 16:306–318.
4. Chalfoun, A. D. and K. A. Schmidt. 2012. "Adaptive breeding-habitat selection: is it for the birds?" *The Auk*, Volume 129, Issue 4, 1 October 2012, pp. 589–599.
5. Chesser, R. T. et al. 2020. "Sixty-first Supplement to the American Ornithological Society's check-list of North American Birds" *The Auk*, vol.137 issue.3 ukaa030. <https://doi.org/10.1093/auk/ukaa030> accessed 2020
6. Coe, F. C. 2014. "Cavity-nesting birds and small woodlands" Woodland Fish and Wildlife Project, Washington State University Cooperative Extension, Oregon State University Extension Service and the U.S. Department of Agriculture, www.woodlandfishandwildlife.com accessed 2020.
7. Cornell Lab of Ornithology: All About Birds. <http://www.allaboutbirds.org> accessed 2020.
8. Creative Commons Licenses. <https://creativecommons.org> accessed 2020.
9. Dendroica: An aid to identifying Western Hemisphere birds. <https://www.natureinstruct.org/dendroica> accessed 2020.
10. ECOS - Environmental Conservation Online System. US Fish & Wildlife Service. <https://ecos.fws.gov/ecp/> accessed August 2020.
11. Fink, A. D. et al. 2006. "Songbird use of regenerating forest, glade, and edge habitat types" *Journal of Wildlife Management*, 70(1):180–188.
12. Flagstad I. and T. Boucher. 2015. "Klondike Gold Rush National Historical Park, Landcover Classes and Plant Associations" Natural Resource Report NPS/KLGO/NRR—2015/917. National Park Service, Fort Collins, Colorado.
13. Flaspohler, D. J., S. A. Temple and R. N. Rosenfield. 2001. "Species-specific edge effects on nest success and breeding bird density in a forested landscape." *Ecological Applications*, 11:32–46.
14. Freemark, K. E. and B. Collins. 1992. "Landscape ecology of birds breeding in temperate forest fragments" in *Ecology and Conservation of Neotropical Migrant Landbirds* - J.M. Hagan III and D.W. Johnston, Eds. Smithsonian Institution Press, Washington, D.C. pp. 443–454.
15. Gaines, D. and S. Granholm. 1990. "Red-breasted Sapsucker" California Wildlife Habitat Relationships System, California Depart. of Fish and Game, Sacramento, California. California's Wildlife, Vol. I-III. B299.
16. Gilbert, W. M. et al. 2020. "Orange-crowned Warbler (*Leiothlypis celata*)" version 1.0. In *Birds of the World* (P. G. Rodewald, Editor) Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bow.orcwar.01>
17. Gravel, S. B. and F. DiBello. 2017. "Analysis of potential habitat fragmentation impacts to songbirds and bats associated with the Baron Winds Project, New York." Stantec Consulting Services Inc. file 195600885.
18. Hahn, B.A. and E. D Silverman. 2006. "Social cues facilitate habitat selection: American Redstarts establish breeding territories in response to song." *Biology Letters*, vol. 2,3 (2006): 337-40.
19. Hobson, K. A. and S. G. Sealy. 1990. "Female song in the Yellow Warbler" *The Condor*, 92:259-261.
20. iNaturalist citizen science web portal. California Academy of Sciences and National Geographic Society, <https://www.inaturalist.org/observations> accessed 2020

21. Integrated Taxonomic Information System (ITIS) on-line database. <http://www.itis.gov> accessed 2020
22. IUCN - International Union for Conservation of Nature. 2020. The IUCN Red List of Threatened Species. Version 2020-2. <https://www.iucnredlist.org> accessed August 2020.
23. Joy, J. B. 2000. "Characteristics of nest cavities and nest trees of the Red-Breasted Sapsucker in coastal montane forests" *Journal of Field Ornithology*, 71(3) 525-530.
24. Manuwal, D. et al. 1998. "Managing Forest Habitats for Migrant Songbirds." Woodland Fish and Wildlife Project, Washington State University Cooperative Extension, Oregon State University Extension Service and the U.S. Department of Agriculture, MISCO198.
25. Marzluff, J. M., et al. 2007. "Consequences of habitat utilization by nest predators and breeding songbirds across multiple scales in an urbanizing landscape." *The Condor*, 109:516–534.
26. McCollin, D. 1998. "Forest edges and habitat selection in birds: a functional approach." *Ecography*, 21:247-260.
27. McWethy, D. B., et al. 2009. "Edge effects for songbirds vary with forest productivity." *Forest Ecology and Management*, 257:665–678.
28. National Audubon Society. <https://www.audubon.org> accessed 2020.
29. National Audubon Society. "Merlin" smartphone application <https://www.audubon.org/app> accessed 2020.
30. Rempel, R. S. et al. 2007. "Forest policy scenario analysis: sensitivity of songbird community to changes in forest cover amount and configuration." *Avian Conservation and Ecology*, 2(1): 5.
31. Rosenberg, K. V. et al. 2016. "Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and continental United States" Partners in Flight Science Committee. 119 pp.
32. Squires, K. A. and F. L. Bunnell. 2018. "Early breeders choose differently - Refining measures of habitat quality for the yellow-bellied sapsucker (*Sphyrapicus varius*), a keystone species in the mixed wood boreal forest." *PloS One* vol. 13,9 e0203683.
33. Stewart, R. M. 1973. "Breeding behavior and life history of the Wilson's Warbler". *The Wilson Bulletin*, Point Reyes Bird Observatory, vol. 85, no. 1.
34. Terraube, J., et al. 2016. "Forest edges have high conservation value for bird communities in mosaic landscapes" *Ecology and Evolution*, 6(15): 5178–5189.
35. U.S. Geological Survey, Alaska Landbird Monitoring Survey, www.usgs.gov/centers/asc/science/alaska-landbird-monitoring-survey accessed 2020.
36. Vigallon, S. M and J. M. Marzluff. 2005. "Is nest predation by Steller's Jays (*Cyanocitta stelleri*) incidental or the result of a specialized search strategy?" *The Auk* 122(1): 36-49.
37. Warnock, N. 2017. "The Alaska WatchList 2017" Audubon Alaska, Anchorage, AK 99501.
38. Willson, M. F. and S. M. Gende. 2000 "Nesting success of forest birds in Southeast Alaska and adjacent Canada." *The Condor*, 102:314-325.
39. xeno-canto: Sharing bird sounds from around the world. <https://www.xeno-canto.org> accessed 2020.
40. Yarrow, R. M. 1970. "Changes in Redstart breeding territory" *The Auk* 87:359-361.

Appendix A. Scientific names and common names of plant species.

source for scientific names: ITIS ⁽²¹⁾

common name	scientific name
black cottonwood	<i>Populus balsamifera</i> (L)
grass	<i>Poaceae</i> family
high-bush cranberry	<i>Viburnum edule</i> (Michx.) Raf.
moss	<i>Bryophyta</i> division
oak fern	<i>Gymnocarpium dryopteris</i> (L.) Newman
pyrola sp.	<i>Pyrola</i> species
red-osier dogwood	<i>Cornus sericea</i> ssp. <i>sericea</i> L.
sedge	<i>Carex</i> genus
Sitka alder	<i>Alnus viridis</i> ssp. <i>sinuata</i> (Regel) A. Löve & D. Löve
Sitka spruce	<i>Picea sitchensis</i> (Bong.) Carrière
willow sp.	<i>Salix</i> species

Appendix B. Scientific names, common names, and 4-letter codes of bird species.

source: Chesser ⁽⁵⁾

code	name	scientific name
AMDI	American Dipper	<i>Cinclus mexicanus</i>
AMKE	American Kestrel	<i>Falco sparverius</i>
AMRE	American Redstart	<i>Setophaga ruticilla</i>
AMRO	American Robin	<i>Turdus migratorius</i>
ATSP	American Tree Sparrow	<i>Spizelloides arborea</i>
BAEA	Bald Eagle	<i>Haliaeetus leucocephalus</i>
BCCH	Black-capped Chickadee	<i>Poecile atricapillus</i>
BEKI	Belted Kingfisher	<i>Megaceryle alcyon</i>
BOWA	Bohemian Waxwing	<i>Bombycilla garrulus</i>
BRCR	Brown Creeper	<i>Certhia americana</i>
CBCH	Chestnut-backed Chickadee	<i>Poecile rufescens</i>
CEDW	Cedar Waxwing	<i>Bombycilla cedrorum</i>
COME	Common Merganser	<i>Mergus merganser</i>
CORA	Common Raven	<i>Corvus corax</i>
COYE	Common Yellowthroat	<i>Geothlypis trichas</i>
DEJU	Dark-eyed Junco	<i>Junco hyemalis</i>
DOWO	Downy Woodpecker	<i>Dryobates pubescens</i>
GCKI	Golden-crowned Kinglet	<i>Regulus satrapa</i>
HAFL	Hammond's Flycatcher	<i>Empidonax hammondi</i>
HAWO	Hairy Woodpecker	<i>Dryobates villosus</i>
HETH	Hermit Thrush	<i>Catharus guttatus</i>
LISP	Lincoln's Sparrow	<i>Melospiza lincolnii</i>
MERL	Merlin	<i>Falco columbarius</i>
NOGO	Northern Goshawk	<i>Accipiter gentilis</i>
NOWA	Northern Waterthrush	<i>Parkesia noveboracensis</i>
NOPO	Northern Pygmy-Owl	<i>Glaucidium gnoma</i>
MALL	Mallard	<i>Anas platyrhynchos</i>
OCWA	Orange-crowned Warbler	<i>Leiothlypis celata</i>
PAWR	Pacific Wren	<i>Troglodytes pacificus</i>
PISI	Pine Siskin	<i>Spinus pinus</i>
PSFL	Pacific-slope Flycatcher	<i>Empidonax difficilis</i>
RBNU	Red-breasted Nuthatch	<i>Sitta canadensis</i>
RBSA	Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>

code	name	scientific name
RCKI	Ruby-crowned Kinglet	<i>Regulus calendula</i>
SSHA	Sharp-shinned Hawk	<i>Accipiter striatus</i>
SPGR	Spruce Grouse	<i>Falcapennis canadensis</i>
SPSA	Spotted Sandpiper	<i>Actitis macularius</i>
SOGR	Sooty Grouse	<i>Dendragapus fuliginosus</i>
STJA	Steller's Jay	<i>Cyanocitta stelleri</i>
SWTH	Swainson's Thrush	<i>Catharus ustulatus</i>
TOWA	Townsend's Warbler	<i>Setophaga townsendi</i>
VATH	Varied Thrush	<i>Ixoreus naevius</i>
WAVI	Warbling Vireo	<i>Vireo gilvus</i>
WETA	Western Tanager	<i>Piranga ludoviciana</i>
WISN	Wison's Snipe	<i>Gallinago delicata</i>
WIWA	Wilson's Warbler	<i>Cardellina pusilla</i>
YEWA	Yellow Warbler	<i>Setophaga petechia</i>
YRWA	Yellow-rumped Warbler	<i>Setophaga coronata</i>

Dyea park-camp bird survey Date: 2020 Observer: _____ page _____ of _____

Weather, other conditions, etc:

[illegible]

R (road path)
edge is treeline: in = wooded
out = mowed road shoulder

behavior notes:

Other notes: