AN ASSESSMENT OF PERCH USE AND POSSIBLE IMPACTS OF PROPOSED HAINES HIGHWAY REALIGNMENTS ON BALD EAGLES DURING FALL AND WINTER, CHILKAT RIVER, ALASKA

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FINAL REPORT

Prepared for

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INTRODUCTION

The State of Alaska Department of Transportation and Public Facilities (DOT&PF) in partnership with the Federal Highway Administration (FHWA) has proposed to improve sections of the Haines Highway between MP 3.5 and MP 25.3. In accordance with the National Environmental Policy Act (NEPA), an Environmental Assessment was prepared (FHWA/ DOT&PF 2013). Numerous comments on the Haines Highway Environmental Assessment (EA) expressed concerns about the potential effects of highway improvements on Bald Eagles (*Haliaeetus leucocephalus*), including loss of roosting/feeding trees, impacts on wetland and salmon habitat, and increased vehicular collisions with Bald Eagles due to greater highway speeds. Importantly, most of the proposed highway modifications lie within the existing DOT&PF Right of Way (ROW) and adjacent to the Chilkat Bald Eagle Preserve (see Hansen et al. 1984, FHWA/DOT&PF 2013) and will receive more scrutiny and require more oversight than most highway modifications in Alaska.

ABR was contracted to assist DOT&PF in investigating these issues and to better describe roosting and perching habitats within the Haines Highway corridor that may be affected by the project. Highway sections where the most common perch trees (riparian black cottonwood [*Populus balsamifera*]) occurred and Bald Eagles have been known to congregate (Council Grounds) were emphasized. Objectives included determining the level of impacts the project might have on these resources, as well as offering recommendations for design modifications to offset potential impacts. To address these objectives, a number of field tasks and library synthesis tasks were initiated:

1. Weekly road surveys were conducted to assess the use of the road corridor by Bald Eagles for perching and roosting during fall and early winter 2013;
2. Locations of specific perches used by Bald Eagles were mapped in those areas proposed for road widening and construction to help evaluate potential impacts of road construction activities on Bald Eagles; and
3. Historic information on Bald Eagles along the Haines Highway (particularly in the Council Grounds region) was synthesized to help with this assessment. This assessment included gathering information on winter distribution and abundance, perching habitat, communal roosts, and vehicle collisions.

This report emphasizes data collected during fall and early winter 2013 surveys and a synthesis of other pertinent unpublished reports and publications. This report does not, however, include information on Bald Eagle nests or any assessment of Bald Eagle use of the project area during the nesting season.

STUDY AREA

The study area comprised the Haines Highway Road corridor between MP 4 and MP 25. Researchers recorded observations occurring within 150 ft of the existing centerline for the road surveys and within a 300 ft right-of-way (ROW) of the existing road and all potential realignments for the perch surveys. Some observations (i.e., index counts) were made within broader sections of the Chilkat River and Klehini River floodplains (Figure 1). The entire area lies within the Northern Coast Mountain Ecoregion (Nowacki et al. 2001) and has been described elsewhere (e.g., Hansen et al. 1984, DOT&PF 2013). Primary habitat and ecological features as they relate to use by Bald Eagles are the region's broad riparian floodplains and associated riverine features (e.g., glacial melt, warmer upwellings) and salmon resources. In particular, a number of seasonal runs of Chum (*Oncorhynchus keta*) and Coho (*Oncorhynchus kisutch*) salmon are critical to local breeding and wintering Bald Eagles, whose numbers have exceeded 3,000 individuals during the late fall–winter period (Hansen et al. 1984). Large trees, including stands of black cottonwoods on the valley floor and Sitka spruce (*Picea sitchensis*) and western hemlock (*Tsuga heterophylla*) on associated uplands (Hansen et al. 1984), provide substrates for nesting, communal roosting, and perches for resting and foraging.

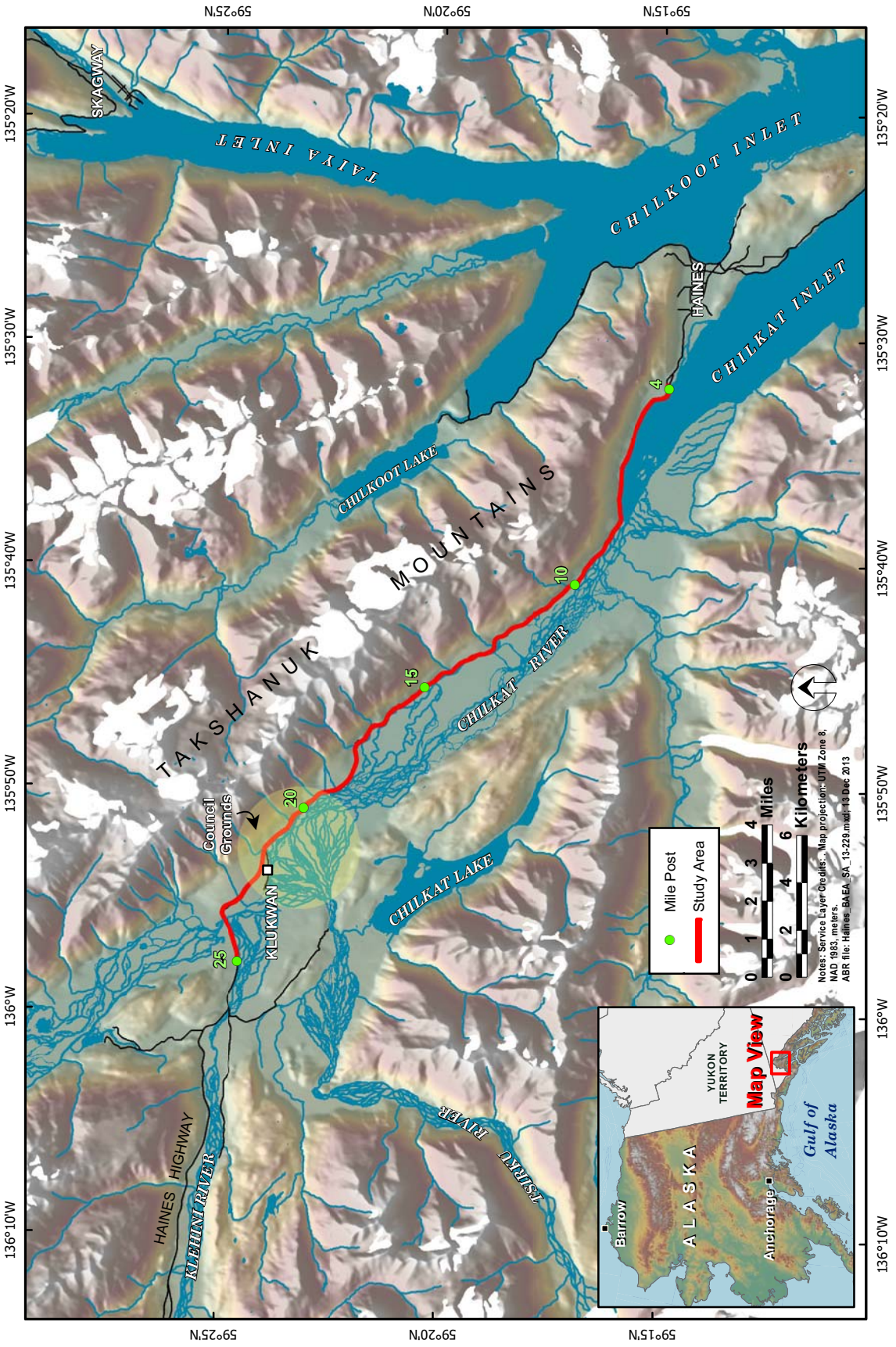

Figure 1. Haines Highway-Bald Eagle Study Area, MP 4-25, along the Chilkat River, Alaska, 2013.

METHODS

FIELD SURVEYS

Field assessments began with a reconnaissance visit (15–18 October 2013) to identify potential study areas within the proposed Haines Highway ROW where counts of Bald Eagles could be made safely within the confines of the highway corridor. Regular surveys were then conducted from 16 October through 5 December to assess use of the study area during the fall and early winter of 2013 and to identify roosting and foraging/resting perches within areas of proposed construction activity (i.e., tree removal). The study area also was visited on 16 December for a late season count of Bald Eagles. Three primary types of replicate surveys were undertaken to enumerate Bald Eagles and to identify perches and evaluate habitat use by Bald Eagles in study area in 2013: Road Censuses, Index Site Counts, and Perch Survey Zone counts and mapping (within areas proposed for modification during proposed highway construction; Figure 2). The schedule for all field surveys is summarized in Table 1.

ROAD CENSUSES

To monitor relative use of sections of the Haines corridor by Bald Eagles in fall and early winter 2013 as a measure of abundance and relative use of the corridor, ABR conducted weekly (i.e., every 7–10 days) Road Censuses of Bald Eagles along the highway 16 October–5 December 2013. Beginning at milepost (MP) 4 and ending at MP 25, a single observer counted all Bald Eagles that were perched within 150 ft of both sides of the existing highway centerline from a vehicle (Figure 2). A driver accompanied the observer and drove 30–35 mph. All Bald Eagles were tallied (regardless of age or location) along each MP or mile section (e.g., MP 4–5, 5–6, etc.). After each MP section was surveyed, observations were entered on a Road Census data sheet.

INDEX SITE COUNTS

Bald Eagle distribution in the Chilkat Valley can show substantial interannual and seasonal changes as the fall and winter seasons progress (e.g., Waste 1985; Hansen et al. 1984; S. Lewis, USFWS, unpubl. data). Therefore, to help us compare our estimates of numbers to historic counts and patterns of use, we attempted to describe the relative abundance and distribution of eagles in the region from specific observation points (Index Sites) during the survey period. Data were gathered weekly from 4 distinct Index Sites between MP 4 and MP 32 of the Haines Highway: Site 1, Middle Klehini River (MP 30); Site 2, Lower Klehini River (MP 26.1), Site 3, Council Grounds (MP20.1), and Site 4, Lower Chilkat River (MP 9) (Figure 2).

The Index Sites were selected to count Bald Eagles along relatively distinctive sections of the Chilkat-Klehini watershed, and because they have been used for this purpose in earlier studies (Hansen et al. 1984, Waste 1985, Randles 2009). Each Index Site allowed for a wide-ranging (>240 degree) view of an extensive reach of the watershed including both shorelines of the main river and associated gravel bars, perches, and sloughs. All Bald Eagles within ~1 mile of the observer were counted at Index Sites primarily using 10 × 40-power binoculars; a Kowa 20–60-power spotting scope also was available should light conditions require more magnification. Eagles were counted and classified as adult (white-headed, 4–5 years) or subadult (brown-headed). Their position in the index area also was noted (i.e., perched on gravel bars/river plains, perched in forest on the far side of river, or perched on shoreline and forested area proximal to the observer). We surveyed all Index Sites during the same day and at least once every 7–10 days. In addition to information on Bald Eagle numbers, weather variables also were recorded at the start of all surveys (e.g., temperature, wind speed and direction, precipitation status, and visibility).

PERCH SURVEY ZONE COUNTS AND MAPPING

The DOT&PF has proposed to improve segments of the Haines Highway from approximately MP 4–25 by widening and or realigning it within their ROW. To assess use of and relative value of specific areas for daytime perching by Bald Eagles, we conducted weekly counts within 19 preselected Perch Survey Zones of varying length (Figure 2). Perch Survey Zones were areas where potential perch trees or cliff perches might be modified or removed during construction as depicted on aerial photographs of

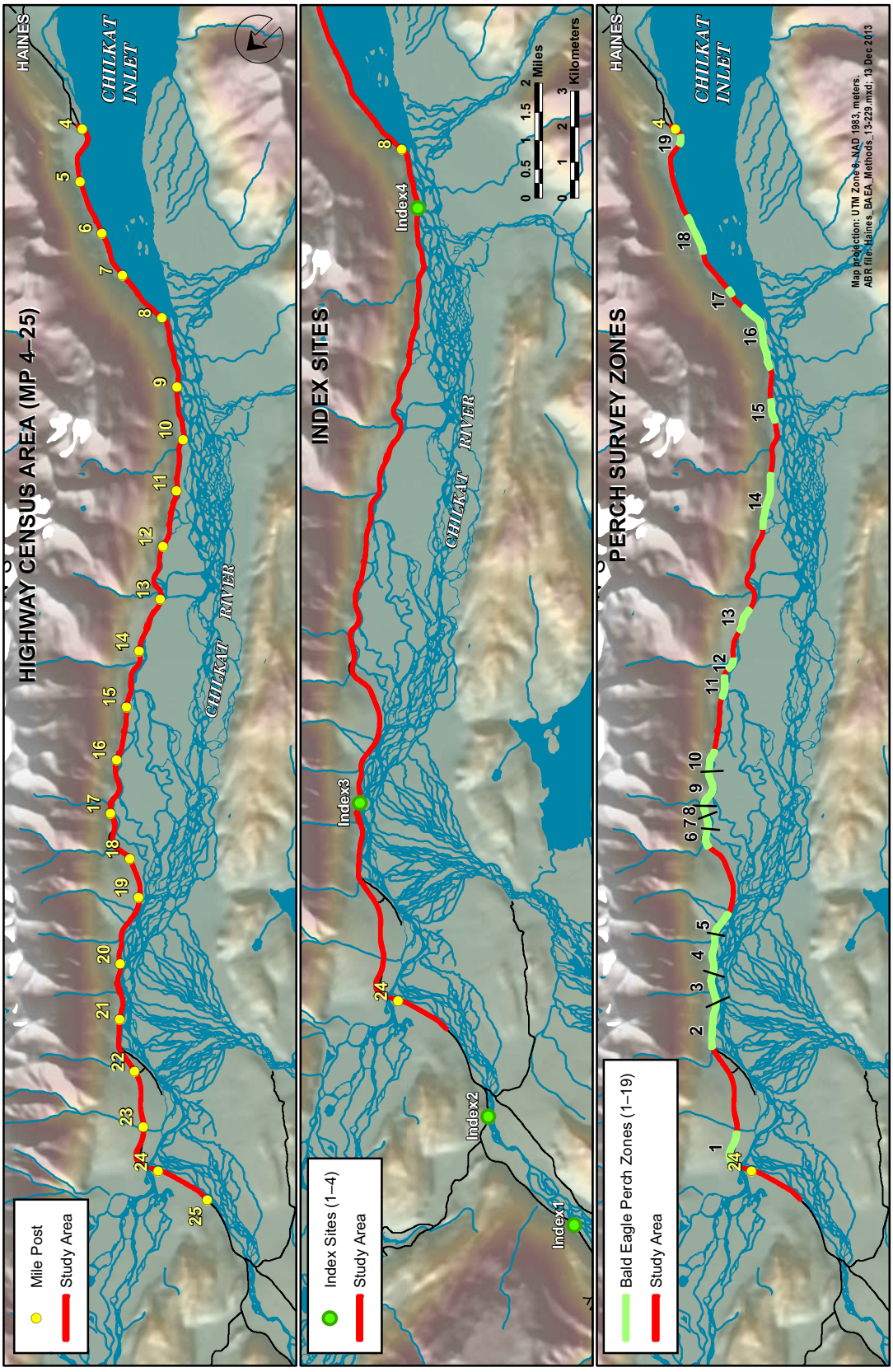

Figure 2. Special study area components for each of 3 primary survey protocols: Highway Census, Index Sites, and Perch Survey Zones, Haines Highway Study Area along the Chilkat River, Alaska, 2013.

Table 1. Survey type, schedules, and approximate durations of Bald Eagle surveys along the Haines Highway, Chilkat River, Alaska, 2013.

	Survey Type and Duration		
Date	Road Censuses	Index Site Counts*	Perch Survey Zones*
16 Oct 13	0810–0850	no survey	0930–1015
17 Oct 13	no survey	0845–1250	1040–1345
26 Oct 13	1330–1430	1455–1606	no survey
1 Nov 13	1330–1435	1455–1640	1600–1523
7 Nov 13	0832–1011	1022–1355	1055–1438
13 Nov 13	0906–0956	1003–1259	1040–1323
20 Nov 13	1010–1125	1015–1130	1215–1415
27 Nov 13	0900–1000	1015–1348	1040–1355
5 Dec 13	0900–1000	0950–1300	1035–1218
16 Dec 13	no survey	1145–1400	no survey

* Survey times for Index and Perch surveys can overlap if one survey delayed completion of tasks of another survey.

the study area (dated 29 October 2013, prepared by DOWL HKM). Areas without suitable perches were generally excluded from our selections (e.g., wet meadow, brushy areas) and were not included in these surveys.

Within each Perch Survey Zone, we counted and classified all Bald Eagles as adult or subadult, and mapped specific locations of eagles within 150 feet of the proposed centerlines in construction zones. Several small areas of shoreline >150–200 ft from the centerline within Zones 2–5 also were searched consistently during every survey. The proposed centerline and the 150 ft boundary or extent of our survey area were shown on high resolution (i.e., 1 pixel = 1.5 ft), aerial color ortho photo-mosaic imagery for the area (aerial photography by Aeromap in 2006). We also established a priority system for our surveys: wooded areas in the Council Grounds region (Chilkat River at ~MP 21.5 to ~MP 19.4, Perch Survey Zones 2–5; Figure 2) were considered highest priority because this area is known to have the highest concentration of Bald Eagles. The entire area between MP 19.4 and 21.5 was included in these high priority Perch Survey Zones. Lower priority zones included all other Perch Survey Zones outside the Council Grounds (i.e., Perch Survey Zones 1 and 6–19; Figure 2) and these were selected because proposed re-alignments might include removing potential perch areas.

For all Bald Eagles observed in Perch Survey Zones, the observer marked each location as precisely as he/she could on a set of high resolution, color aerial photo imagery for the area. High resolution photography allowed the recorder to distinguish unique features of the study areas often including individual or small copses of trees. Numerous physical features such as openings in tree stands, boundaries of gravel and paved turnouts, individual whorls of trees, and small creeks helped to orient the recorder and allow more precision in mapping. A unique number was assigned to each perch location and data compiled on data sheets for each perch location included the number and age of the perched eagles, perch platform (river bar, tree [species], cliff, highway), and estimated size of the tree. Four tree size classes were used: pole (<6 inches Diameter at Breast Height [DBH]), small timber (6–12 in DBH), large timber (12–24 in DBH), and very large timber (>24 in DBH). The observer gathered data on any eagles perched on the highway or crossing the highway at or below vehicle height (<10 ft) (e.g., location, behavior, estimated flight elevation).

For the Council Grounds region, a single observer parked his/her vehicle midway in the area (~MP 20.1) and walked along the foot trail or along the edge of the road, always aware of traffic and road conditions. The observer was accompanied by a driver for surveys within the other Perch Survey Zones (i.e., zones 1 and 6–19), and during these surveys suitable habitat was searched for eagles from specific observation points and/or from the vehicle slowly driving (~30 mph) through the zone counting and aging Bald Eagles and mapping their locations. A flashing light, placed on top of the vehicle, was used to alert other drivers of the vehicle's slow speed. Protocol also specified that the observer would mark any specific locations (perches) with 3 or more Bald Eagles outside the designated Perch Survey Zones (e.g., marked on the same imagery). Weather variables were also collected at the start of all surveys (e.g., temperature, wind speed and direction, precipitation status, and visibility) and if weather changed during the survey, time and types of changes were noted on Perch Survey Zone data sheets. Finally, an alarm was set on a small, mobile GPS unit, which alerted the observer to the beginning and end of each Perch Survey Zone.

All Bald Eagle locations within Perch Survey Zones were digitized after the field season using ArcMap v. 10.2 software. To determine relative densities of Bald Eagles using the study area, we overlaid a 10 × 10-m grid (GIS layer) over a map of Perch Zones 2–5 (i.e., Council Grounds). For each grid-cell, we calculated the area in the study area that was developed (i.e., roadway, parking lots), water (river or streams), or land (all undeveloped, generally forested habitat including areas that may be altered during road construction). We then calculated the number of adult, subadult, and total eagles in each grid-cell for each survey. For each grid-cell, we calculated the mean density of eagles in forested habitat per survey (total eagles/[area of habitat × number of surveys]), the total number of eagles observed on any one survey, and the number of surveys with eagles present (0–8). These variables were used as indicators of typical use, peak use, and consistency of use during the study period.

COMMUNAL ROOST RECONNAISANCE

Although identification of communal roost sites outside the road corridor study area was not a specific objective of our surveys, we were prepared to describe Bald Eagle movements from the study area while we were engaged in other surveys. We also made 2 specific efforts to monitor movements to or from historic roosting locations. Before dusk on 19 and 20 November, with the onset of relatively cold and stormy weather predicted, we tried to record movements of Bald Eagles departing from the Council Grounds to conifer wooded slopes southwest of the Council Grounds. These areas had been identified as communal roost sites for Bald Eagles during inclement weather in the 1980s (Figure 3; Hansen et al. 1985; A. Hansen, pers. comm.). Observers scanned areas using 10 × 40 power binoculars and watched for departures of Bald Eagles from their perches along the Chilkat River. Observations were made primarily from MP 20.5 and steep banks at MP 19.4 (~1400–1600 h), as well as at other locations in the same area during drives through the Council Grounds area on those evenings.

In addition, limited observations of night roosting Bald Eagles along the highway between MP 21 and 20 were made using night vision goggles (NVG) on the evening of 19 November and morning of 20 November. A small number of perched eagles were identified after dusk by driving along the highway and finding them silhouetted in cottonwoods along the shoreline of the Chilkat River; locations were established in relationship to good trail and highway access (e.g., pullouts). The observer returned approximately 1 h after dark (19 November) and 1 h before sunrise (20 November) to relocate eagles at these perch trees.

Finally, we supplemented the results of these reconnaissance surveys with information from a cooperative study on Bald Eagles in the Chilkat Valley being undertaken by the USFWS and the University of California at Santa Cruz (S. Lewis, USFWS pers. comm; R. Wheat, UCSC, pers. comm). In 2012, scientists radio-tagged 5 Bald Eagles in the Chilkat region and in 2013 captured and tagged another 9 Bald Eagles (S. Lewis, USFWS, pers. comm.; R. Wheat, UCSC, pers. comm.). Only general location/time of day/date

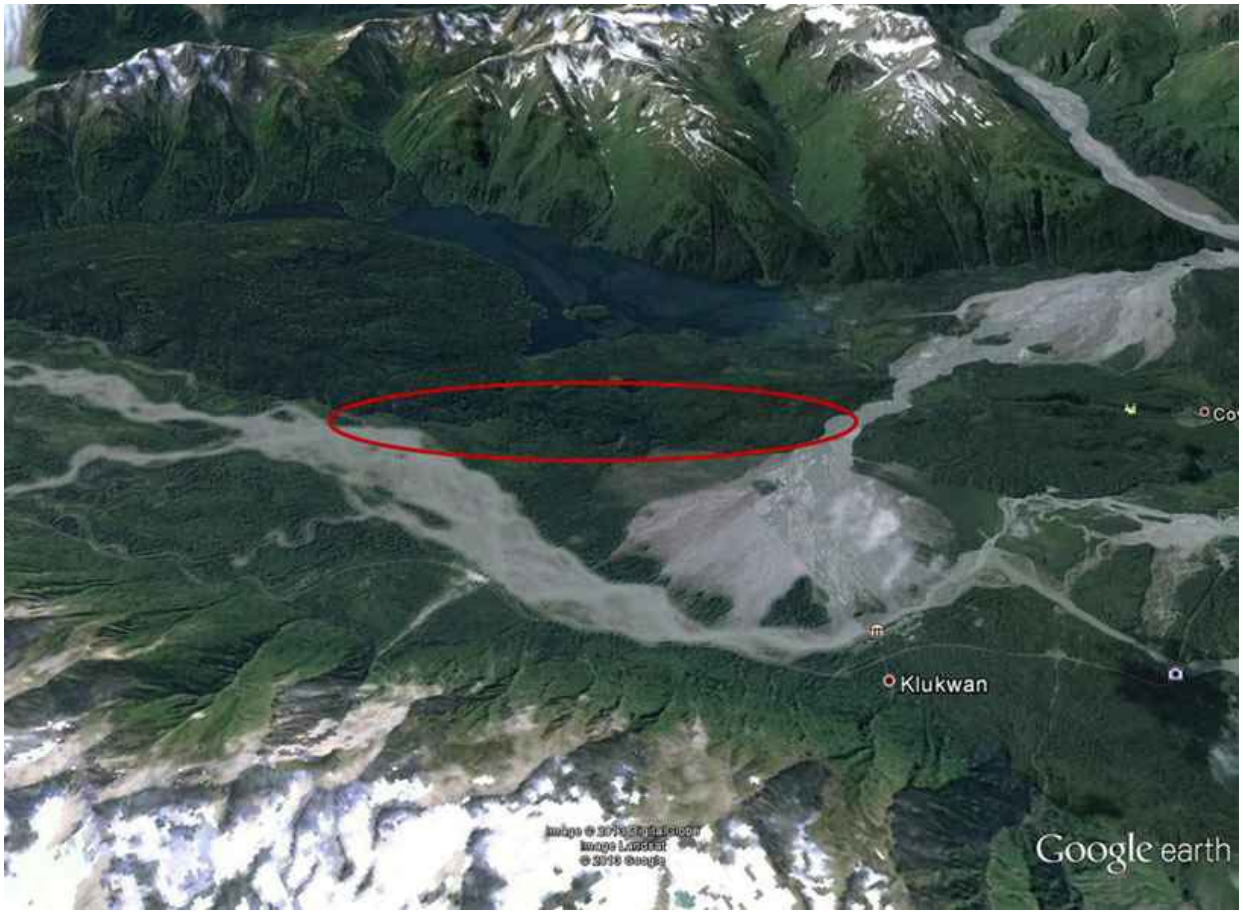

Figure 3. Approximate location of historic Bald Eagle communal roosts southwest of the Council Grounds, 1979–1983 (A. Hansen, Montana State University, pers. comm.; Hansen et al. 1984).

information was available for Bald Eagles captured and marked in 2012 (http://.ecologyalaska.com/eagle-tracker; R. Wheat, pers. comm.).

COLLISION MORTALITY REVIEW AND ASSESSMENT

ABR gathered information from published and unpublished literature and from interviews and correspondence with Bald Eagle scientists, experts, and naturalists in the region, agency biologists in Alaska, Canada, and the Pacific Northwest, as well as other organizations familiar with Bald Eagle winter biology and/or mortality factors (e.g., local and regional raptor rehabilitation centers). During this process, ABR also reached out to a number of stakeholders (e.g., USFWS, ADFG) in an effort to improve the level of detail on these topics for the Chilkat River region. Background information on the Bald Eagles within the area has been summarized in the Environmental Assessment (FHWA/DOT&PF 2013) and a number of reports and publications (e.g., Hansen et al. 1984, Waste 1985, Wright and Schempf 2008). However, long-term monitoring of the wintering population has included a myriad of different researchers, including volunteer naturalists (e.g., Hodgson n.d., Randles 2009) using various protocols. More recent studies employing satellite transmitter technology offer an additional baseline to understand the region's dynamic intersection of salmon, terrestrial habitats, and large predators, such as the Bald Eagle.

RESULTS

ROAD CENSUSES

Eight Road Censuses were conducted at 7–10 day intervals through the late fall–early winter season, 16 October–5 December 2013. We recorded 632 Bald Eagles during these surveys, averaging 79 ± (SD) 19 eagles per survey (Table 2). The highest count of Bald Eagles occurred during a survey on 13 November when 133 Bald Eagles were recorded within 47% of our delineated MP sections. The lowest count occurred on 5 December, when 34 Bald Eagles were recorded within 33.3% of all delineated MP sections. Bald Eagles were distributed more widely along the Haines Highway census area in the first half of our field surveys, from 16 October through 13 November, compared to the period between 20 November and 5 December (Table 2). During the latter period, Bald Eagles were only recorded at 33% of all MP sections. Bald Eagles were always recorded on surveys in milepost sections MP 19–22 (i.e., Council Grounds), while no Bald Eagles were recorded during all censuses at 2 milepost sections (MP 22–23, 24–25; Table 2, Figure 4a).

Nearly 84% of all Bald Eagle sightings and all peak counts for the road census area were recorded during Road Censuses in MP sections 19–22 of the Haines Highway, which include the Council Grounds area (Table 2, Figure 4b and 4c). In addition, nearly half of all sightings (47.3%) were made within 1 MP section (MP 20–21) and weekly counts ranged from 14–66 Bald Eagles (mean = 37.4 ± 15.1; Table 2; Figure 4b). Besides MP sections within the Council Grounds, only 3 other MP sections (4–5, 14–15, and 16–17) had >10 eagle observations during all highway censuses combined; <3 Bald Eagles were observed at nearly half (47.6%) of all MP sections (Table 2).

INDEX SITE COUNTS

A maximum of 516 Bald Eagle observations, comprising 454 adults (88%) and 62 subadults (12%) were counted on 13 November from 4 Index Sites. Counts were made during 9 count periods between 16 October and 16 December 2013 (Table 3). Weather was fair to good for all observation days with the exception of poor visibility on 27 November 2013 when observations were not collected at Index Site 1 (MP 30) and Index Site 2 (MP 26.6).

Adult Bald Eagles predominated on all counts from Index Sites, with the exception of more subadults than adults observed at Index Site No. 2 on 17 October (Table 3; Figure 5). The percentage of subadult Bald Eagles counted during Index Site counts declined from 28% on our first survey to 3.8% on 21 November, before increasing slightly before our last surveys (Figure 5). Most Bald Eagles were recorded from Index Site 3 or the Council Grounds (98% on 13 November: 507 adults, 62 subadults). Total numbers of Bald Eagles were relatively low at all other observation sites during our study period: maximum of 12 (Index Site 1), maximum of 48 (Index Site 2), maximum of 18 (Index Site 4) during the field season (Table 3).

Peak numbers of Bald Eagles (516) were recorded on 13 November in the study area (Table 3; Figure 5). However, total numbers of Bald Eagles recorded on the 2 previous surveys, or the first 2 weeks of November, were similar and within 7.6% of peak numbers (Figure 5). On surveys during the last 2 weeks of November and the first week of December, total numbers of Bald Eagles recorded varied substantially, but by 5 December had declined 75.7% from the peak on 13 November (Figure 5).

PERCH SURVEY ZONES

Bald Eagles were located at an average of 58.4 ± (SD) 20.0 perch locations within 14 of our 19 established Perch Survey Zones (i.e., potential construction/habitat modification zones) during each of the 8 surveys conducted from 16 October through 5 December (Table 4, Figure 6, Appendix 1). No Bald Eagles were observed during perch surveys in 5 disturbance zones: 1, 7, 13, 17, and 18. The majority of these 467 perch locations (422 locations, 90.4%) occurred within 3 Perch Survey Zones (2–4) or the core of the Council Grounds area (MP 19.4–21.5; Table 4, Figure 6). The 45 remaining perch locations were scattered through 11 other Perch Survey Zones south of the Council Grounds.

An average of 72.9 ± 23.6 Bald Eagle observations was recorded during each of the 8 surveys at all perch sites within Perch Survey Zones (Table 4, Figure 6, Appendix 1). The

Table 2. Results of surveys for Bald Eagles within 21 milepost sections along the Haines Highway (MP 4-25), Chilkat River, Alaska 2013.

MP Section	16 Oct	26 Oct	1 Nov	7 Nov	13 Nov	20 Nov	27 Nov	5 Dec	Total (%)	Mean ± SD
4–5	5	0	2	2	1	0	0	0	10 (1.6)	1.3 ±1.8
5–6	0	1	3	2	2	0	0	0	8 (1.3)	1.0 ± 2.0
6–7	1	1	2	1	0	0	0	0	5 (0.8)	0.6 ± 0.7
7–8	0	0	0	1	0	0	0	0	1 (0.2)	0.1 ± 0.4
8–9	0	0	0	1	1	0	0	0	2 (0.3)	0.3 ± 0.5
9–10	1	0	0	0	2	0	0	0	3 (.05)	0.4 ± 0.7
10–11	0	0	0	5	1	0	1	0	7 (1.1)	0.9 ± 1.7
11–12	0	1	0	2	0	0	0	0	3 (0.5)	0.4 ± 0.7
12–13	0	0	2	0	0	0	0	0	2 (0.2)	0.3 ± 0.7
13–14	0	1	2	1	0	3	0	0	7 (1.1)	0.9 ± 1.2
14–15	1	0	2	0	6	1	1	1	12 (1.9)	1.5 ± 1.9
15–16	0	0	0	0	0	0	4	1	5 (0.8)	0.6 ± 1.4
16–17	9	3	0	3	0	2	0	2	19 (3.0)	2.4 ± 3.0
17–18	1	0	1	1	0	0	0	0	3 (0.5)	0.4 ± 0.5
18–19	1	1	0	1	0	2	2	3	10 (1.6)	1.3 ± 1.0
19–20	25	8	13	23	31	10	6	9	125 (19.8)	15.6 ± 9.4
20–21	29	38	32	41	66	32	47	14	299 (47.3)	37.4 ± 15.11
21–22	9	9	20	26	21	11	5	4	105 (16.6)	13.1 ± 8.1
22–23	0	0	0	0	0	0	0	0	0 (0)	0
23–24	2	0	2	0	2	0	0	0	6 (0.9)	0.8 ± 1.0
24–25	0	0	0	0	0	0	0	0	0 (0)	0
Total	84	63	81	110	133	61	66	34	632 (100.0)	79.0 ± 19.3

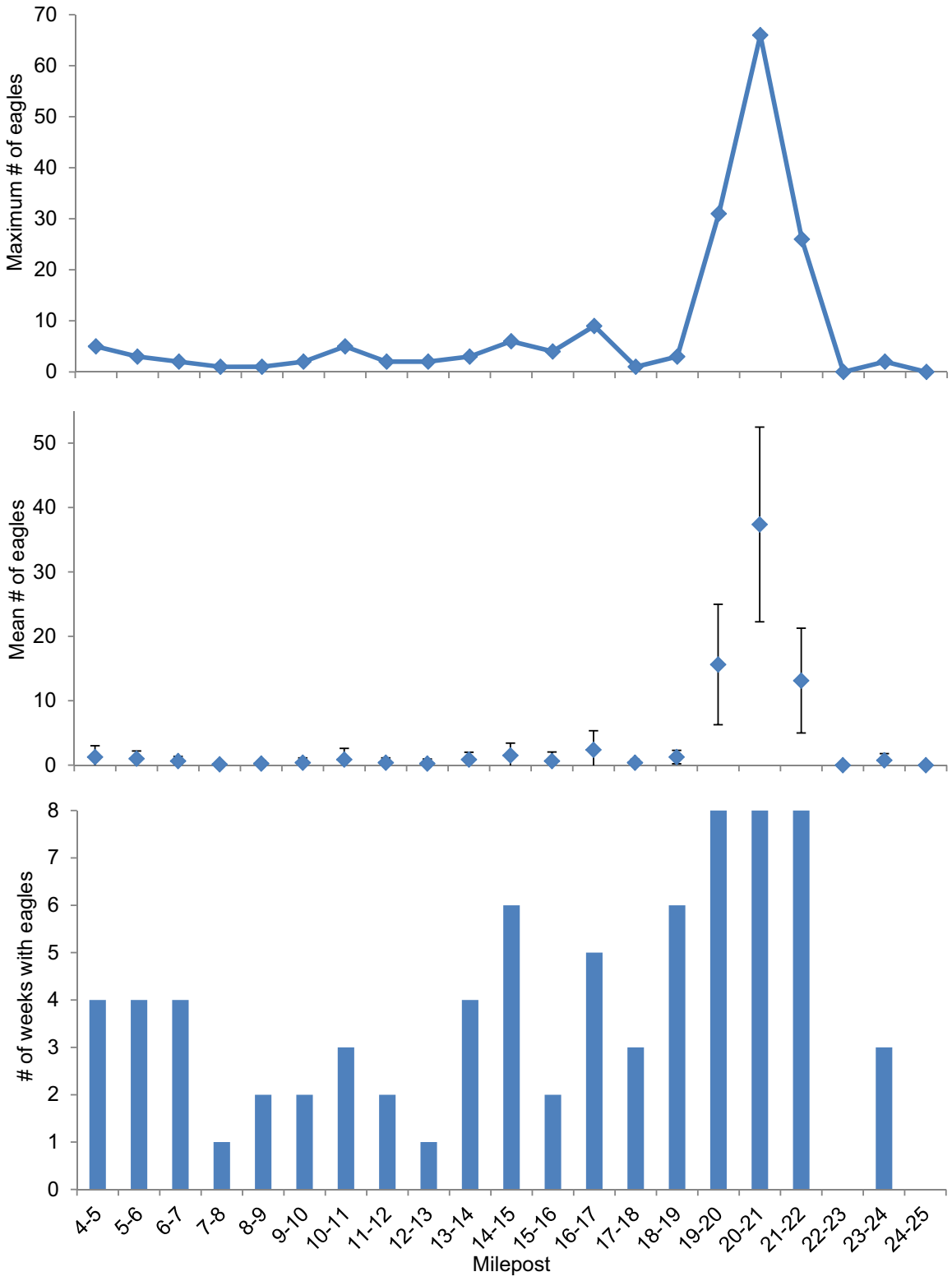

Figure 4. Maximum and mean numbers and the frequency of occurrence of Bald Eagles within milepost sections of the Haines Highway during weekly highway censuses along the Chilkat River, Alaska, 16 October–5 December 2013.

Table 3. Numbers of Bald Eagles counted from 4 Index Sites along the Haines Highway, Chilkat River, Alaska, 17 October–16 December 2013.

	Index Site														
	No. 1 (U. Klehini, MP 30)			No. 2 (Klehini, MP 26.9)			No. 3 (Council Gr., MP 20.1)			No. 4 (L. Chilkat, MP 9)			All locations		
Date	Adults	Subadults	Subtotal	Adults	Subadults	Subtotal	Adults	Subadults	Subtotal	Adults	Subadults	Subtotal	Adults	Subadults	Total
17 Oct	10	2	12	20	28	48	181	53	234	5	1	6	216	84	300
26 Oct	1	0	1	11	5	16	105	23	128	2	0	2	119	28	147
1 Nov	4	0	4	6	3	9	358	88	446	18	0	18	386	91	477
7 Nov	1	0	1	13	1	14	356	103	459	10	1	11	380	105	485
13 Nov	3	0	3	4	0	4	445	62	507	2	0	2	454	62	516
20 Nov	5	0	5	6	1	7	165	6	171	2	0	2	178	7	185
27 Nov	-	-	-	-	-	-	267	24	291	3	0	3	270	24	294
5 Dec	0	0	0	2	0	2	108	14	122	1	0	1	111	14	125
16 Dec	2	0	2	2	0	2	169	12	181	0	0	0	173	12	185

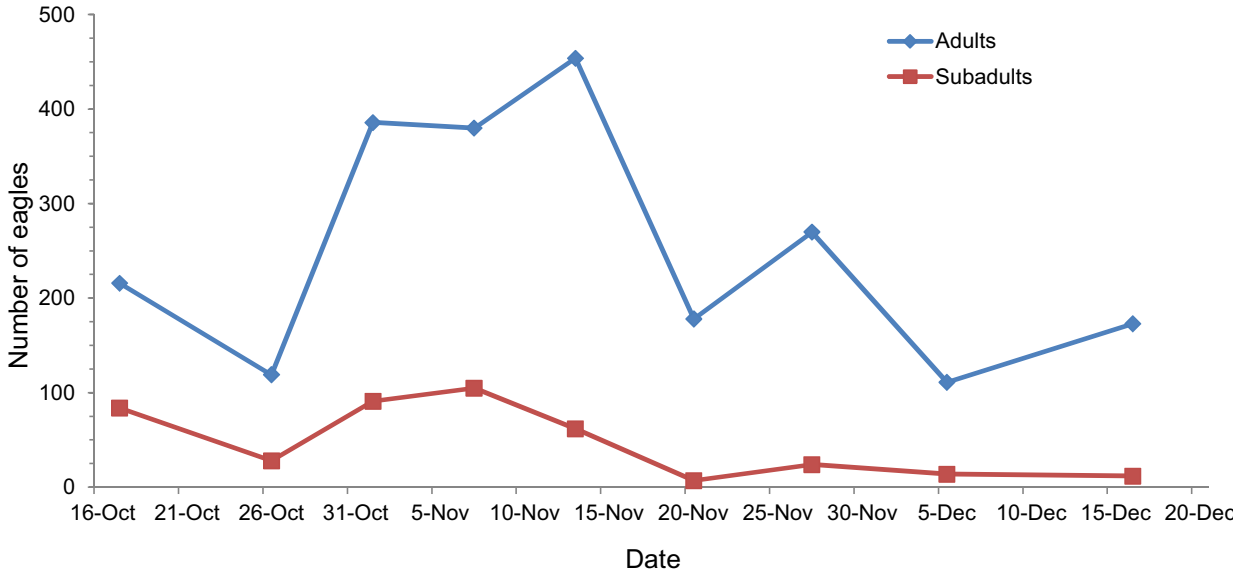

Figure 5. Number of Bald Eagles recorded from 4 Index Sites along the Haines Highway, Chilkat River, Alaska, 2013.

majority of these Bald Eagles (91.1%; 450 adults, 81 subadults) occurred within Perch Survey Zones 2–4. The remaining 52 Bald Eagles (45 adults, 7 subadults) located during perch surveys were scattered through 11 other Perch Survey Zones. Eagle group size ranged from 1–6 individuals, and most observations (85%) were of adult plumaged individuals (Table 4). Over two thirds of all Bald Eagles (67.9%) observed were single birds and only 6.4% of all groups were >2 Bald Eagles, comprising 18% of total Bald Eagles recorded (Table 5).

Nearly all Bald Eagle perch trees were cottonwoods (98%). The remaining 8 perch locations were observations of 4 Bald Eagles on gravel bars (Zone 2), 2 in spruce trees (Zone 11), and 2 on cliffs (Zone 11). Although records of Bald Eagles using spruce trees and cliffs were limited during perch surveys, we occasionally observed Bald Eagles perched in conifers and associated cliffs on the eastern side of the Haines Road between MP 4 and MP 15. These observations occurred outside our perch survey periods. Finally, 1 Bald Eagle was observed perched on the ground within the ROW near MP 21.5 on 1 November. This was the only observation of a Bald Eagle perched on the ground outside the river bars along the Chilkat and Klehini rivers in 2013.

We estimated DBH for a subsample of our perches within the Council Grounds area (n = 224 perches). Nearly half (45.1%) of all perch trees were in the large timber category (12–24 in DBH). Over a quarter of perch trees sizes were small timber perches (27.2% [6–12 in DBH]) and very large timber (26.8% [>24 in DBH]). Only 2 perches were classified as pole timber (< 6 in DBH). All DBH estimates were from cottonwood perch trees.

In an effort to help characterize diurnal perch use by Bald Eagles within Perch Zones 2–5 (Council Grounds), mean densities, maximum use, and frequency of use by eagles at perches were calculated within 10 m × 10 m cells for our 8 surveys for the entire area. Although there are differences in these metrics, maximum use is presented in Figure 7 to help visualize patterns of use in the study areas. Mean use and frequency of use of the study area by Bald Eagles are presented

Table 4. Average number of perch locations and perched Bald Eagles during 8 surveys of Perch Survey Zones in the Haines Highway Study Area, Chilkat River, Alaska, 2013.

Zone	Perch Observations (Mean ± SD)	Perched Bald Eagles		
		Adult (Mean ± SD)	Subadult (Mean ± SD)	Total (Mean ± SD)
1	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
2	20.8 ± 9.4	20.0 ± 9.6	7.1 ± 4.0	27.1 ± 11.9
3	18.1 ± 7.7	20.3 ± 8.4	1.1 ± 1.0	21.4 ± 8.9
4	13.9 ± 5.9	16.0 ± 6.6	1.9 ± 1.5	17.9 ± 6.6
5	2.5 ±2.3	2.5 ± 3.0	0.3 ± 0.5	2.8 ± 2.8
6	0.1 ± 0.4	0.1 ± 0.4	0.0 ± 0.0	0.1 ± 0.4
7	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
8	0.1 ± 0.4	0.1 ± 0.4	0.0 ± 0.0	0.1 ± 0.4
9	0.9 ± 0.8	0.9 ± 1.1	0.4 ± 0.7	1.3 ± 1.5
10	0.1 ± 0.4	0.1 ± 0.4	0.0 ± 0.0	0.1 ± 0.4
11	0.5 ± 0.8	0.4 ± 0.5	0.1 ± 0.4	0.5 ± 0.8
12	0.5 ± 0.8	0.5 ± 0.8	0.0 ± 0.0	0.5 ± 0.8
13	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
14	0.3 ± 0.5	0.3 ± 0.5	0.0 ± 0.0	0.3 ± 0.5
15	0.1 ± 0.4	0.3 ± 0.7	0.0 ± 0.0	0.3 ± 0.7
16	0.1 ± 0.4	0.1 ± 0.4	0.0 ± 0.0	0.1 ± 0.4
17	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
18	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
19	0.4 ± 0.7	0.4 ± 0.7	0.1 ± 0.4	0.5 ± 1.1
Grand Total	58.4 ± 20.0	61.9 ± 21.8	11.0 ± 4.8	72.9 ± 23.6

in Appendices 2 and 3, respectively. As expected, eagles appeared to prefer to perch in large cottonwoods close to the river, and there were clear spatial patterns with the highest numbers and densities of Bald Eagles, and the most consistent use, occurring in areas near where salmon typically spawn (Figure 7, Appendices 2 and 3). The most densely and regularly used area occurred along the shoreline of the Chilkat River, especially between MP 20.4 and 21.3. Use of riparian habitat south of this shoreline area appeared to be limited or more dispersed. Between MP 19.7 and 20.3, use of upland areas (i.e., above or northeast of the road) appeared to be less dense than shoreline areas, except adjacent to the highway in Perch Survey Zone 4. Cottonwoods along the river in this section are less dense than elsewhere along the shoreline. Many of the gaps in distribution, particularly along the river side of the highway are probably due to a lack of cottonwood trees or other perches (e.g., gravel bars), but this is not the case for gaps in distribution of Bald Eagles on the upland side of the Highway in Perch Survey Zones 2 and 4 where trees are abundant (Figure 7).

COMMUNAL ROOSTING

We did not record Bald Eagles departing *en masse* from the Council Grounds region at and after dusk on 19 and 20 November. Instead, there seemed to be a slow attrition of the number of birds on the highway side of the shoreline (i.e., lower number of birds from afternoon counts). In

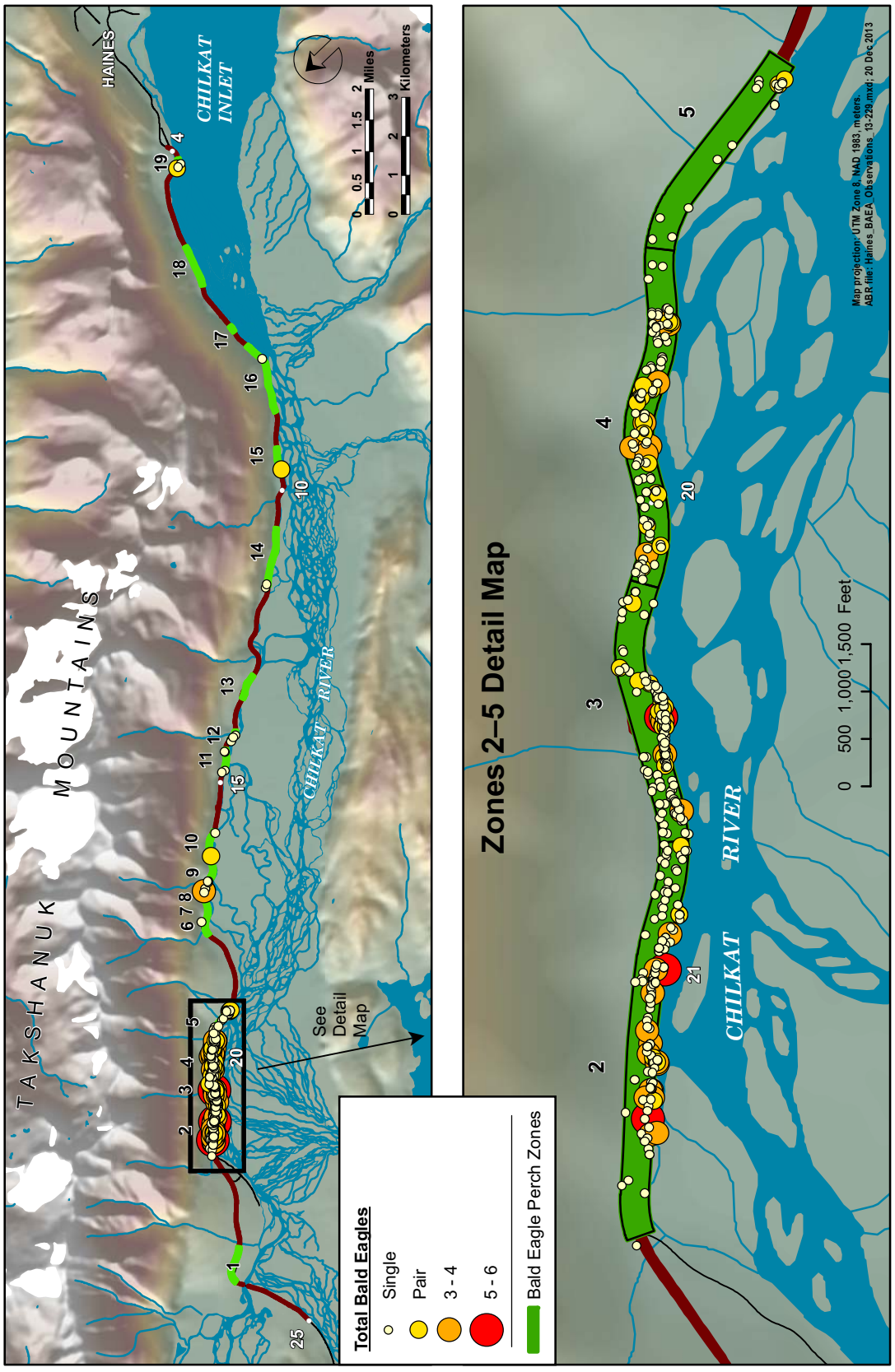

Figure 6. Distribution of all Bald Eagle perches recorded within 19 Perch Survey Zones, Haines Highway Bald Eagle Study Area, Chilkat River, Alaska, 16 October–5 December 2013.

Table 5. Group sizes of Bald Eagles perched within 19 Perch Survey Zones along the Haines Highway, Chilkat River, Alaska, 2013.

Group Size	No. of Groups	No. Adults	No. Subadults	Total Birds	% occurrence of group	% of birds in group from total birds
1	396	345	51	396	84.8	68
2	41	72	10	82	8.8	14
3	20	46	14	60	4.3	10
4	7	20	8	28	1.5	5
5	1	4	1	5	0.2	1
6	2	8	4	12	0.4	2
Grand Total	467	495	88	583	100	100

addition, based on the NVG-assisted nocturnal surveys, some Bald Eagles remained at perches throughout the night along the east side of the river. On the evening of 19 November, 12 Bald Eagles were perched in trees at 5 distinct locations between MP 19.7 and 20.8 at last light (~1645 h). At 1800 h, 4 eagles remained at 3 of the perches observed at 1645 h. At sunrise on the morning of 20 November, at least 3 Bald Eagles were still present at 3 of the perches located the previous evening. Numerous eagles were present in cottonwoods on the west side of the highway at sunrise on 19 and 20 November, suggesting overnight perching was common near the river on those days.

COLLISION HISTORY

Although we regularly drove the highway in the study area and frequently walked primarily on the shoulder of the highway from MP 19.5–21.5 to conduct eagle perch surveys, no dead or injured eagles were recorded during our field studies. These were not formal surveys along the highway to try to document vehicle collisions with Bald Eagles, however, and we acknowledge a number of factors that can influence locating avian carcasses (e.g., scavengers removing specimens, injured birds hiding in less conspicuous areas, etc.).

We are not aware of any regular or intensive efforts to identify road mortalities and factors influencing rates of detecting dead eagles along this or other highways in Alaska including the Haines Highway (S. Lewis, USFWS, pers. comm.; J. Scholl, DOT&PF, pers. comm.). The Takshanuk Watershed Council (Haines, AK), however, has started a citizen reporting process to identify Bald Eagle-vehicle collision events (http://takshanuk.org/node/add/eagle-collision).

Currently, most information is sparse, anecdotal, or does not include enough data to specify cause of mortality (e.g., carcasses are too old, unknown trauma is listed). That said, there are records of Bald Eagle mortalities (including vehicle collisions, injuries, and mortalities), indicating that collisions with vehicles along the Haines Highway do occur within the study area (Haines Police Station, Police blotter, 2009–2013; P. Randles, TWC, pers. comm.). Four Bald Eagles were recorded as injured along the Haines Highway during the winters of 2012 (2) and 2009 (2; Haines Police Station, Police blotter, 2009–2013). Two of these Bald Eagles were definitive, vehicle-collision victims: 1 Bald Eagle was reported hit at MP 7 and flew away (23 February 2013) and 1 was hit at MP 20.5 (2 December 2009). The other 2 Bald Eagles were reported injured at MP 14.5 (4 December 2013, 19 December 2009) but no cause was determined. One report included reference to 30 carcasses found in the spring of 1978 along the Haines Highway, but the author noted that several carcasses appeared to have gunshot wounds (Waste 1984). All had deteriorated before appropriate necropsies could be performed.

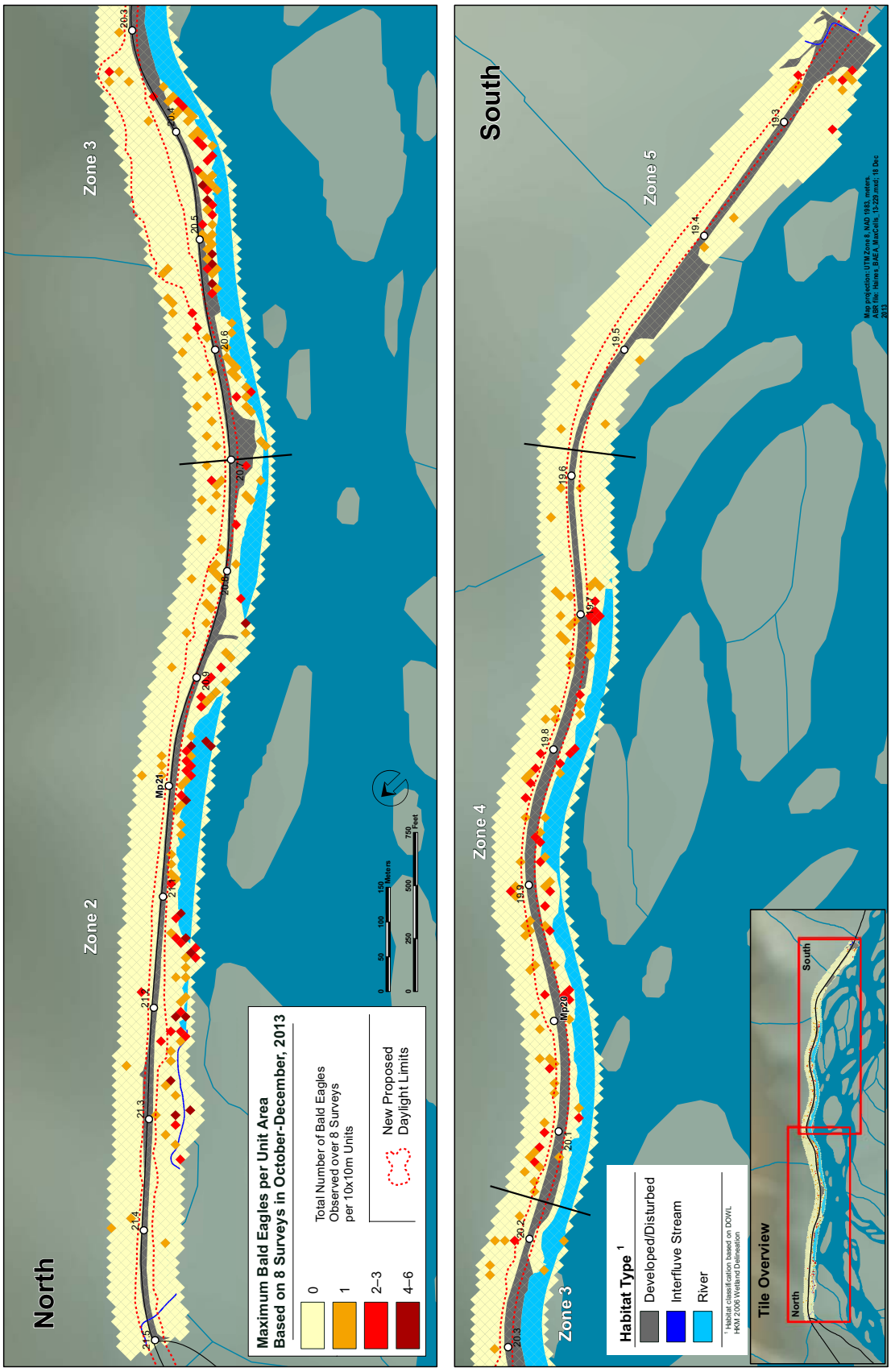

Figure 7. Maximum use of perch locations by Bald Eagles within 10 m × 10 m cells in the Council Grounds, Perch Survey Zones 2–5, Chilkat River, Alaska, 16 October–5 December 2013.

For 344 Bald Eagles collected and necropsied in Alaska (242 from Southeast Alaska) from 1975–1989, trauma was determined to be the most frequent cause of death (24.7% statewide, 23.5% in Southeast Alaska; Thomas 2008). The exact cause of these traumatic injuries usually could not be determined precisely, but case histories (e.g., found near road) often suggested that these birds were hit by vehicles or collided with power lines and poles adjacent to the highway (Thomas 2008). Interestingly, the proportion of trauma deaths were similar to data for nearly 2,000 Bald Eagles collected in the lower 48 states (Buehler 2000), although the general appearance of Alaskan birds suggested poor condition compared to outside specimens (Thomas 2008). Summarizing information from ~155 birds admitted to the Sitka Raptor Rehab Center, at least 6% were determined to be victims of vehicle collisions, but half of those were collisions with aircraft (SRC, unpubl. annual summaries prepared for USFWS). Similarly, 7% of Bald Eagles admitted to the Bird Treatment and Learning Center (TLC) in Anchorage (2007–2011) were listed as vehicular collision victims (n = 272). Unfortunately, unknown causes were listed for >43% and >61% of all eagles brought in to the SRC and TLC centers, respectively (SRC, unpublished data; annual summaries prepared for USFWS; TLC, unpublished data).

DISCUSSION

BALD EAGLE ABUNDANCE IN 2013

Bald Eagle abundance—an index of the population as documented on our surveys—was consistent with historic and other current information. First, other studies found that although seasonal and interannual Bald Eagle numbers and peak use were highly variable over the years of survey coverage, Bald Eagles generally were most abundant and concentrated in the Council Grounds between October and late December, when late-spawning chum salmon are most available along this reach of the river (1980–1983, Hansen et al. 1984; 1977–1979, Waste 1984; 2009–2013, Randles, 2009, P. Randles, TWC, pers. comm. and unpubl. data). Indices of Bald Eagle abundance during surveys in 2013 also followed this seasonal pattern. A volunteer effort with regularly scheduled repeat-surveys in 2013 showed a peak of 685 Bald Eagles throughout the Chilkat River system (Mud Bay through MP 30) on 3 November, and recorded observations of 305–537 Bald Eagles on 3 surveys between 9 November and 26 November (P. Randles, TWC, pers. comm. and unpubl. data). These dates and numbers were similar to our findings. Our count of 446 Bald Eagles from the Council Grounds (Index Site #3) on 1 November, is similar to Randles's total of 515 birds recorded within 4 of her observation sites encompassing most of the Council Grounds area on 3 November 2013 (i.e., Slide, Slide–21 Mile, 21 Mile, 21–Wells Bridge, P. Randles, TWC, pers. comm. and unpubl. data).

Second, adult Bald Eagles generally arrive later than subadults and the proportion of subadults decreases through the fall and early winter (Hansen et al. 1984; Waste 1985; P. Randles, TWC, pers. comm. and unpubl. data). Subadults comprised 15–40% of the population censuses in the early to mid-1980s, declining in numbers as the seasons progressed (Hansen et al. 1984). In 2013, Randles documented the percentage of subadults range from 7% to 39% during 11 counts along the Chilkat River, 14 September–26 November (P. Randles,TWC, pers. comm. and unpubl. data), with higher percentages during September and early October and lower percentages through November. By the time our surveys began in mid-October, Randles had recorded 26% of Bald Eagles to be subadult plumaged birds (19 October), very similar to 28% subadults recorded during our counts on 17 October. In addition, our lowest estimate of the proportion of subadults (8%) occurred on 27 November, nearly identical to Randles's lowest proportion of subadults on 26 November (7%).

Direct comparisons of abundance of Bald Eagles and timing of their use of the area among years is difficult because of interannual and seasonal variability, different survey methods, availability of salmon, and differences in other environmental variables (i.e., dates of freeze-up). There are some datasets and observations, however, which suggest eagle numbers were low in 2013 compared to recent years. For example, peak numbers determined by ground counts in 2013 included our Index Site count of 516 Bald Eagles on 13 November and 690 Bald Eagles counted

within the Chilkat region by Randles on 3 November (P. Randles, TWC, pers. comm. and unpubl. data). In 2009, 2011, and 2012, peak counts by Randles were 1,157, 2,264, and 855, respectively, using similar survey protocols and timing of observations (P. Randles, TWC, pers. comm. and unpubl. data). These differences among years equaled a range of 24–228% greater peak use in those 3 earlier years than the peak use recorded in 2013. Anecdotally, a number of photographers commented on fewer Bald Eagles on the highway side of the river in 2013 compared to recent years and fishermen commented that there were fewer salmon in 2013.

The availability of salmon during critical winter months has been identified as the leading cause for Bald Eagles to concentrate along the Chilkat River (Hansen et al 1984). And changes in salmon availability (i.e., numbers of salmon, ice conditions) likely affects numbers of eagles present in the Chilkat area. During the 20 aerial surveys conducted within the entire Chilkat-Chilkoot system study area 1979–2001, peak numbers ranged from 1,124 (1986) to 3,986 (1984) (S. Lewis, USFWS, unpubl. summaries of aerial survey counts). Although differences among years partially reflect different protocols and timing of surveys (e.g., more surveys in some survey years, allowing more opportunity to record peak use), information from long-term escapement assessments for chum and Coho salmon in the Chilkat drainage (Bachman 2010) also suggests real differences in Bald Eagle numbers affected by the chum salmon abundance and availability. Although salmon were within escapement goals in 2013, they were at lower numbers than most other years (Figure 8; R. Bachman, ADFG, pers. comm.), possibly affecting numbers of Bald Eagles using the region in 2013.

PERCHING AND ROOSTING USE OF THE HIGHWAY CORRIDOR IN 2013

During all 4 winters of intensive Bald Eagle research in the 1980s, most diurnal perch use by Bald Eagles was reported along the Chilkat–Tsirku shorelines, including highway frontage in the Council Grounds (Hansen et al. 1984). During inclement weather, perch use shifted from more

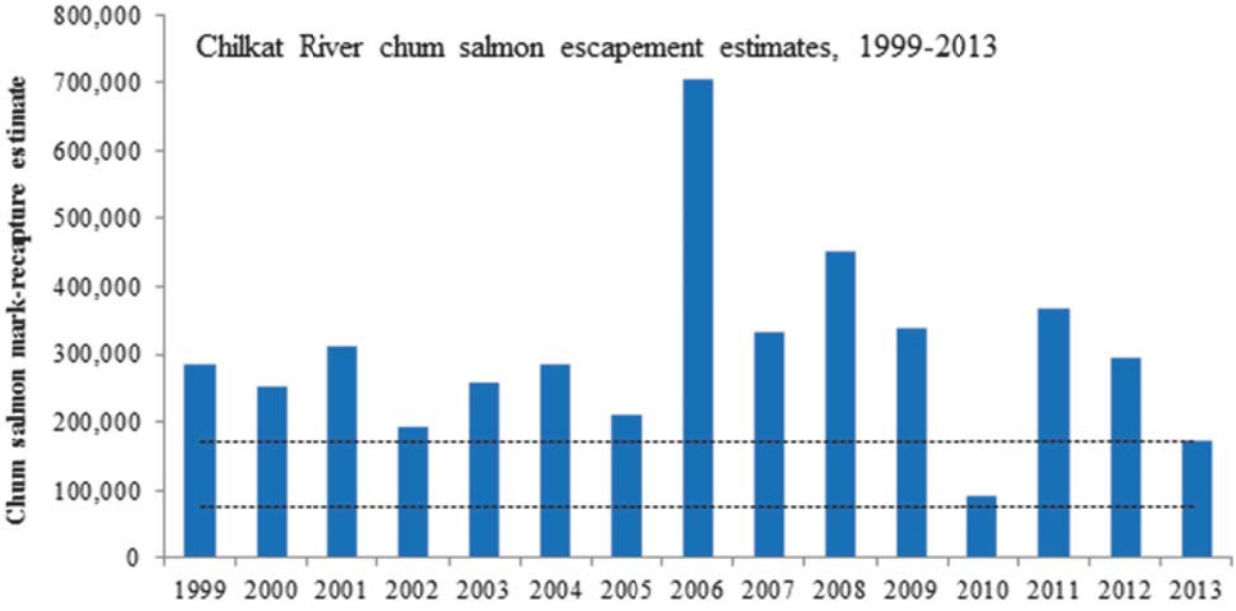

Figure 8. Chilkat River chum salmon escapement estimates, 1999–2013 (Data from D. Bachman, Alaska Department of Fish and Game, Haines, AK).

Figure 9. Movements and perch locations of an adult Bald Eagle (3 E) within the Council Grounds of the Chilkat River and use of historic communal roosting areas, 4 November–5 December 2012 (data from http://www.ecologyalaska.com/eagle-tracker/3e/).

dispersed perching in these streamside cottonwood stands to communal roosting in conifer stands southwest of the river (Hansen et al. 1984; A. Hansen, Montana State Univ., pers. comm.; Figure 3). Substantial use (100–500 birds; 22% of Council Grounds population estimates) was identified at night at these communal roosts, often during winter storms and when human disturbance occurred on the feeding grounds (Hansen et al.1984). Recent studies using satellite transmitters on a small number of Bald Eagles captured in the Council Grounds area, revealed diverse migration routes and wintering and summering areas, including some return to these historic roosting sites. For example, at least 2 of 4 eagles with satellite transmitters (Bald Eagles 3E and 4 P), whose data were collected for the 2012–2013 winter season, spent considerable time in late winter at traditional roosting habitats described in 1985 as well as perching within the Council Grounds (Figure 9; e.g., http://.ecologyalaska.com/eagle-tracker). In contrast, other research did not identify daily movements that would indicate the existence of unidentified roosts distinct from areas of daytime perches (1978–1979, Waste 1985). Waste (1985) reported that as dusk approached, eagles slowly left feeding areas and flew to trees adjacent to the floodplains to roost. This slow departure of birds from roosts near the highway or remaining at roosts through the night near the highway was recorded during our survey period. Greater movements to communal roosting areas in conifer timber might be linked to more severe winter weather patterns than those recorded during our surveys.

Daily roost or perch areas are probably selected because they offer special advantage such as proximity to feeding areas, presence of suitable perch trees, social exchanges, and other ecological benefits (Call 1979, Buehler 2000). Bald Eagle communal roosts are predictable habitats in wintering areas that offer protection from weather and predators (Isaacs and Anthony 1987, Harmata and Stahlecker 1993, Buehler 2000). While eagles dispersed during the day at foraging and resting perches that were proximal to food resources (i.e., close to water; Chandler et al. 1995), those at large communal roosts in western states were often substantial distances from their foraging areas (Buehler 2000, others). Furthermore, Chilkat Bald Eagles have used stands dominated by conifers for communal roosting, like other western populations of Bald Eagles (Dellasalla et al. 1998, Buehler 2000). Although proposed modifications to the Haines Highway will not impact historic communal roosting sites southwest of the Chilkat River, additional analyses (e.g., telemetry locations) might provide more extensive and current information on perch and roosting area selection by Bald Eagles in the study area.

RISK OF VEHICLE COLLISIONS

Bald Eagles have been reported as victims of collisions with vehicles for 0 to 29% of all mortalities summarized in numerous databases (Appendix 4). The relative number of Bald Eagles where cause of death is definitely vehicle-caused ranges from incidental or not reported to frequently occurring. Some researchers suggested that eagles were probably under-represented in most road-kill databases (e.g., USFWS 2012, C. Hill *fide* G.Hesse, Wildlife Collision Prevention Program, BC, Canada) and, because the cause of death for significant numbers of Bald Eagles found injured or dead often is ‘unknown trauma,’ road collisions and mortalities are probably underestimated.

However, based on reports from wildlife collision databases, Departments of Transportation, and University or private conservation organizations (e.g., bird rehabilitation centers), the majority of sites where Bald Eagles are regularly hit by vehicles (including trains) are located in areas where winter carrion is a major food source for the eagles. These areas are usually interior locations, such as the intermountain west and Midwest. Road corridors often attract eagles where they will scavenge on road-killed or railroad-killed wildlife. Scavenging behavior tends to increase during the winter months in interior areas when freezing lakes and rivers reduce the availability of their main prey (fish). Bald Eagles engorged with carrion and surprised by the approach of a vehicle are susceptible to collisions. For instance, in Michigan, 29% of all recorded Bald Eagle mortalities between 1987 and 2008 were due to vehicular collisions, particularly where road-killed white-tailed deer were numerous (http://www.fws.gov/midwest/news/324.html). Significant mortalities of Bald Eagles associated with feeding on winter carrion also have been reported in Idaho (USFWS 2012), Maine (R. Bostwick, Maine DOT-ENV, pers. comm.), and Florida (FFWCC 2008).

Numbers of Bald Eagles being hit by vehicles in coastal areas similar to the Haines Highway study area appear to be more limited. For 196 Bald Eagles treated at the Wolf Hollow Wildlife Rehabilitation Center (WHWRC) in Friday Harbor, WA, only 2 were confirmed as being hit by a vehicle (S. Aitken, WHWRC, pers. comm.). In over 20 years of work in western Washington, much of it with Bald Eagles and highway planning projects, Jim Watson (Washington Department of Fish and Wildlife, pers. comm.) could only recall the occasional vehicle collision with Bald Eagles trying to fly over a high-traffic, major highway on Lake Washington, near Bellevue, Washington.

But there are incidents in these regions that help frame the risk for eagles crossing roads even without carrion as an attractant. Campbell and Preston (2006) reported that a Bald Eagle was hit while flying to a fish spawning site in British Columbia. Similarly, 2 Bald Eagles were killed on highways while swooping low across roads, and other reports from the same area described Bald Eagles nearly being hit by cars as they focused on prey (S. Aitken, WHWRC, pers. comm.). Although vehicle collision records at the Alaska Raptor Center include aircraft, there was a record of a bus-Bald Eagle collision near Sitka (ARC 2010). Another Bald Eagle was killed along a road (Hwy 89, 2-lane rural road in California with 55 mph posted speed limit) when it ‘may have swooped across the road to (or from) a creek’ running

parallel to the road (http://www.wildlifecrossing.net/california/roadkill/12665). There are no records of Bald Eagles being killed near other major fall and winter congregation areas including the Fraser (southwestern British Columbia) and Skagit (Western Washington) drainages (R. Rea, Ecosystem Science and Management Program, BC, pers. comm.; J. Watson, Wash. Dept. Fish and Game, pers. comm.).

Reported Bald Eagle mortalities have generally occurred for many highway types with two or more lanes and where posted speeds range from 55–65 mph. There is the argument that increased speed will undoubtedly increase the risk of collision of motor vehicles with animals, including Bald Eagles, and that even with posted speed limits, many drivers will drive at 'design speed' or as fast as the road will allow (S. Jacobson, USFS, pers. comm.). Higher speeds, particularly on turns and blind spots would seem to increase risk to any large birds feeding, alighting, or taking off from a road. In an extensive synthesis of highway collision literature in North America and Europe, Erithzoe (2002) noted that bird mortalities (including raptors) begin to occur with speeds >35 mph, were often associated with carrion, and that even with low volume traffic, high speeds were more dangerous. But in one notable study in Canada, the authors found that more birds and mammals were consistently killed on a low volume, slower speed (50–70 kph) 2-lane highway compared to the high speed (90–120 kph) Trans-Canada Highway (Clevenger et al. 2003). They also suggested that a higher speed road with a raised bed was less likely to cause collision than flatter, slower roads. Additionally they suggest that birds were less susceptible to colliding with vehicles on roads with more forested edges than open terrain.

The most common element among most collisions with Bald Eagles appears to be Bald Eagles colliding with vehicles while associated with feeding on road-kills or carrion. The act of surprising Bald Eagles perched on highways may be reduced if realignments widen the shoulders and eliminate sharper turns on the road, as are proposed in the current Haines Highway realignments. Furthermore, while passive hunting and scavenging behaviors of Bald Eagles where fish resources are abundant probably lower the risk for collision, Bald Eagles in pursuit of prey or carrying prey have been hit crossing highways as well. This behavior might be the greater risk than scavenging carrion for Bald Eagles along sections of the Haines Highway.

CONCLUSIONS AND RECOMMENDATIONS

The main concerns regarding Bald Eagles associated with proposed developments along the Haines Highway on the Chilkat River include alteration of salmon spawning habitats and subsequent effects on eagle foraging, removal of traditional cottonwood perches in the ROW (especially those between the road and salmon spawning sites) and displacement of eagles, and increased collisions and mortality due to increased vehicle speed. Our research efforts in 2013 were focused on field surveys for evaluating the abundance and distribution of eagles and their perch locations and on assessing collision risks by examining the literature and unpublished sources. Surveys were conducted in areas of proposed highway development, particularly the Council Grounds region.

Results from our Road Censuses and Index Site counts were similar to results from earlier research; numbers of Bald Eagles during the study period (October–December) peaked in late fall (i.e., November), adults became more abundant than subadults as the season progressed, riparian cottonwoods were the primary perch sites, and the most Bald Eagles and most consistent use occurred within the Council Grounds (~MP 19.4-21.5). Our counts and other observations indicated that numbers of Bald Eagles were lower in 2013 compared to some recent years. The fall-winter Chilkat population has varied over the years, however, and Bald Eagle distribution and abundance is markedly influenced by salmon numbers and their availability.

Results from our Perch Survey Zone investigation also indicated that Bald Eagles were more abundant in the Council Grounds section of the proposed Haines Highway alignment and substantially less numerous within all other proposed development areas in the ROW. More than 90% of all perch records occurred in the Council Grounds, and the greatest Bald Eagle

density in the ROW study area occurred along the river southwest of the highway (~MP 19.7-21.3). Upland, hillside trees also were important perches and used regularly in this section of the Council Grounds area, but not as frequently or by as many Bald Eagles. Only 10% of perch observations occurred between MP 4 and 19.4 where the highway bordered the Chilkat River, sloughs, or tributaries. Since riparian cottonwood habitat is abundant in this area, the relatively low numbers of eagles is likely attributable to other factors (e.g., salmon availability).

The literature and a number of unpublished databases from throughout the range of Bald Eagles in North America suggest that most Bald Eagle collisions with vehicles are associated with road carrion, particularly during winter months. Collision mortalities are substantial in some areas and may be under reported because a large proportion of mortalities are often reported in 'unknown trauma categories'. Most problem areas reported are interior locations, where availability of preferred prey (fish) is limited in winter and eagles are forced to take greater risks foraging on the highway.

Bald eagles also have been struck by vehicles where salmon are available, including along the Haines Highway, but evidence does not suggest more than occasional road fatalities. Mortalities might increase in areas of the Haines Highway corridor if improved highway conditions allow speeds greater than 55 mph, which may give birds scavenging on the road less time to react. In addition, if removing cottonwoods opens the area for lower flights between perches and foraging areas, eagles may increase their time in an area of greater risk. In concert, these factors may increase the risk for Bald Eagles crossing the road from their perching areas.

Recommendations in the National Management Guidelines for Bald Eagles call for minimizing 'potentially disruptive development (e.g., cutting perch trees) in the eagle's direct flight path between their nest and roost sites and important foraging areas' (USFWS 2009: 14). In the Council Ground area, we think this could be interpreted to include avoiding the removal of perch trees adjacent to the Chilkat River.

Overall, we think there are two main sources of potential impacts that warrant further consideration: habitat loss (i.e., perch removal) in a limited number of locations and increased eagle mortality due to vehicle collisions. In an effort to reduce the impacts of the Haines Highway widening and potential perch removal, we offer the following recommendations:

- Remove as few cottonwood trees as possible, especially from stands along the shoreline side of the Haines Highway within the Council Grounds; and
- Plant cottonwoods in open areas between the highway and river to mitigate for trees removed elsewhere in the Council Grounds and to sustain cottonwood stands along the river; this might induce Bald Eagles to fly higher over the Highway during their forays from perches to foraging sites.

Our observations of nocturnal perching/ roosting in the Council Grounds were very limited, but night time roosting/perching does occur within the ROW. Additional assessments of night-time roosting could provide information to improve our understanding of perching habitat within the Haines Highway corridor ROW. Therefore, we would also recommend:

- Collaborating with an ongoing USFWS-UCSC satellite-tracking project to acquire and analyze location information to help determine the distribution and degree of nocturnal perching/roosting sites in the Council Grounds area.

Although existing information suggests that the potential for vehicle-Bald Eagle collisions and the primary environmental conditions associated with collisions (presence of carrion) are both limited along the Haines Highway, we would recommend some baseline monitoring efforts and precautions to offset potential impacts. First, DOT&PF could provide signage and public awareness displays alerting drivers to Bald Eagles in greater use areas. Second, some level of pre- and post-construction monitoring to help quantify highway-associated mortality of Bald Eagles along the Haines Highway should be considered. Should unacceptable levels of Bald Eagle mortality from vehicle collisions be identified, additional measures such as formally instituting a slower

speed limit and/or swift removal of carrion in late winter within the Council Grounds area could be applied.

Finally, although in our professional opinion we do not think proposed alterations to the Haines Highway corridor will have a population effect on Bald Eagles in the Chilkat region, there may be changes in patterns of distribution and use of eagles that may impact other qualities and resources of this area. For example, removing cottonwoods may cause Bald Eagles to move farther from locations now accessible to recreationists (e.g., photographers, bird-watchers). Further, aesthetics and natural habitats may at least be temporarily affected. As the road realignment project moves forward, it will be important to continue to consider, monitor and protect these unique qualities of the Chilkat Bald Eagle Preserve during all construction and maintenance activities.

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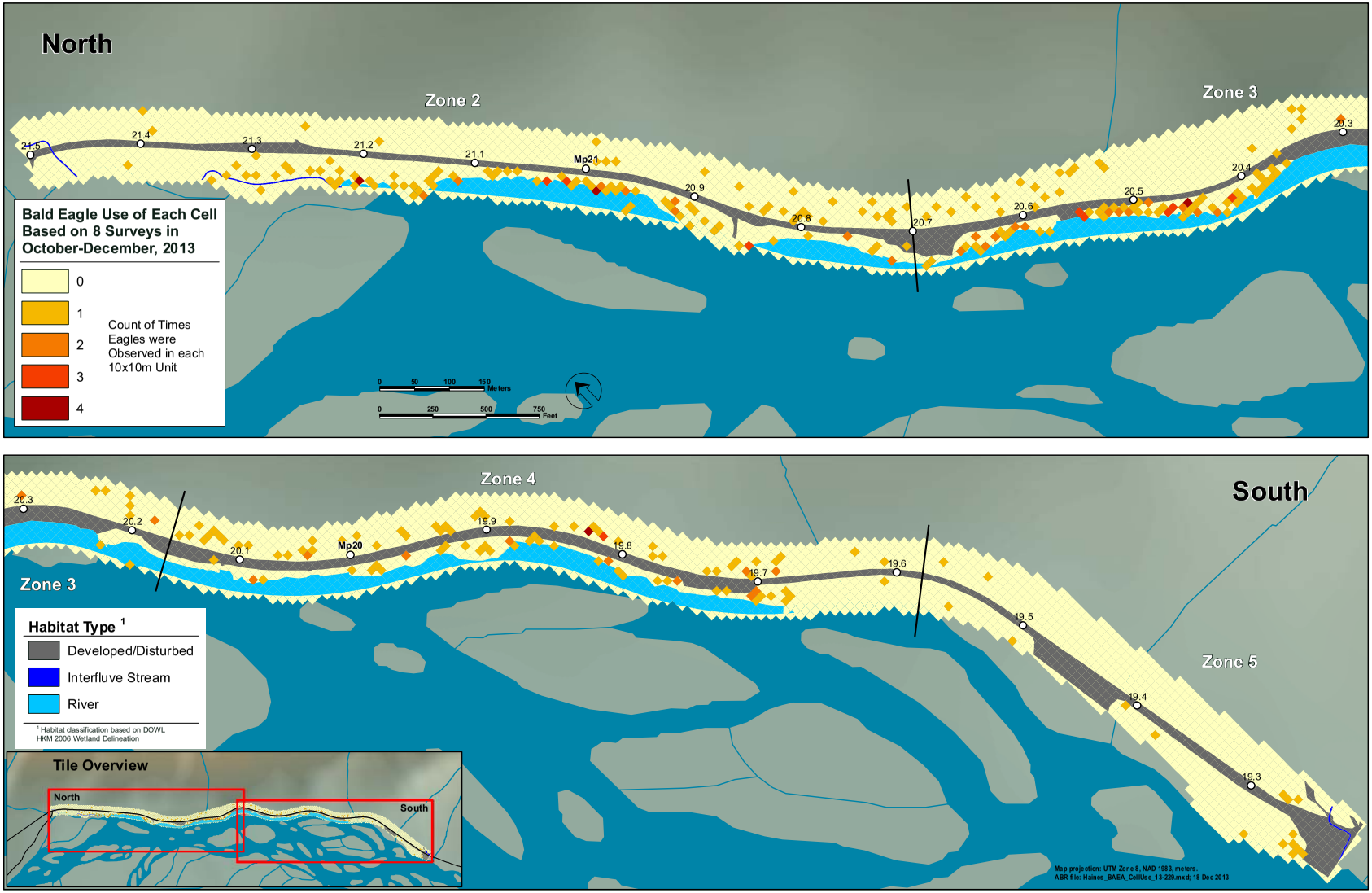
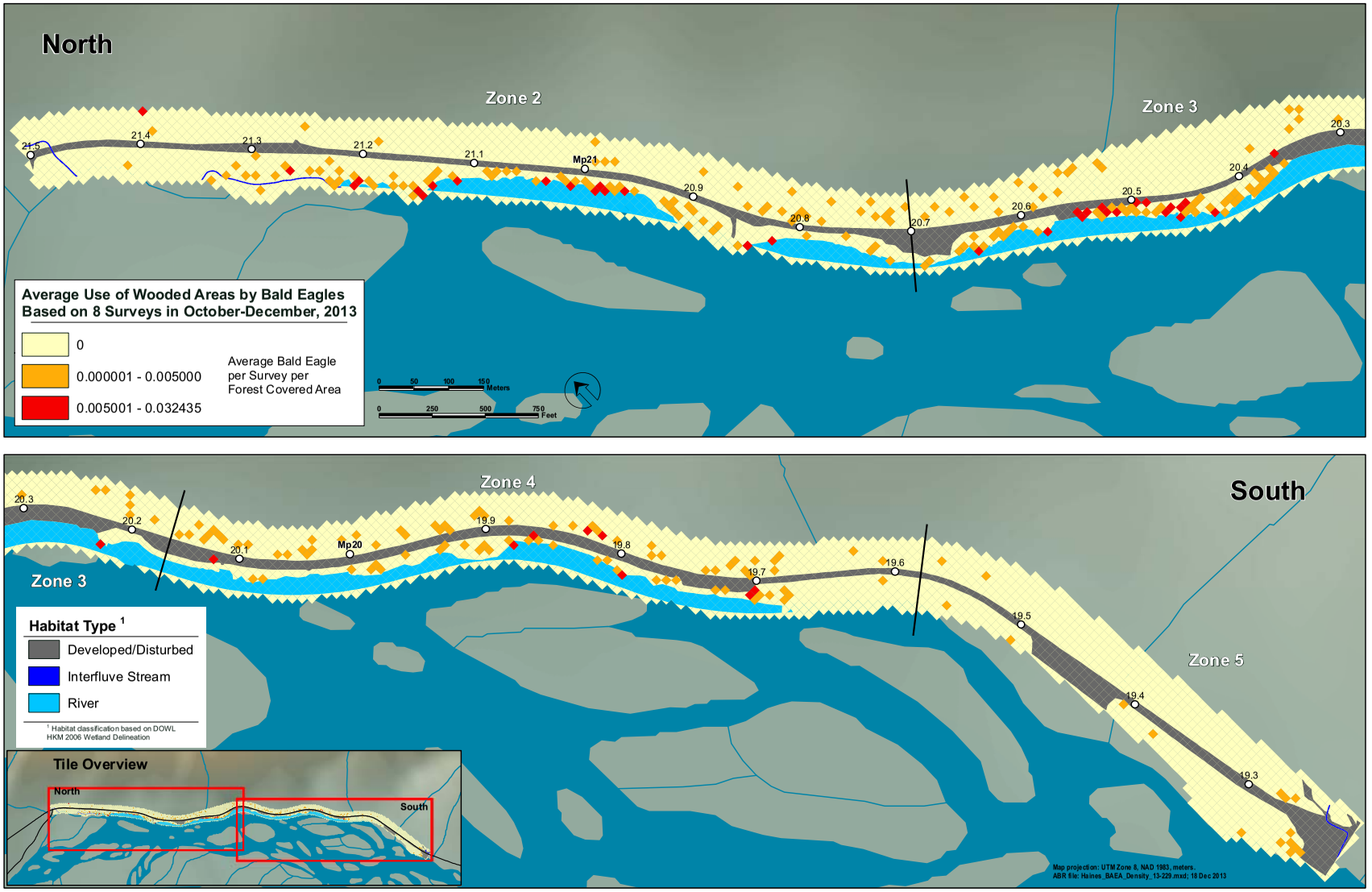
Appendix 1. Counts of perched Bald Eagles within 19 Perch Survey Zones during surveys in the Haines Highway-Bald Eagle Study Area, Chilkat River, Alaska, 2013.

	Survey Date																							
	16 Oct			17 Oct			1 Nov			7 Nov			13 Nov			20 Nov			27 Nov			5 Dec		
Zone	Adults	Subadults	Subtotal	Adults	Subadults	Subtotal	Adults	Subadults	Subtotal	Adults	Subadults	Subtotal	Adults	Subadults	Total	Adults	Subadults	Subtotal	Adults	Subadults	Subtotal	Adults	Subadults	Subtotal
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	13	10	23	6	8	14	38	14	52	26	8	34	20	8	28	21	3	24	22	4	26	14	2	16
3	10	1	11	11	1	12	31	2	33	26	3	29	20	0	20	19	1	20	31	1	32	14	0	14
4	16	3	19	15	4	19	29	0	29	15	2	17	19	2	21	6	1	7	11	0	11	17	3	20
5	3	0	3	1	0	1	6	0	6	2	0	2	0	0	0	0	1	1	8	0	8	0	1	1
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
9	0	1	1	3	0	3	0	0	0	2	2	4	1	0	1	0	0	0	0	0	0	1	0	1
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
11	1	1	2	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0
12	0	0	0	1	0	1	0	0	0	2	0	2	1	0	1	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0
15	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	1	0	1	2	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	46	16	62	39	14	53	104	16	120	76	15	91	62	10	72	47	6	53	74	5	79	47	6	53



Appendix 2. Frequency of use of perch locations by Bald Eagles within 10 m × 10 m cells in the Council Grounds, Perch Survey Zones 2–5, Chilkat River, Alaska, 16 October–5 December 2013.



Appendix 3. Average use of perch locations by Bald Eagles within 10 m × 10 m cells in the Council Grounds, Perch Survey Zones 2–5, Chilkat River, Alaska, 16 October–5 December 2013.

Appendix 4. Bald Eagle-vehicle collision interactions and mortality records from a number of published and unpublished North American sources.

Cause of Mortality	Region	Range of Years	Total specimens	% = collisions	Sources	Comments	Reference
trauma	Alaska	1975–1989	344	24.7	collection	includes vehicles	Thomas 2008
trauma	North America		87	24	collection	includes vehicles	Schmeling and Locke 1982
trauma	North America	1963–1984	1428	23	misc.	includes vehicles; totals include samples from other literature referenced here	Buehler 2000
vehicles	North America						Hager 2009
vehicles	Virginia	1993–2003	95	6	Rehab Center	numerous injured eagles	Harris et al. 2007
collision	Western Canada	1986–1998	145	24			Wayland et al. 2003
vehicles	Montana/western states	1979–1997	57	7	Band Recoveries		Harmata et al 1999
impact trauma	Alaska and other states	varied	76	9.2	collection	no reference to vehicles for Alaskan birds	Coon et al. 1970
vehicles	Michigan	1987–2008	774	29	collection	numerous Bald Eagle-vehicle collisions; carrion on highways	http://www.fws.gov/midwest/news/324.html
vehicles	North America	no dates	10	10	collection		Keran 1981
vehicles	North America	through 1979	173	4	Band Recoveries		Keran 1981
vehicles	Minnesota	1974–1979	88	?	Rehab Center	numerous Bald Eagle-vehicle collisions	Keran 1981
vehicles	Idaho	2011–2012	>5	?	DOT	Highway 30 near Montpelier, Idaho	USFWS 2012
autos/train	Oregon		5	?	FWS	multiple highways/one train	D. Leal, pers. comm.; unpubl. data
vehicles	Maine	1998–2013	50	?	DOT	numerous Bald Eagle-vehicle collisions; carrion on interstates	R. Bostwick, Maine DOT-ENV; unpubl. data
vehicles	Florida	1963-1994	?	44	Dot	numerous Bald Eagle-vehicle collisions reported	FFWCC 2008