SPRING 2017 RAPTOR MIGRATION REPORT

GUNSIGHT MOUNTAIN HAWKWATCH – ALASKA

HawkWatch International, Inc.

Salt Lake City, Utah

Anchorage Audubon Society

ALASKA DEPARTMENT OF FISH AND GAME

HAWKWATCH INTERNATIONAL

Conserving Raptors and Our Shared Environment

www.hawkwatch.org

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INTRODUCTION

The Gunsight Mountain HawkWatch in southcentral Alaska is a new effort to monitor population trends of migratory raptors breeding in portions of southern and western Alaska. HawkWatch International (HWI) initiated full-season standardized counts at Gunsight Mountain in spring 2016, however the area has been a well-known migration corridor since the 1970s. Bob Dittrich and Ted Swem conducted sporadic counts at Gunsight Mountain in the 1980s, and several years of incomplete counts were conducted between 2003 – 2009 (Fritz and Fritz 2011). In 2015, HWI conducted 2-weeks of exploratory spring migration counts with funding provided by the U.S. Fish & Wildlife Service and Anchorage Audubon Society. In 2016, HWI conducted the first full-season of standardized spring migration counts at Gunsight Mountain with support from The Eppley Foundation for Scientific Research and Anchorage Audubon Society. A second full-season of standardized counts was conducted in 2017 with support from Alaska Department of Fish and Game (ADFG) and the Anchorage Audubon Society. HWI will operate the site for a third consecutive year in spring 2018 with generous support from ADFG.

The Gunsight Mountain HawkWatch was 1 of 9 long-term, annual migration counts operated or co-sponsored by HWI in North America during autumn 2016 and spring 2017. The primary objective of these efforts is to track long-term regional population trends of diurnal raptors in western North America and around the Texas Gulf Coast (Hoffman and Smith 2003; Smith et al. 2001, 2008 a, b). The status of many of Alaska's raptor species is assessed via the citizen science-based Breeding Bird Survey (BBS), which does not sample raptors well in Alaska because of the remoteness of the state, and the nature of the survey protocol (it is designed for songbirds along roads that have relatively small territories and are very vocal). Monitoring a portion of Alaska's migrant raptors via counts at Gunsight Mountain may add substantially to our knowledge of raptor population size and health in the state. Gunsight Mountain falls within the Northwestern Interior Forest, Northern Pacific Rainforest, and Western Alaska bird conservation regions, and the Pacific Birds Habitat Joint Venture. Raptors can serve as important biological indicators of ecosystem health (Bildstein 2001) and long-term migration counts can be a cost effective and efficient method for monitoring regional status and trends of multiple raptor species (Zalles and Bildstein 2000).

In addition to long-term counting and banding efforts, HWI conducts and supports other studies to further our knowledge about the biology of migrating raptors. Some of these efforts include: telemetry work to identify species' ranges, migratory routes, and connectivity, as well as blood sampling to track changes in raptor health (e.g., Hoffman et al. 2002, Lott and Smith 2006, Goodrich and Smith 2008, DeLong and Hoffman 2004, McBride et al. 2004).

Beyond having scientific and conservation value, each site in HWI's migration network offers unique opportunities for the public to learn about raptors and the natural environment. Providing such opportunities is an important component of the Gunsight Mountain HawkWatch and HWI's overall mission. With thousands of people driving the Glenn Highway in Alaska each year and easy accessibility, Gunsight Mountain offers excellent opportunities for public outreach and educating visitors about the conservation needs and biology of raptors and the ecosystems of the great state of Alaska.

STUDY SITE

The migration at Gunsight Mountain is unique among sites in HWI's network for a variety of reasons. Gunsight Mountain is a valley migration site lying in the Tahneta Pass between the Chugach and Talkeetna Mountain ranges, 155 km miles northeast of Anchorage and 113 km from Palmer along the Glenn Highway (Figure 1A). These two glacial-covered mountain ranges may act as barriers to migration for two reasons: 1) minimal thermal lift is generated over glaciers, and 2) raptors tend to avoid sparsley vegetated landscapes. As raptors move in a southwesterly direction through the valley during spring, these two mountain ranges act as a natural funnel, concentrating migrating raptors through the Tahneta

Pass. Several feet of snow usually cover the ground throughout much of the migration season, providing excellent reflective underside lighting on sunny days. Gunsight Mountain is also the only spring migration site in HWI's current migration network.

The Gunsight Mountain count sites (described in Methods) are located at various pullouts along the Glenn Highway, Matanuska-Susitna Borough, Alaska. The count sites can be easily accessed immediately adjacent to the Glenn Highway at mileposts 121, 120, and 118.8 (Figure 1B). Early season counting is conducted at the milepost 121 pullout as the bulk of Golden Eagle passage occurs along the distant Syncline Mountains to the north. Mid- and late-season counting is conducted at the milepost 120 pullout as the migratory flight shifts away from the Syncline Mountains and is dominated by flights overhead and over the valley north of the Chugach Range for all species. Two days of counting are also performed at the milepost 118.8 pullout concurrent with the annual Anchorage Audubon Society and Mat-Su Birders Hawk Watch Weekend. Observation site elevations range from 918 – 985 m and provide excellent views of the valley and surrounding mountains to the north, east, and south. Gunsight Mountain itself (el. 1,963 m) largely obstructs views to the west. The predominant vegetation within the valley consists of Black Spruce (*Picea mariana*), Alder (*Alnus sp.*), and Willow (*Salix sp.*).

METHODS

From 7 March – 15 May, HawkWatch International (HWI) conducted spring raptor migration counts at Gunsight Mountain. Hawk counts were primarilyconducted by two experienced observers (F. Nicoletti and F. Simeone) with several seasons of raptor migration experience (Appendix A). Additional survey effort (minimum of 6 days) was provided by HWI staff (N. Paprocki: 9 days), volunteer Step Wilson (10 days), volunteer Dan Crowson (7 days), volunteer Steve Ericson (7 days), volunteer Bob Power (6 days), and numerous other volunteers from the Anchorage Audubon Society and Mat-Su Birders.

We conducted counts at three different pullouts along the Glenn Highway, Matanuska-Susitna Borough, Alaska (Figure 1B). Counts from 7 March – 31 March were conducted from the milepost 121 pullout (GPS coordinates: 61.881901, -147.336551). Counts from 1 April – 15 May were conducted at the milepost 120 pullout (GPS coordinates: 61.865761, -147.349418). We also conducted two days of counts (15 & 16 April) at the milepost 118.8 pullout (GPS coordinates: 61.853095, -147.371737).

Weather permitting; observations usually began at 0900 H and ended at 1700 H Alaskan Standard Time. Data collection followed standardized protocols used at all HWI migration sites (Hoffman and Smith 2003). Observers routinely recorded the following data:

1. Species, age, sex, and color morph of each migrant raptor, whenever possible and applicable (Appendix B lists common and scientific names for all species, information about the applicability of age, sex, and color morph distinctions, and two-letter codes used to identify species in some tables and figures).
2. Hour of passage for each migrant; e.g., the 1000–1059 H AKST.
3. Wind speed and direction, air temperature, percent cloud cover, predominant cloud type(s), presence of precipitation, visibility, and an assessment of thermal-lift conditions, recorded for each hour of observation on the half hour.
4. Predominant direction, altitude, and distance from the lookout of the flight during each hour.
5. Total minutes observed and the mean number of observers present during each hour (included designated observers plus volunteers/visitors who actively contributed to the count [active scanning, pointing out birds, recording data, etc.] for more than 10 minutes in a given hour), recorded on the hour.

6. A subjective visitor-disturbance rating for each hour, recorded on the hour.
7. Daily start and end times for each official observer.

2017 RESULTS AND DISCUSSION

Observation effort and weather summary

Gunsight Mountain HawkWatch's standard season runs 7 March – 15 May; in 2017 observers were able to count on 67 of a possible 70 days during this period for a total of 516.25 hours (Appendix C). Daily count effort ranged from 1.25 – 11 hours depending on weather and flight conditions, and no counts were conducted on 3 days due to weather or planned off days for observers. The average hourly temperature was 0.9 ºC (Range: -19.6 – 13.7 ºC) and average wind speed was 4.7 km/hr (Range: 0 – 16.0 km/hr). The Gunsight Mountain valley is oriented in a NE-SW direction and NE winds predominated (64% of hourly wind directions) over SW winds (10% of hourly wind directions). Average atmospheric pressure was 29.65 in HG (Range: 29.02 – 30.45 in HG). In 2017 based on hourly recording of conditions during observation it was clear 36% of the time, partly cloudy 12% of the time, mostly cloudy 18% of the time, and overcast 35% of the time. Compared to 2016, the 2017 season averaged colder, with higher atmosepheric pressure, and less cloud cover (Appendix D).

FLIGHT SUMMARY

2017 Overall Flight (Fig. 3, Appendix C):

A total of 2,468 migrant raptors of 13 species were counted in 2017 (Table 1) for a total passage rate of 480 raptors per 100 hours of observation. This total and passage rate were considerably lower than our only previous year of full-time counts (3,087 and 628, respectively in 2016). Raw counts of Northern Harrier, Sharp-shinned Hawk, Rough-legged Hawk, and Golden Eagle were all considerably lower in 2017 compared to 2016 (Appendix C).

The 2017 flight consisted of 54% Buteos, 29% Eagles, 8% Accipiters, 7% Harriers, 0.02% Falcons, 0.01% Ospreys, and 0.0% unidentified raptors. The Red-tailed Hawk was the most commonly observed species (45% of the total), followed by Golden Eagle (29%), Rough-legged Hawk (9%), Northern Harrier (7%), and Sharp-shinned Hawk (5%). The remaining species comprised 2% or less each (Table 1).

Wind direction is known to affect passage rates at particular migration sites (Swem 1982). Since the Gunsight Mountain valley is oriented in a NE-SW direction, we calculated the following hourly passage rate averages by hourly wind direction: NE winds (all N to E winds; 64% of hourly records) = 5.17 raptors/hr; SW winds (all W to S winds; 10% of hourly records) = 3.87 raptors/hr; All other wind directions (26% of hourly records) = 3.88 raptors/hr (Figure 2). Qualitative comparisons between hourly passage rates suggests that tail winds (NE in origin) corresponded to slightly higher passage rates in both 2016 and 2017 (Appendix D).

We observed a complex distribution in the overall passage rate timing from 7 March – 15 May with three discrete peaks in passage rate (Figure 3). The first peak occurred from 27 – 31 March; second peak from 6 – 10 April; and third peak from 26 – 30 April.

Osprey and Northern Harriers (Fig. 4):

The Northern Harrier count (171) was lower than the 2016 total (244), suggesting a lower passage rate for harrier's. The Osprey count (18) was the highest ever documented at Gunsight Mountain (Table 1).

The timing of Northern Harrier migration peaked from 26 – 30 April, and was later than most other species observed (Figure 4). The 2017 harrier migration also peaked later than in 2016 (26 – 30 April vs. 21 – 25 April, respectively; Figure 4).

Accipiters (Figs. 5 & 6):

The Sharp-shinned Hawk count (134) was lower than the 2016 total (189), suggesting a lower passage rate for the species. The Northern Goshawk count (61) was very similar to the 2016 total (63).

The timing of Sharp-shinned Hawk migration peaked from 26 – 30 April, and was later than most other species observed (Figure 5). Northern Goshawk passage rates were low throughout the season, but two peaks were observered from 22 – 26 March and 6 – 10 April (Figure 6) suggesting an earlier migration than all other species except the Golden Eagle. On April 7, 2017 a total of nine migrant goshawks were counted, breaking the previous single-day record of six. The 2017 accipiter migration also peaked later than in 2016 for both Sharp-shinned Hawk and Northern Goshawk (Figure 5, Figure 6).

Buteoine Hawks (Figs. 7 & 8):

The Red-tailed Hawk count (1,104) was the highest ever documented at Gunsight Mountain, but was similar to the 2016 total (1,066). The Rough-legged Hawk count (223) was lower than the 2016 total (297) and was the third lowest count total since 2003 (includes 10 years with ≥ 16 days of counting), suggesting the possibility of recent declines in this population. Observers also counted two migrant Swainson's Hawks in 2017, esclipsing the previous single-season record of one.

The timing of both Red-tailed Hawk and Rough-legged hawk migration showed a bimodal distribution in 2017 with an early peak from 6 – 10 April and a second, smaller peak from 26 – 30 April (Figure 7, Figure 8). Contrary to most other species of raptor in 2017, the first and largest peak in the Buteo flight occurred earlier than in 2016.

The second peak in the Buteo flight (26 – 30 April) was heavily influenced by the second highest count day of the 2017 season on 29 April (172 total raptors). While only speculative, this second, delayed peak in the Buteo flight may have been influenced by poor weather in Canada prior to 29 April delaying the northward migration of many individuals (local communications). Much of the Buteo flight on 29 April consisted of adult or birds of unknown age, suggesting this peak was not the result of a later influx of immature birds.

Eagles (Fig. 9):

The Golden Eagle count (705) was substantially lower than the 2016 total (1,163), suggesting a lower passage rate for the species. However, the 2017 total was still higher than any total prior to 2016, corroborating previous observations that historical counts missed much of the Golden Eagle passage window. Bald Eagle counts were suspended in 2017 based on recommendations from the Gunsight Mountain 2016 Annual Report (HWI 2016) and Alaska Department of Fish and Game. Migrant Bald Eagles are notoriously difficult to count at Gunsight Mountain because of their unusual flight patterns (i.e., often opposite the direction of the overall flight), and HWI will continue the cessation of Bald Eagle counts unless a pressing conservation concern develops for the species.

In 2017, we again began counts on 7 March in an attempt to document the beginning of the Golden Eagle migration season. Very low passage rates during the first two, 5-day count windows (< 1.1 eagles per 10 hours) suggests we did document the beginning of eagle migration. Golden Eagle passage in 2017 peaked from 27 – 31 March (Figure 9), later than in 2016 (22 – 26 March).

Accurate aging of migrant Golden Eagles is quite difficult and often requires a full tail-spread to confirm adult vs. older sub-adults (Liguori 2004), however counters were able to assign an age category (Appendix B) to 624 Golden Eagles (88.5%) in 2017. Of the 624 Golden Eagles assigned to an age category 539 were adults (86%) while 85 were not adults (14%). Of known-aged eagles counted, only 23

(3.7%) were identified as immature (born in 2016). This suggests that immature Golden Eagles may migrate later than May 15 (McIntyre et al. 2008), move through a different migratory corridor, or are more difficult to detect while migrating. Prior Golden Eagle trapping efforts conducted at Gunsight Mountain suggested that much of the flight prior to 10 April consisted of adults and sub-adults ≥ 4 years old (95%; Alaska Department of Game & Fish and U.S. Fish & Wildlife Service unpublished data). Our 2017 age structure corroborated this as we found 531 of 559 aged eagles prior to 10 April to be adults (95%).

The significantly lower count of Golden Eagles in 2017 (705 vs. 1,163 in 2016) is concerning, however the proximate causes of this reduction are difficult to discern with only two years of full-time counts. 2017 migration flight paths from Golden Eagles trapped and transmittered at Gunsight Mountain suggests that a higher proportion of eagles took flight paths that may have made them more difficult or impossible to count (unpublished data) than in 2016. Inclimate weather that restricted counting and visibility during late March may have also contributed to lower counts in 2017. These factors are purely speculative however, and detailed analyses of transmittered eagle flight paths and weather are needed to accurately assess possible causes of the 2017 eagle count decline.

Falcons (Fig. 10):

Proportion of the overall flight for all falcon species was low (0.02%), however the American Kestrel count (8) was the highest ever recorded at the site. Observers also counted 24 Merlins, 4 Peregrine Falcons, and 2 Gyrfalcons.

We combined all falcon species in our timing analysis because of low individual species counts. The timing of Falcon migration peaked from 26 – 30 April, and was later than all other species observed (Figure 10). Low passage rates make between year comparisons difficult, but overall falcon timing may have been slightly earlier in 2017 compared to 2016 (Figure 10).

VISITOR PARTICIPATION AND PUBLIC OUTREACH

369 people made individual visits to the Gunsight Mountain HawkWatch site in 2017 to watch hawks together and learn about their migration, natural history, ecology, and some of the threats raptors face. Overall, visitors stopped at the HawkWatch 36 of a possible 67 days (54%). Many visitors also contributed officially documented volunteer time and mileage to the project (32 individuals) while assisting official observers with the count. The 2017 volunteer effort was valued at an estimated $59,588.17. This volunteer support was a huge boost to our count effort, will help fund the 2018 spring count, and if perpetuated, may be a way to continue long-term survey efforts through the use of matching funds from volunteer time and mileage. The vast majority of visitors spending time at the site were Alaskan residents visiting from the communities in and around Anchorage, Palmer, and Fairbanks. We also had visitors from as far away as California.

Frank Nicoletti and Francesco Simeone provided great daily interpretation information to visitors. Additionally, Neil Paprocki gave two formal presentations on raptor migration at Gunsight Mountain to Anchorage Audubon Society members and the general public on 8 March and 16 April to a total of 110 attendees. Finally, the 2017 Hawk Watch Weekend hosted by the Anchorage Audubon Society and Mat-Su Birders was a huge success with over 230 total visitors over the jovial 2-day weekend. Raptor identification workshops were offered to visitors on both days by Bob Dittrich and Neil Paprocki.

2016 FALL MIGRATION ACROSS HWI'S NETWORK

HawkWatch International and partners operated 8 fall count sites in 2016 (Figure 1). During the 4,451 hours of standardized observation, we counted 713,979 migrating birds of prey. The power and utility of HWI's network of fall count sites, and long-term monitoring in general, lies in that it allows identification

of patterns in regional raptor populations, both over time at a single site and also network-wide. Declines in counts or passage rates for a species or group of species at the regional level can highlight the need for more focused research or management attention at local scales, while increases may indicate the success of management and conservation efforts. While each site in HWI's network varied in terms of individual species or group counts, notable network-wide patterns in 2016 included (Table 2):

- Below average Kestrel numbers at 5 of 8 sites (no sites w/ above average counts).
- Below average counts for Prairie Falcons and Osprey at 5 of 8 sites.
- Above average Merlin counts at 5 of 8 sites, only exception was Manzanos with a count below average (this site had second lowest overall (all raptors) count in 32-yr history)
- Above average counts at Bridger, Commissary, and Grand Canyon for second year in a row overall and for most species.
- Below average counts for Red-tailed Hawks at 4 of 8 sites, including a record low at Corpus Christi; above average counts at 3 sites.
- Record highs for:
    - Golden Eagles at Commissary (only network site w above average Golden Eagle count)
    - All falcons except Kestrels and Northern Harriers at the Grand Canyon
    - Bald Eagles at Chelan Ridge
    - Mississippi Kites at Corpus Christi (shattered previous record of 27,285)

HWI partners with Hawk Mountain Sanctuary, the Hawk Migration Association of North America (HMANA), and Bird Studies Canada (BSC) to provide western US data for the Raptor Population Index (RPI), a collaborative standardized effort to monitor raptor migration across North America.

ACKNOWLEDGMENTS

Funding for the 2017 migration count at Gunsight Mountain was generously provided through a working agreement with the Alaska Department of Fish and Game, greatly facilited by Travis Booms. HWI private donors and members also contributed financial support. The 2017 count would not have been possible without funding for a 2-week exploratory count in 2015 provided by Steve Lewis of the U.S. Fish & Wildlife Service and the Anchorage Audubon Society and a full-season count in 2016 funded by the Eppley Foundation for Research.

None of this work would have been possible without the intrepid early observations conducted at Gunsight Mountain by Bob Dittrich, Ted Swem, and others. Paul and Cecily Fritz carried the torch of hawkwatching at Gunsight Mountain during the 2000s, and greatly inspired the local bird watching communities in Anchorage and Palmer to become more involved in counting at Gunsight. Their article on "The Hawks of Gunsight Mountain, Alaska" in a 2011 issue of Birding Magazine initially introduced HawkWatch International to the site during the summer of 2014. We are indebted to all of these people for discovering the site, conducting historic migration counts, and for rallying local community support.

A huge thank you must be extended to all of the volunteer observers who assisting in this count effort, and for providing their volunteer time and mileage information to the Alaska Department of Fish and Game for future funding efforts. The local birding community from the Anchorage Audubon Society and Mat-Su Birders put on another fabulous and well-attended Hawk Watching Weekend in 2017. White Keys (Anchorage Audubon) again played an enormous role in volunteer recruitment, organization, and other logistical aspects of the project. Paul and Sue Wiltse provided generous food donations to our 2017 crew, for which we are very grateful. Special thanks to Tom "Hawk" and Dove Hawkins for their hospitality and company at Sheep Mtn Vacation Rentals. Finally, enormous thanks and appreciation to

our 2017 observers: Frank Nicoletti and Franceso Simeone. Your willingness to brave the cold Alaskan spring will not be forgotten!

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Table 1. Counts and historical records of spring migrating raptors at the Gunsight Mountain HawkWatch, AK. Note that 2003 – 2016 mean counts represent 8 years of partial-season counts from 2003 – 2009 & 2015, and one full-season of counts in 2016; all other years had less than 16 days of counts conducted and were not included in our summary data, but are included for purposes of daily records.

		2003-2016		All-time Historical Records	
	Species	**Mean Count[1]**	**2017**	**Season**	**Daily**
	Osprey	3.0	18	18 (2017)	6 (2016)
	Northern Harrier	192.4	171	493 (2006)	167 (2006)
	Short-eared Owl	0.1	1	1 (2x)	1 (2x)
Accipiters					
	Sharp-shinned Hawk	101.7	134	227 (2006)	58 (2006)
	Northern Goshawk	22.3	61	63 (2016)	9 (2017)
	TOTAL ACCIPITERS	124.0	195	252 (2016)	
Buteos					
	Swainson's Hawk	0.3	2	2 (2017)	1 (>3x)
	Red-tailed Hawk	778.7	1104	1104 (2017)	269 (2009)
	Rough-legged Hawk	309.7	223	479 (2009)	126 (2005)
	Unidentified buteo	10.3	9		
	TOTAL BUTEOS	1099.0	1338	1538 (2009)	
Eagles					
	Golden Eagle	407.7	705	1163 (2016)	229 (2016)
	Unknown eagles	0.1	0		
	TOTAL EAGLES	407.8	705	1163 (2016)	
Falcons					
	American Kestrel	2.1	8	8 (2017)	3 (2007)
	Merlin	11.6	24	27 (2016)	7 (2011)
	Peregrine Falcon	2.8	4	6 (2005)	3 (2005)
	Gyrfalcon	0.3	2	2 (2017)	1 (>3x)
	Unidentified falcon	0.2	0		
	TOTAL FALCONS	17.0	38	38 (2017)	
	Unidentified Raptor	9.1	2		
	GRAND TOTAL	1852.4	2468	3087 (2016)	429 (2005)

[1]Data obtained from hawkcount.org and primarily collected by Cecily Fritz, Paul Fritz, Bob Sartor, Charlie Sartor, and other volunteers. Used with permission.

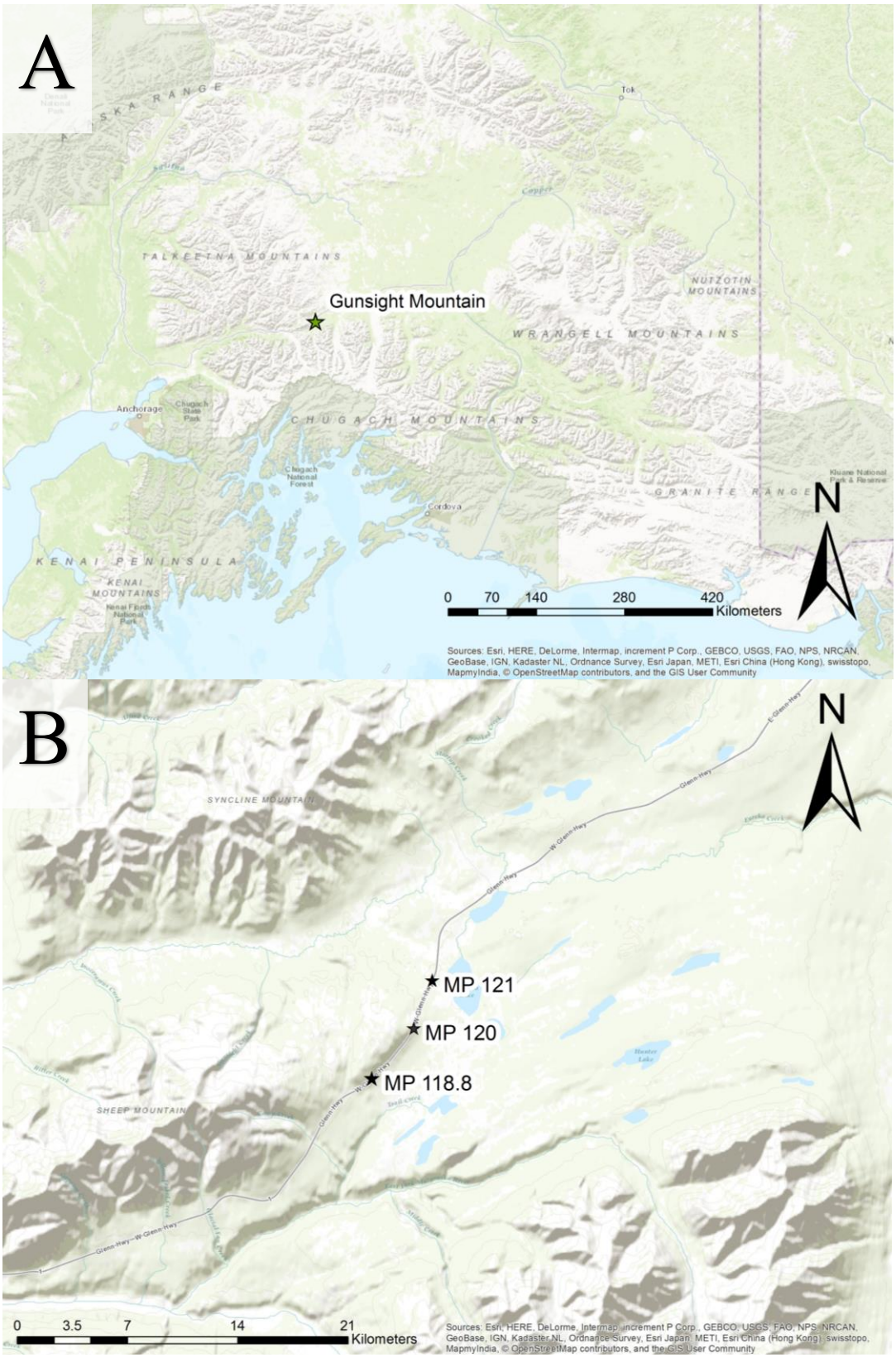

Figure 1. The location of (A) Gunsight Mountain, Matanuska-Susitna Borough, Alaska and (B) three count sites used during spring migration from 7 March – 15 May.

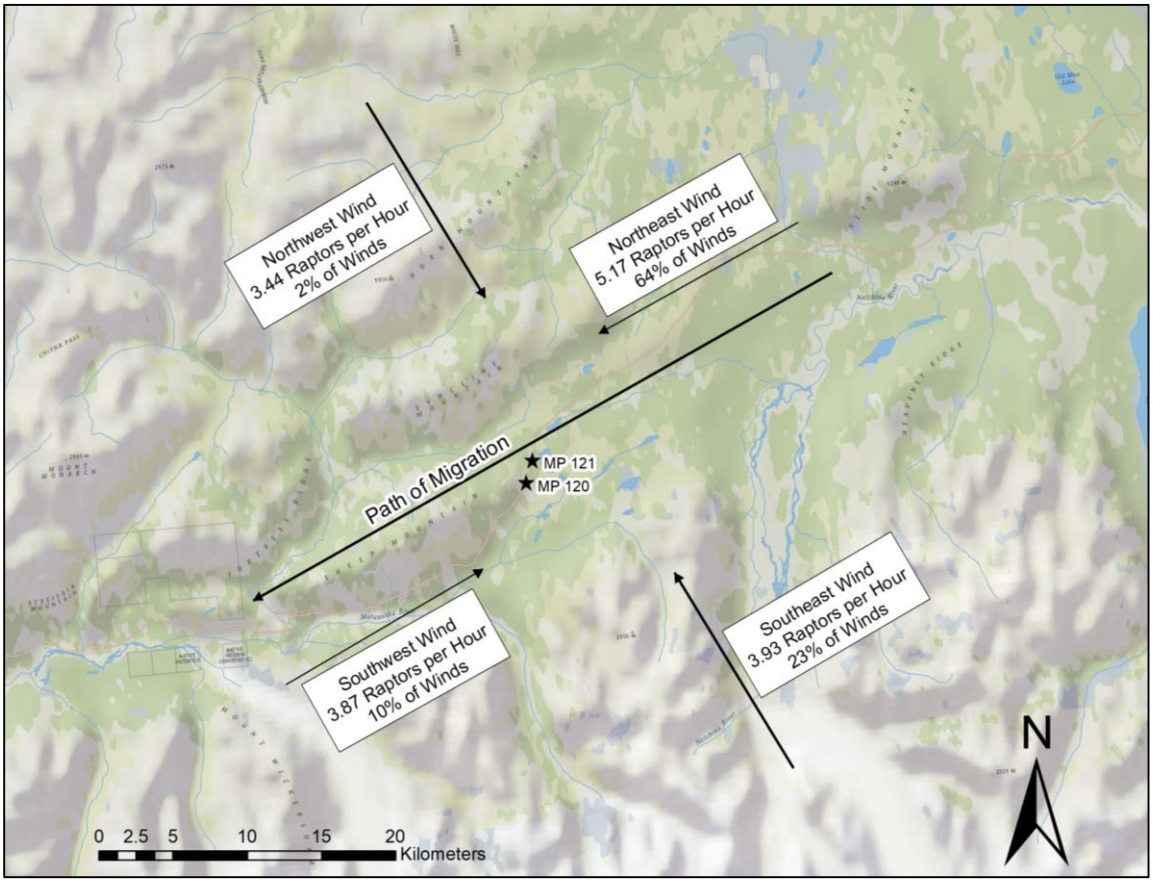

Figure 2. 2017 hourly passage rates by hourly wind direction at Gunsight Mountain, Matanuska-Susitna Borough, Alaska.

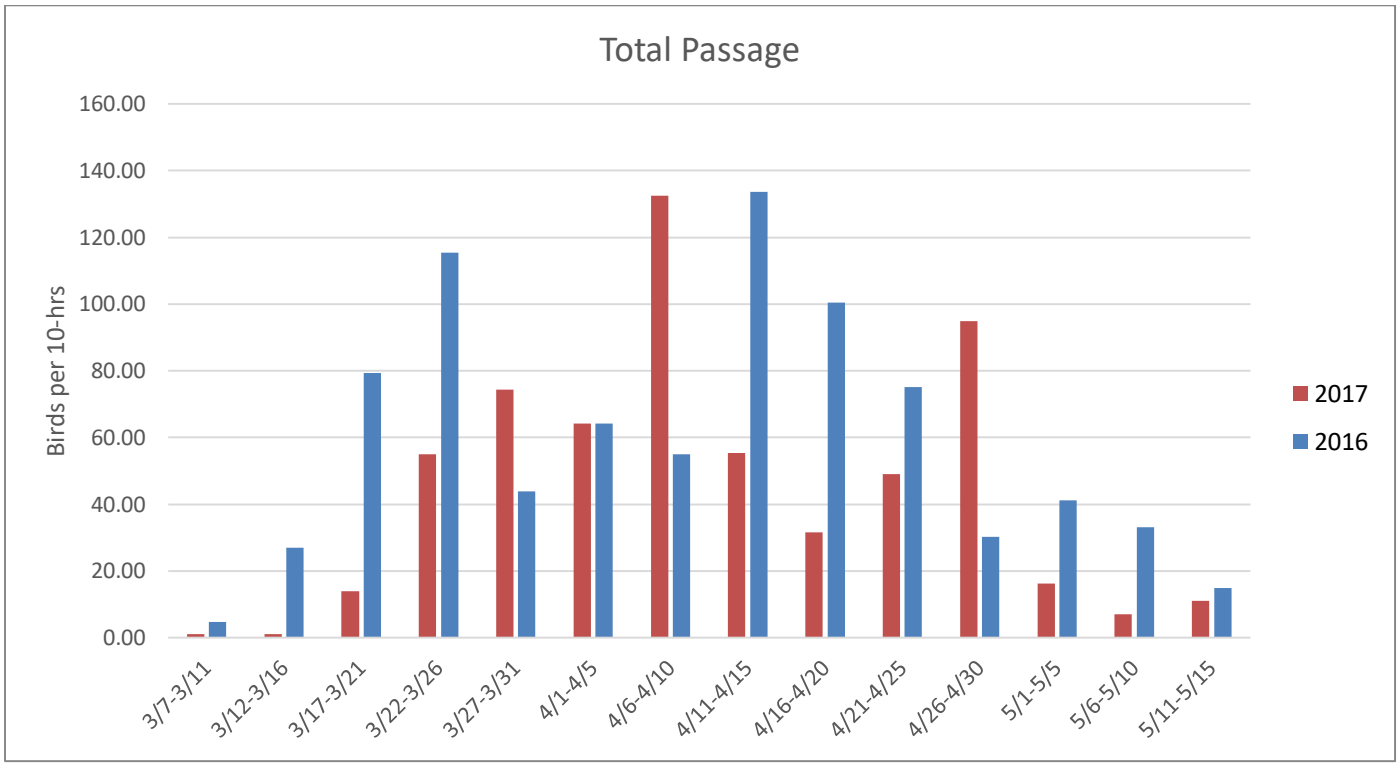

Figure 3. Spring 2016 (blue) and 2017 (red) Total Migrant Raptor Passage Rates within 5-day Windows at Gunsight Mountain, AK.

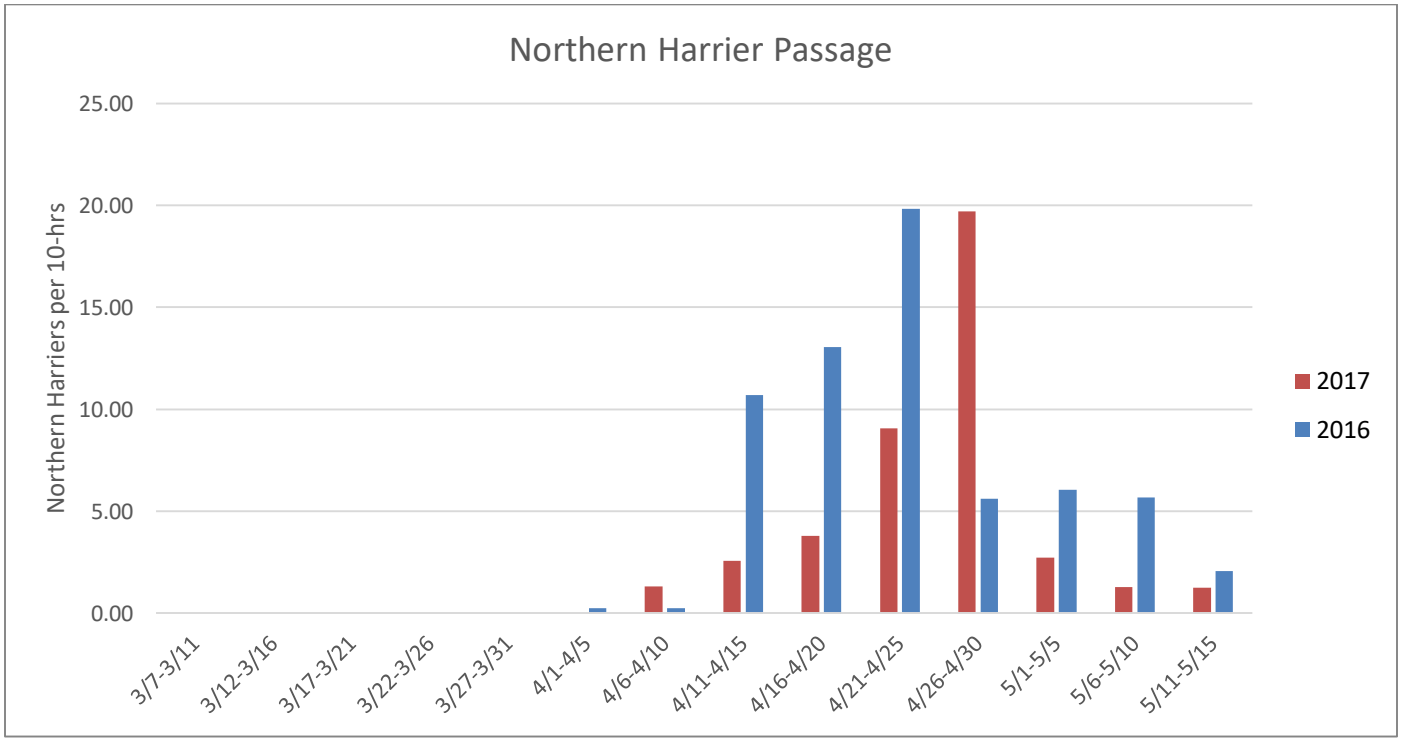

Figure 4. Spring 2016 (blue) and 2017 (red) Northern Harrier Passage Rates within 5-day Windows at Gunsight Mountain, AK.

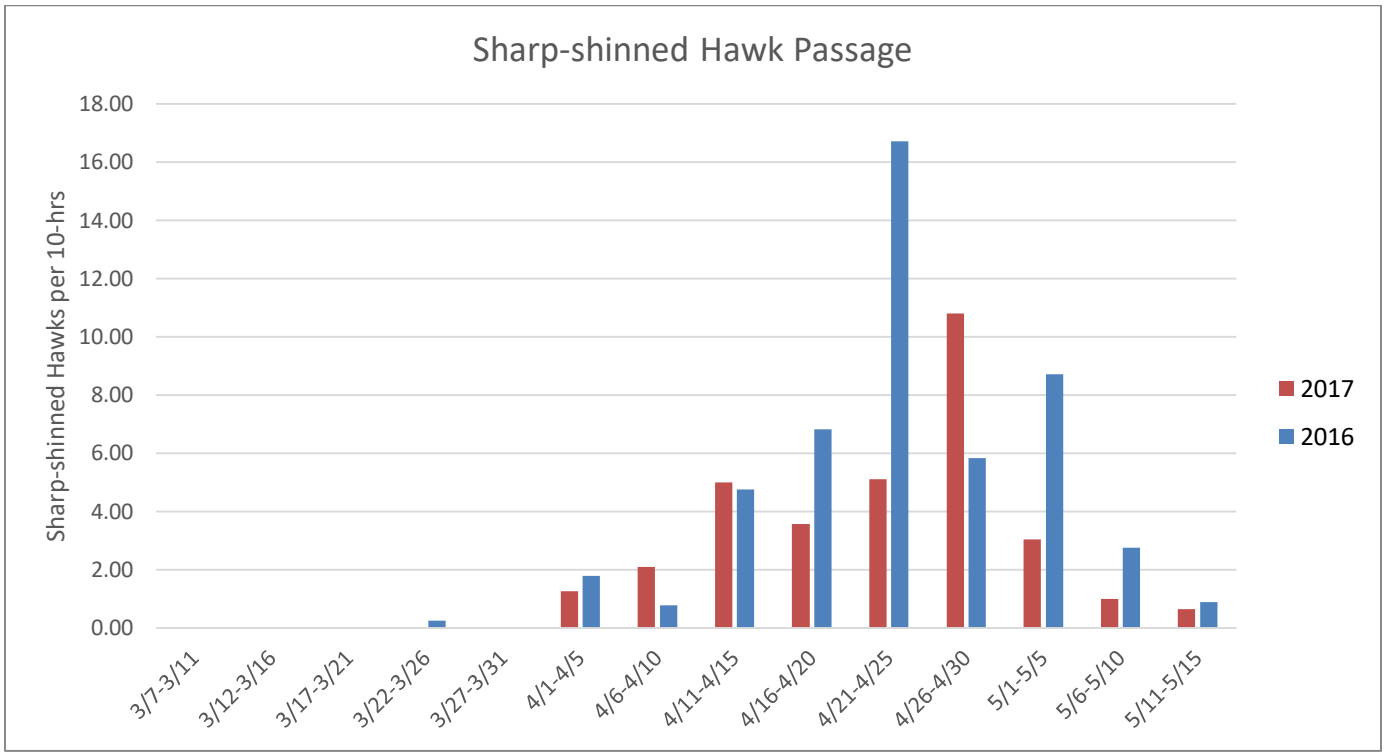

Figure 5. Spring 2016 (blue) and 2017 (red) Sharp-shinned Hawk Passage Rates within 5-day Windows at Gunsight Mountain, AK.

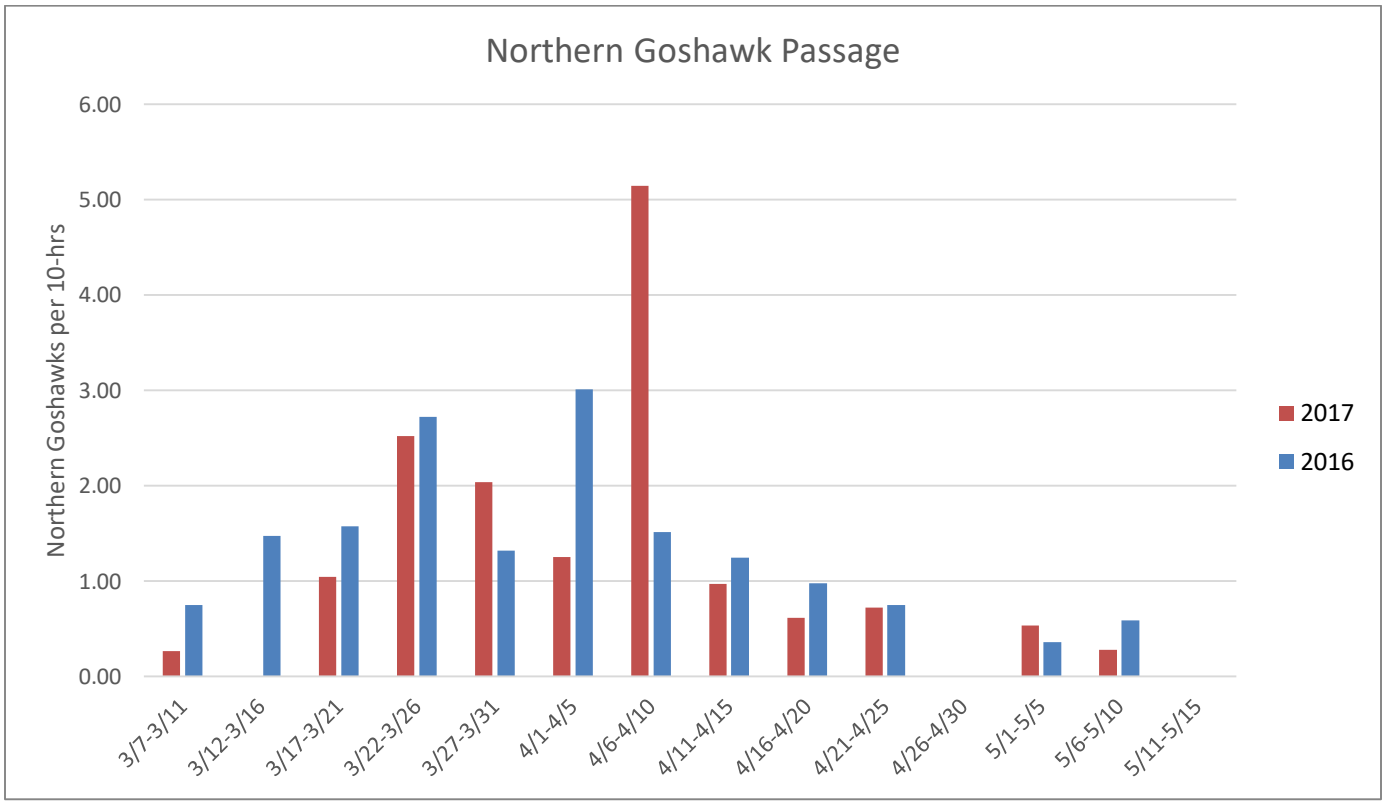

Figure 6. Spring 2016 (blue) and 2017 (red) Northern Goshawk Passage Rates within 5-day Windows at Gunsight Mountain, AK.

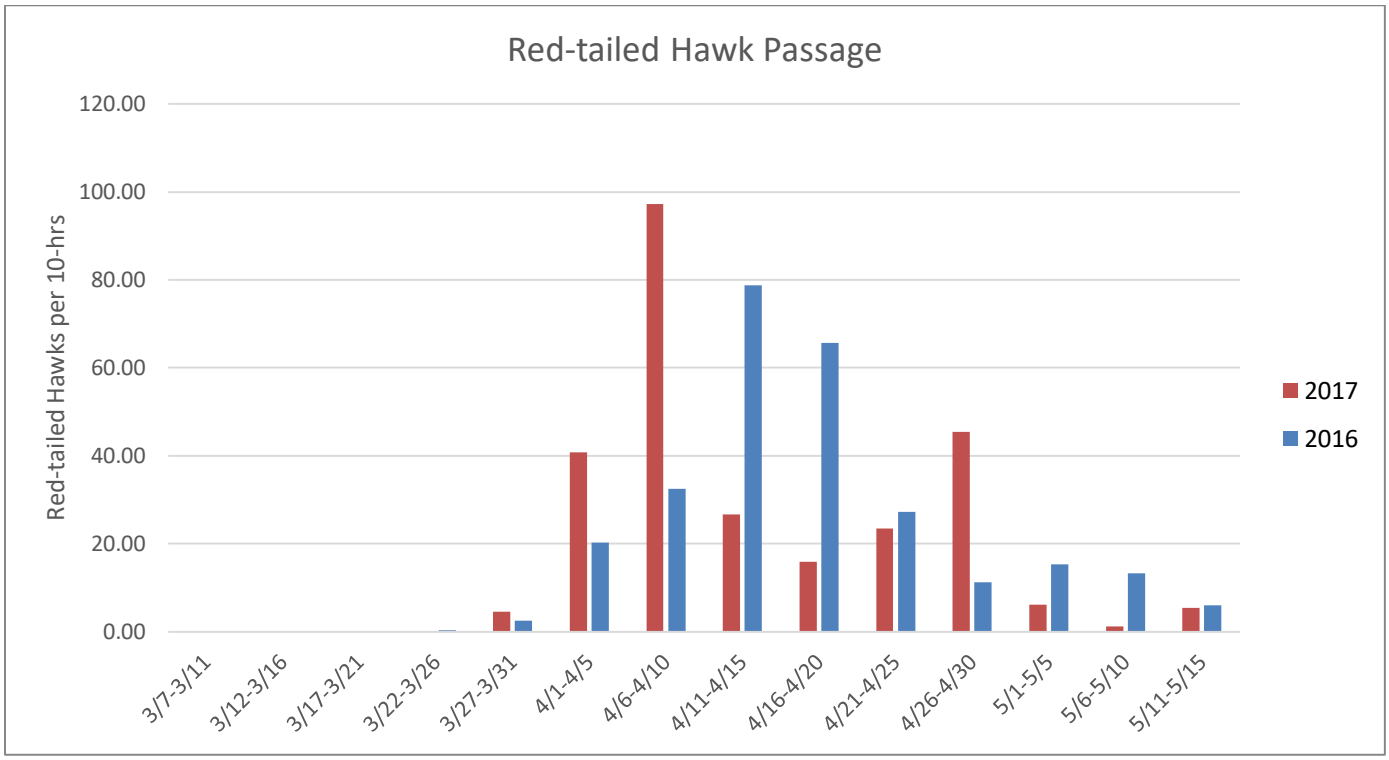

Figure 7. Spring 2016 (blue) and 2017 (red) Red-tailed Hawk Passage Rates within 5-day Windows at Gunsight Mountain, AK.

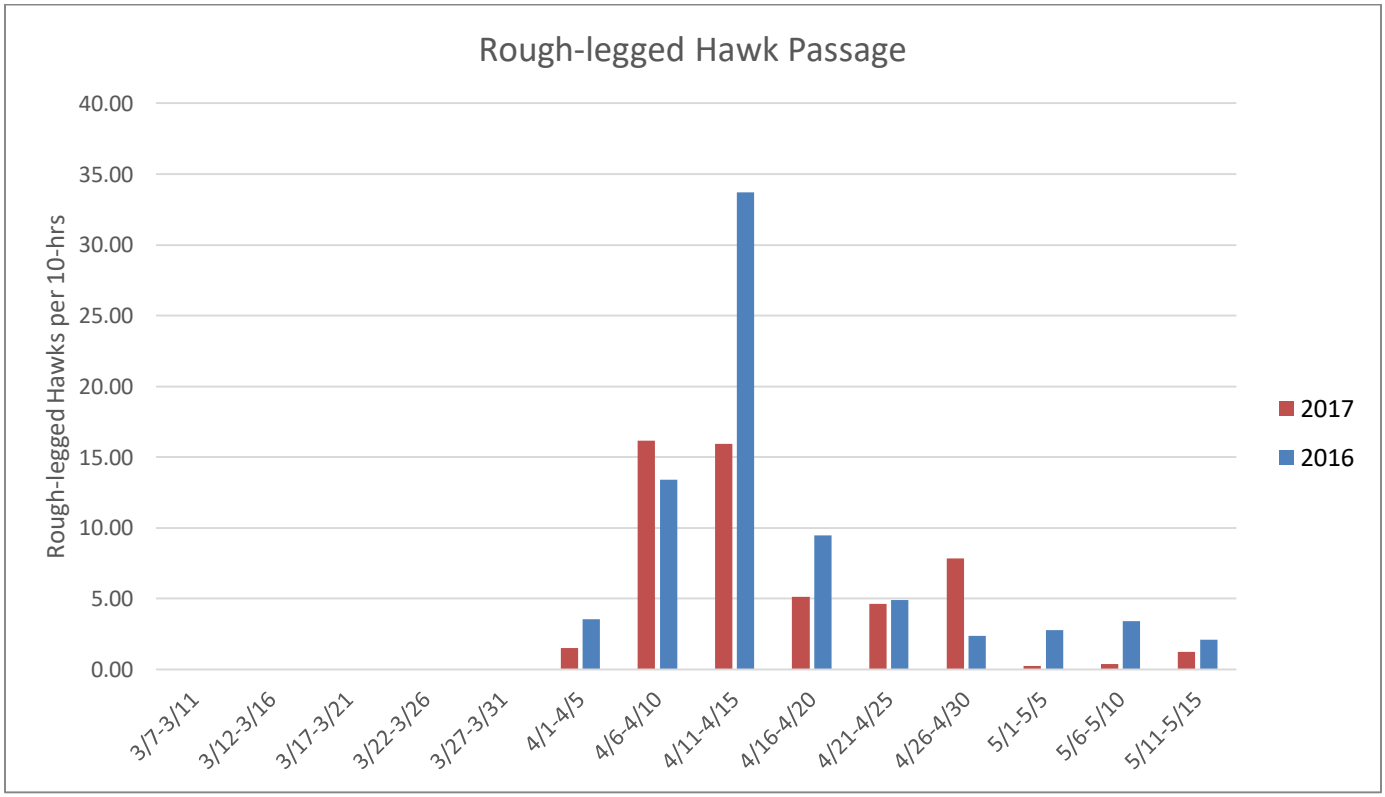

Figure 8. Spring 2016 (blue) and 2017 (red) Rough-legged Hawk Passage Rates within 5-day Windows at Gunsight Mountain, AK.

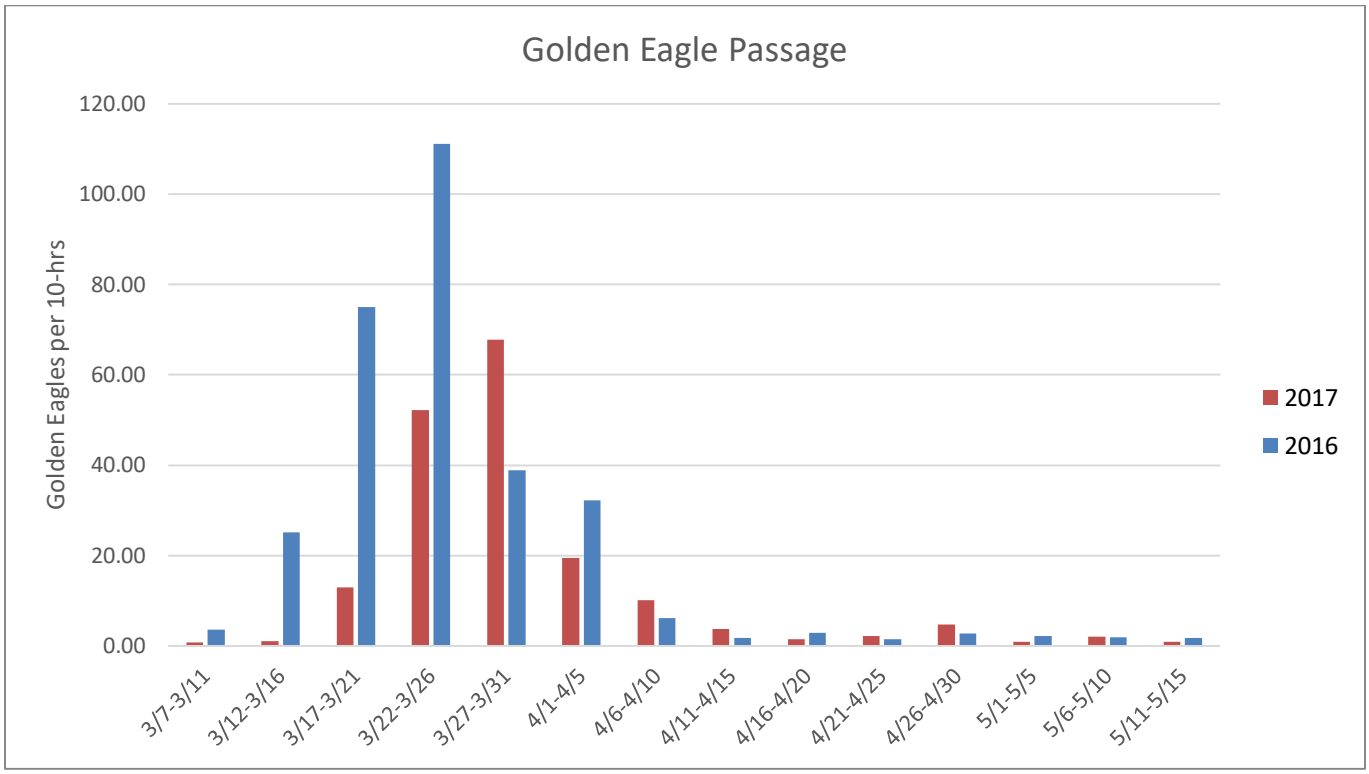

Figure 9. Spring 2016 (blue) and 2017 (red) Golden Eagle Passage Rates within 5-day Windows at Gunsight Mountain, AK.

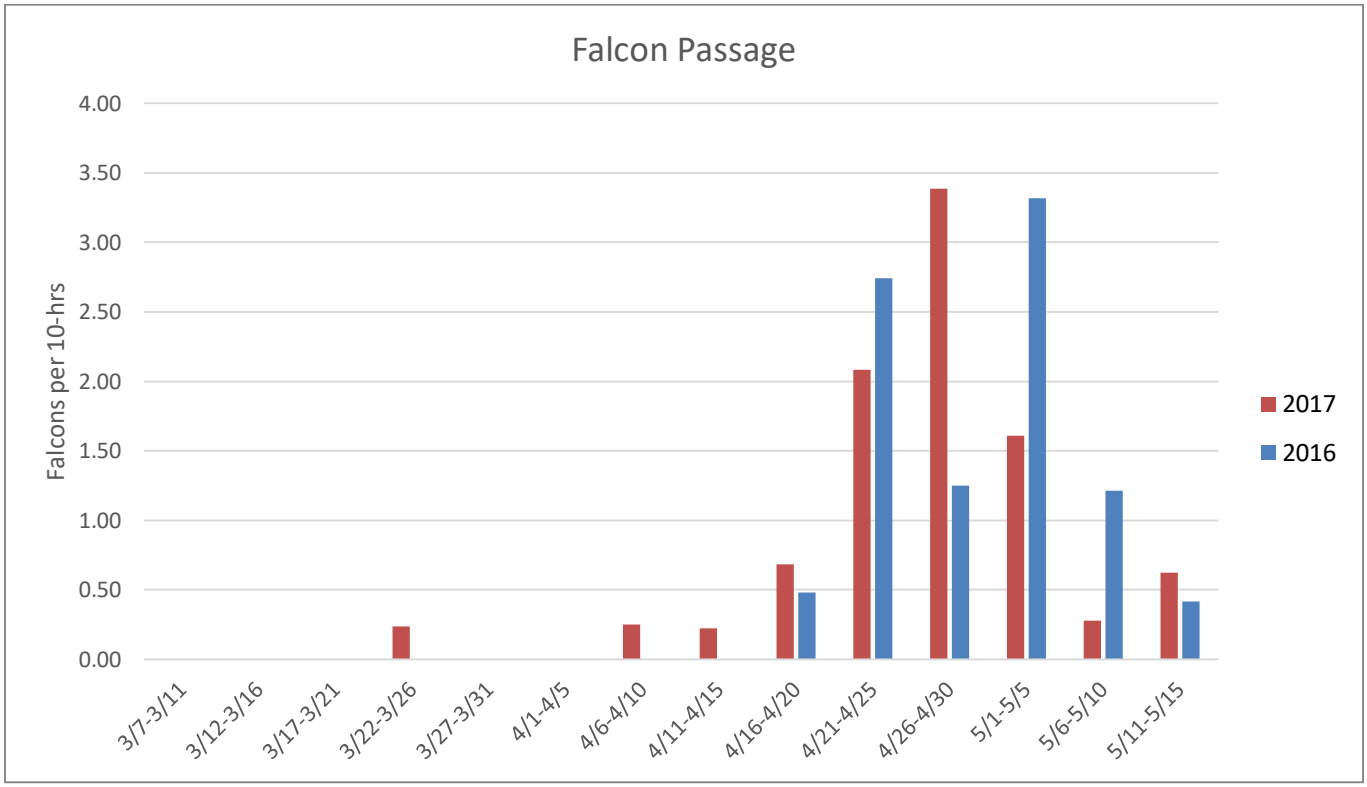

Figure 10. Spring 2016 (blue) and 2017 (red) Falcon Passage Rates within 5-day Windows at Gunsight Mountain, AK.

Table 2. Summary of the 2016 fall flight of migrating raptors across HWI's monitoring network. Values are counts ; green indicates a count significantly higher (outside the 95% confidence interval) than the historic site average, red indicates a count significantly lower than average, and black indicates a count that does not differ from the site average. Asterisks denote a record high or low count. *In 2016 HWI monitored fall migration for 4,452 hrs and counted 713,979 birds.*

	Bonney Butte, OR	Chelan Ridge, WA	Bridger Mtn, MT	Commissary Ridge, WY	Goshute Mts, NV	Yaki Pt, AZ	Manzano Mts, NM	Corpus Christi, TX
	Hours Counted in 2016							
Species	366	421	381.8	*573.8*	698.5	600.8	553.5	856.3
Black Vulture								140
Turkey Vulture	596	63	14	59	370		214	45293
Osprey	66	*16*	13	22	54	70	22	187
Northern Harrier	12	82	44	52	211	*68*	30	158
Crested Caracara								5
Common Black Hawk								0
Harris' Hawk								5
Accipiters								
Sharp-shinned Hawk	1146	490	616	1487	3204	1667	892	2159
Cooper's Hawk	362	196	198	536	1960	1255	466	824
Northern Goshawk	24	13	62	45	27	10	9	0
Unidentified accipiter	43	74	60	66	656	377	94	64
TOTAL ACCIPITERS	1575	773	936	2134	5847	3309	1461	3047
Buteos								
Red-shouldered Hawk	0	0		0	*3*	0	0	15
Broad-winged Hawk	4	8	31	25	91	37	8	594222
Short-tailed Hawk								0
Swainson's Hawk	0	6	4	96	180	59	149	2255
White-tailed Hawk								22
Zone-tailed Hawk							3	7
Red-tailed Hawk	344	151	212	1183	3128	1510	421	*44*
Ferruginous Hawk	0	0	3	8	9	10	5	2
Rough-legged Hawk	3	28	77	11	20	0	0	0
Unidentified buteo	25	35	16	37	102	60	22	24
TOTAL BUTEOS	376	228	343	1360	3533	1676	608	596591
Eagles								
Golden Eagle	66	87	1434	*476*	139	4	95	0
Bald Eagle	83	*18*	78	230	10	8	2	9
Unknown eagles	*11*	0	1	11	5	1	0	0
TOTAL EAGLES	160	105	1513	*717*	154	13	97	9
Falcons								
American Kestrel	9	26	88	167	893	496	237	810
Merlin	108	34	33	31	42	*22*	17	83
Prairie Falcon	2	6	14	5	11	*11*	13	7
Peregrine Falcon	17	9	30	13	26	*19*	35	224
Aplomado Falcon								0
Unidentified falcon	4	2	4	2	*43*	*33*	9	10
TOTAL FALCONS	140	77	169	218	1015	581	311	1134
Kites								
Hook-billed Kite								0
Swallow-tailed Kite								152
White-tailed Kite								13
Mississippi Kite								*35219*
Unidentified Kites								0
TOTAL KITES								*35384*
Unidentified Raptor	2	30	34	18	185	*71*	6	172
GRAND TOTAL	2927	1374	3066	4580	11369	5788	2749	682126

Figure 13. Locations of fall HawkWatch sites operated by HWI and partners (symbols with borders represent sites that conducted banding in 2016).

Appendix A. History of official observer participation at Gunsight Mountain, AK: 2003–2017.

2003[1] Voluntarily surveyed: Cecily Fritz, Paul Fritz, Bob Sartor, Charlie Sartor, and other volunteers.

2004 Voluntarily surveyed: Cecily Fritz, Paul Fritz, Bob Sartor, Charlie Sartor, and other volunteers.

2005 Voluntarily surveyed: Cecily Fritz, Paul Fritz, Bob Sartor, Charlie Sartor, and other volunteers.

2006 Voluntarily surveyed: Cecily Fritz, Paul Fritz, Bob Sartor, Charlie Sartor, Bob Dittrick, and other volunteers.

2007 Voluntarily surveyed: Cecily Fritz, Paul Fritz, Bob Sartor, Charlie Sartor, and other volunteers.

2008 Voluntarily surveyed: Cecily Fritz, Paul Fritz, Bob Sartor, Charlie Sartor, Bill Clark, and other volunteers.

2009 Voluntarily surveyed: Paul Fritz, and other volunteers.

2015 One full-time observer with additional rotating volunteer support: Neil Paprocki, and 58 volunteer observers.

2016 Two full-time observers: Rya Rubenthaler (4)[2], Caitlin Davis (1), Dan Crowson, Neil Paprocki, and other volunteers.

2017 Two full-time observers: Frank Nicoletti (35) and Francesco Simeone (1).

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[1] Historical observer information from 2003 – 2009 obtained from data entered into hawkcount.org.

[2] Numbers in parentheses indicate previous full seasons (spring and fall) of observation experience.

Appendix B. Common and scientific names, species codes, and regularly applied age, sex, and color-morph classifications for all diurnal raptor species observed during spring migration at Gunsight Mountain, AK.

Common Name	Scientific Name	Species Code	Sub-species Code[1]	Age[2]	Sex[3]	Color Morph[4]
Osprey	*Pandion haliaetus*	OS	U	U	U	NA
Northern Harrier	*Circus cyaneus*	NH	U	A I Br U	M F U	NA
Sharp-shinned Hawk	*Accipiter striatus*	SS	U	A I U	U	NA
Northern Goshawk	*Accipiter gentilis*	NG	U	A I U	U	NA
Unknown accipiter	*Accipiter* spp.	UA	U	U	U	NA
Swainson's Hawk	*Buteo swainsoni*	SW	U	U	U	D L U
Red-tailed Hawk	*Buteo jamaicensis*	RT	H, O, U	A I U	U	D L U
Rough-legged Hawk	*Buteo lagopus*	RL	U	A I U	U	D L U
Unknown buteo	*Buteo* spp.	UB	U	U	U	NA
Golden Eagle	*Aquila chrysaetos*	GE	U	I, S, NA, A, U[5]	U	NA
Unknown eagle	*Aquila* or *Haliaeetus spp.*	UE	U	U	U	NA
American Kestrel	*Falco sparverius*	AK	U	U	M F U	NA
Merlin	*Falco columbarius*	ML	U	U	U	NA
Peregrine Falcon	*Falco mexicanus*	PG	U	U	U	NA
Gyrfalcon	*Falco peregrinus*	GY	U	A I U	U	NA
Unknown falcon	*Falco* spp.	UF	U	U	U	NA
Unknown raptor		UU	U	U	U	NA

[1] Sub-species codes: H = Harlan's, O = other, U = unknown.

[2] Age codes: A = adult, I = immature (HY), Br = brown (adult female or immature), U = unknown age.

[3] Sex codes: M = male, F = female, U = unknown.

[4] Color morph codes: D = dark or rufous, L = light, U = unknown, NA = not applicable.

[5] Golden Eagle age codes: I = Immature: juvenile or first-year bird, bold white wing patch visible below, bold white in tail, no molt; S = Subadult: white wing patch variable or absent, obvious white in tail and molt or tawny bar visible on upper wing; NA = Not adult: unknown age immature/subadult; A = Adult: no white in wings or spread tail; U = Unknown.

Appendix C. Annual observation effort and spring raptor migration counts by species at Gunsight Mountain, AK: 2003–2017. Includes years where counts were conducted for a minimum of 16 days.

YEAR	2003	2004	2005	2006	2007	2008	2009[1]	2015	2016	2017
Start date	23-Mar	31-Mar	26-Mar	25-Mar	24-Mar	22-Mar	25-Mar	6-Apr	7-Mar	7-Mar
End date	17-May	2-May	1-May	7-May	6-May	2-May	30-Apr	27-Apr	14-May	15-May
Days of observation	23	22	22	17	22	28	31	16	65	67
Hours of observation	99.0	105.0	96.8	80.3	119.0	137.5	211.6	135.1	491.3	514.0
Raptors / 100 hours	1290	1080	1764	2811	1466	1385	1051	987	628	480
SPECIES										
Osprey	0	0	0	7	2	1	0	0	17	18
Northern Harrier	150	159	293	493	196	52	94	51	244	171
Short-eared Owl	1	0	0	0	0	0	0	0	0	1
Sharp-shinned Hawk	63	119	137	227	93	33	38	16	189	134
Northern Goshawk	15	5	13	9	22	17	43	14	63	61
TOTAL ACCIPITERS	78	124	150	236	115	50	81	30	252	195
Swainson's Hawk	0	1	0	1	0	0	0	0	1	2
Red-tailed Hawk	461	452	625	666	663	1078	1059	938	1066	1104
Rough-legged Hawk	265	219	357	368	310	285	479	207	297	223
Unidentified buteo	36	0	2	0	16	11	0	16	12	9
TOTAL BUTEOS	762	672	984	1,035	989	1,374	1,538	1,161	1,376	1,338
Golden Eagle	269	127	252	462	395	421	492	88	1163	705
Unidentified eagle	0	0	0	0	0	0	0	0	1	0
TOTAL EAGLES	269	127	252	462	395	421	492	88	1164	705
American Kestrel	3	3	1	2	7	0	1	0	2	8
Merlin	8	12	20	18	5	5	7	2	27	24
Peregrine Falcon	2	3	6	3	2	1	4	1	3	4
Gyrfalcon	0	0	0	1	0	1	0	0	1	2
Unknown falcon	1	0	0	0	0	0	0	0	1	0
TOTAL FALCONS	14	18	27	24	14	7	12	3	34	38
Unidentified raptor	3	35	2	0	34	0	7	1	0	2
GRAND TOTAL	1,277	1,135	1,708	2,257	1,745	1,905	2,224	1,334	3,087	2,468

[1]2003 – 2009 data obtained from hawkcount.org and primarily collected by Cecily Fritz, Paul Fritz, Bob Sartor, Charlie Sartor, and other volunteers. Used with permission.

Appendix D. Weather and flight summary for spring raptor migration counts at Gunsight Mountain, AK: 2016 & 2017.

YEAR	2016	2017
No Count Days	5	3
Total Raptors	3,087	2,468
Raptors / hour	6.3	4.8
WIND		
Average Hourly Wind km / hr	4.9	4.7
N-E wind % of hourly	52	64
N-E Raptors / hour	7.07	5.17
E-S wind % of hourly	19	23
E-S Raptors / hour	5.55	3.93
S-W wind % of hourly	16	10
S-W Raptors / hour	6.02	3.87
W-N wind % of hourly	6	2
W-N Raptors / hour	4.26	3.44
TEMPERATURE & PRESSURE		
Average Hourly Temp ℃	3.8	0.9
Average Hourly Pressure	29.45	29.71
CLOUD COVER		
Clear %	29	36
Partly cloudy %	13	12
Mostly cloudy %	23	18
Overcast %	35	35
FLIGHT DIRECTION		
No flight/not recorded %	31	35
% of flight hours (East)	23	30
% of flight hours (West)	28	29
% of flight hours (Overhead)	35	22
% of flight hours (Mixed)	13	18
FLIGHT HEIGHT		
Below eye level	2	0
Eye level to 30m	6	8
Unaided eye	71	52
At limit of unaided vision	9	34
Binoculars (to 10x)	0.3	6
Variable	12	0