

**FALL 2000 RAPTOR MIGRATION STUDIES
IN THE GRAND CANYON OF ARIZONA**

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INTRODUCTION

The Grand Canyon Raptor Migration Project in Arizona is an ongoing effort to monitor long-term trends in populations of raptors using the southern portion of the Intermountain migratory flyway (Hoffman et al. in review). The flight through this region is one of the largest concentrations of migrating raptors known in North America west of the Mississippi River. To date, observers have recorded 19 species of migratory raptors at the two sites, with combined counts typically ranging between 10,000 and 12,000 migrants per season. Chuck LaRue discovered the flyway in 1987 and Christie Van Cleve conducted exploratory counts at points along the south rim in 1989 and 1990. HawkWatch International (HWI) initiated standardized counts of the autumn raptor migration through this region at Lipan Point on the south rim of the Grand Canyon in 1991, and began standardized monitoring at a second site on the south rim (Yaki Point) in 1997. The 2000 season marked the 10th consecutive count at Lipan Point and the 4th consecutive full-season count at Yaki Point. This report summarizes the 2000 count results for both sites.

The Grand Canyon project includes 2 of 15 migration counts (12 fall, 3 spring) conducted or sponsored by HWI in North America during 2000. The primary objective of these efforts is to track long-term population trends of diurnal raptors throughout primarily western North America (see Smith and Hoffman 2000 for a comprehensive review of raptor migration monitoring in western North America). Raptors feed atop food pyramids, inhabit most ecosystems, occupy large home ranges, and are sensitive to environmental contamination and other human disturbances. Therefore, they serve as important biological indicators of ecosystem health (Cade et al. 1988; Bednarz et al. 1990a; Bildstein and Zalles 1995). Moreover, due to the remoteness and widespread distribution of most raptor populations, migration counts likely represent the most cost-effective and efficient method for monitoring the regional status and trends of multiple raptor species (Bednarz and Kerlinger 1989, Titus et al. 1989, Bildstein and Zalles 1995, Bildstein et al. 1995, Dunn and Hussell 1995, Dixon et al. 1998, Smith and Hoffman 2000).

These migration studies also offer unique opportunities for the public to learn about raptors and the natural environment, and providing such opportunities is another important component of HWI's mission. Accordingly, since 1995 the Grand Canyon field crew has included trained educators dedicated to conducting environmental education programs at the sites and facilitating interactions between visitors and the field biologists. With about 5 million people visiting the park each year and easy accessibility, the Grand Canyon sites offer excellent opportunities for public outreach and education about the ecology and conservation needs of raptors and the Grand Canyon ecosystem.

STUDY SITES

Lipan Pt. is located in Coconino County, Arizona (36° 01' 59.2" N, 111° 51' 11.5" W) along the south rim of the Grand Canyon (Figure 1) at an elevation of about 2,125 m (6,973 ft). The site is an established lookout for visitors to Grand Canyon National Park, which can be accessed by driving 3.2 km (2 mi) southwest on Hwy 64 from the east entrance to the park. The observation point is located about 170 m (520 ft) south of the parking lot at the edge of the canyon rim, directly above an Anasazi granary. The spot provides nearly a 360° view of the surrounding landscape, with excellent visibility along the canyon to the north, south, and west. The predominant vegetation consists of big sagebrush (*Artemisia tridentata*), cliffrose (*Cowania mexicana*), Utah juniper (*Juniperus osteosperma*), and two-needle pinyon (*Pinus edulis*).

Yaki Pt. is located in Coconino County, Arizona (36° 03' 31.0" N, 112° 05' 01.7" W) along the south rim of the Grand Canyon (Figure 1) at an elevation of about 2,025 m (6,644 ft). This site also is a popular canyon lookout, which visitors can access from Hwy 64 about 11.2 km (7 mi) northeast of the south

entrance to the park. The predominant vegetation is similar to that found at Lipan Pt. The view at Yaki Pt. is superb for sheer grandeur, providing views of the canyon to the west and north; however, thick vegetation obscures the view to the east from the point.

The migration over the Grand Canyon is unique among HWI's western sites because migrating raptors are not guided to the region by mountain ridges and must rely on thermal lift rather than ridge updrafts to carry them over the broad North Kaibab Plateau toward the canyon. The Painted Desert along the eastern boundary of the park (Figure 1) may serve as a barrier to many southbound migrants because most raptors tend to avoid such sparse and inhospitable habitats, although the region produces excellent thermal lift conditions. Conversely, the heavily forested North Kaibab Plateau, which lies immediately west of the desert, provides an accessible pathway toward the canyon. However, because there are no distinct ridges to serve as leading lines for migrating raptors (*sensu* Mueller and Berger 1967) and provide a concentrated, stable source of lift, the migrants probably approach the canyon along a relatively broad front. Accordingly, we at HWI hypothesize that monitoring at multiple points will ultimately provide valuable information about variation in daily and seasonal concentrations and a better index to the migration volume through the region. We also believe that Yaki Pt. and Lipan Pt. represent particularly good monitoring locations because they lie immediately across from "peninsulas" of plateau land that jut out into the canyon from the north rim. This arrangement produces especially narrow gaps between the two canyon rims, which we believe the migrants seek out, much as migrating raptors often seek the narrowest passage across large bodies of water (Kerlinger 1989).

METHODS

Four official or designated observers, assisted by local volunteers Christi Van Cleve and Kate James and on-site educators Monique Imberski and Erin McEldowney, conducted standardized daily counts of migrant raptors from traditional count sites at Yaki and Lipan Points. The official observers—Adam Hutchins, Steve Seibel, Geoff Evans, Jody Bartz—rotated between sites and observation partners to minimize potential observer bias. Volunteers Christi Van Cleve and Kate James helped with observations at Lipan Pt. only. The on-site educators helped at both sites when their education schedules allowed. This arrangement ensured that at least two counters were present at all times at both sites. Official observers Steve Seibel and Adam Hutchins each had two full seasons of previous raptor migration counting experience; Geoff Evans had received prior training at HWI's Manzano Mountains site in New Mexico; and Jody Bartz engaged in her first season of migration counting (see Appendix A for a complete history of observer participation at the two sites). Christi Van Cleve has worked nearly full-time on the Lipan Point count each year of the project, and Kate James has helped with the Lipan Pt. count on a more limited basis for several years. Other visitors to the sites also occasionally assisted in spotting migrants. The on-site educators routinely facilitated interactions with visitors, including coordinating with personnel from Grand Canyon National Park to conduct educational programs with organized groups of park visitors.

Weather permitting, observations typically began by 0900 hrs Mountain Standard Time (MST) and ended by 1700 hrs MST. The 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 species codes used in some tables and figures).
2. Hour of passage for each migrant; e.g., the 1000–1059 hrs MST.

3. Wind speed and direction, air temperature, percent cloud cover, predominant cloud type(s), 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 mean number of observers (official observers plus visitors who actively scanned for migrants for more than 10 minutes in a given hour) and visitors (all other guests) present during each hour.
6. Daily start and end times for each official observer.

The observers used high quality 8–10x binoculars to assist in spotting and identifying birds. Clark and Wheeler (1987), Dunne et al. (1988), and Wheeler and Clark (1995) served as primary identification references. Assessments of wind speed, cloud type, cloud cover, and flight altitude followed guidelines published by the Hawk Migration Association of North America (HMANA). Assessments of thermal lift conditions as poor, fair, good, or excellent involved subjective evaluations of solar intensity, wind speed, and migrant behavior.

The observers classified as residents and excluded from daily counts any raptor that exhibited hunting, territorial display, or perching behaviors for extended periods. The observers occasionally recorded as migrants birds that were not moving in a southerly direction, if such birds otherwise displayed migrant characteristics; i.e., continuous flight without stopping or substantially changing directions for several kilometers. Such birds may be dispersing juveniles or adults dispersing relatively short-distances from their nesting territories to favored wintering grounds in the same general region. However, recent satellite telemetry work also shows that species such as Prairie Falcons and Ferruginous Hawks frequently “migrate” in non-standard directions to take advantage of favored post-breeding and wintering grounds (Watson and Pierce 2000, K. Steenhof, USGS Snake River Field Station, personal communication).

In this report, we compare annual statistics from 2000 against means \pm 95% confidence intervals (CI) for previous seasons. We equate significance with a 2000 value falling outside of the 95% CI for the associated mean.

RESULTS AND DISCUSSION

WEATHER SUMMARY

Eight distinct rainy cold fronts passed through during this count season, compared to only three last year (see Appendixes C and D for daily weather records from the two sites). Inclement weather entirely precluded observations on six days in 2000, compared to none in 1997 and 1999 and four in 1998. Otherwise, overall the weather during 2000 on active observation days was similar to the past three years except for showing a slightly higher proportion of days with moderate as opposed to light winds, a slightly higher proportion of days with winds from the southwest to northwest, and less haze than in 1998 and especially 1999.

OBSERVATION EFFORT

The observers worked on 67 (66 at Yaki) of 71 possible days between 27 August and 5 November (Tables 1 and 2). Although lower than during the past three years, the numbers of observation days are about average for the site. Similarly, the numbers of observation hours logged at each site (497.34 at

Lipan; 513.10 at Yaki) were within 3% of average (Tables 1 and 2). The 2000 averages of 2.4 observers/hour (including official and guest observers; value is mean of daily values, which are in turn means of hourly values) at Lipan Point and 2.2 observers/hour at Yaki Point are 4% and 20% above average, which is a significant improvement for Yaki Point.

MIGRATION SUMMARY

The observers counted 5,664 migrant raptors of 16 species at Lipan Point and 5,409 migrant raptors of 17 species at Yaki Point during the 2000 season (Tables 1 and 2, and see Appendixes E and F for daily count records and Appendixes G and H for annual summaries at each site). The Lipan flight was composed of 47% accipiters, 27% buteos, 19% falcons, 2% vultures, 2% Ospreys, 2% harriers, and <1% eagles and unidentified raptors. The Yaki flight was composed of 61% accipiters, 17% buteos, 19% falcons, 1% each of vultures, Ospreys and harriers, and <1% eagles and unidentified raptors. This pattern of compositional differences between the two sites is typical, with Yaki Point consistently attracting a higher proportion of accipiters and fewer buteos than Lipan Point (Figure 2). The migration-composition differences likely reflect differences in topography around the two sites, which effect local thermal production and therefore vary the attractiveness of each site for soaring species.

In 2000, the Lipan count featured higher than average proportions of accipiters and falcons and lower than average proportions of buteos and eagles, while the Yaki flight featured significantly lower than average proportions of buteos, vultures, and harriers (Figure 2). Thus, buteos were generally underrepresented this season.

As usual, Sharp-shinned, Cooper's Hawks, Red-tailed Hawks, and American Kestrels were the four most abundant species at both sites (Tables 1 and 2). At Lipan Point, the Prairie Falcon count (9) reached a record high and the Broad-winged Hawk count (15) was the second highest ever recorded at the site (Appendix G). In contrast, counts reached record lows for Cooper's Hawk (968) and Golden Eagle (9), and ranked second lowest for Swainson's Hawk (22) and American Kestrel (1045). At Yaki Point, counts exceeded those from the previous three years for Cooper's Hawk, Northern Goshawk, Rough-legged Hawk (first ever recorded for Grand Canyon projects), and American Kestrel (Appendix H). In contrast, counts dropped below or tied the lowest count from the previous three years for nine species.

At Lipan Point, the Prairie Falcon was the only species that showed a significantly higher than average passage rate (100%) in 2000 (Table 1). In contrast, the Yaki count showed a 38% drop in Prairie Falcons (Table 2); however, combining data from the two sites still indicates a 25% increase in Prairie Falcons compared to the past three years (Table 3). An 82% higher than average count of 15 Broad-winged Hawks at Lipan Point (second highest for the project) just barely ranks as a significant difference due to high annual variation, while the corresponding passage rate falls just within the 95% confidence interval for the mean (Table 1). The Yaki count again indicates the opposite pattern—a 59% drop in Broad-winged Hawks. In this case, however, when the comparison is restricted to the last four seasons, both sites indicate a drop (14–59%) in the passage rate of Broad-winged Hawks. Here it is important to note that the Lipan data currently indicate a significant, long-term increasing trend for Broad-winged Hawks, which is consistent with evidence from many other western count sites (Smith et al. in press). At Yaki Point, the Northern Goshawk was the only commonly occurring species that showed a significantly higher than average (109%) passage rate in 2000 (Table 2). The long-term data for Lipan Point show only a 7% higher than average passage rate in 2000 for goshawks (Table 1), but when restricted to the past four years, the Lipan data also show a much higher (152%) than average passage rate in 2000 (Table 3).

At Lipan Point, eight species showed significantly lower than average passage rates in 2000 (Turkey Vulture, Cooper's Hawk, Swainson's Hawk, Red-tailed Hawk, Golden and Bald Eagles, American Kestrel, and Merlin; Table 1). The Yaki data give consistent indications for six of these species (i.e., at

least slightly below average passage rates in 2000), but give opposite indications for Cooper's Hawks and American Kestrels (Table 2), even if the comparisons are restricted to the past four years during which time both counts occurred. The divergent site-specific trends translate to a 7% combined-site increase between 2000 and the 1997–1999 average for American Kestrels, and a 14% decrease for Cooper's Hawks (Table 3).

More generally, with counts from the two sites combined, only Northern Goshawks and Prairie Falcons showed substantially (>10%) higher than average passage rates in 2000, whereas 11 species showed substantially lower than average values (Table 3). The relatively high prevalence of stormy weather may have influenced this pattern. In this regard, it may be noteworthy that many of the prominent declines involve vultures, buteos and eagles, all large soaring birds that rely heavily on thermals (not as prevalent during cold, wet weather) to save energy during migration.

At this time, simple linear regression analyses of annual passage rates indicate no significant ($P < 0.05$) long-term trends at Lipan Point (Figures 3–7), except for Broad-winged Hawks (increasing; Smith et al. in press). However, marginally significant trends ($0.05 < P \leq 0.10$) are indicated for Osprey (increasing), Ferruginous Hawk (decreasing), Golden Eagle (decreasing), and American Kestrel (decreasing). In fact, data from both sites and the combined-site data indicate a decreasing pattern for Golden Eagles.

Sharp-shinned Hawks, Cooper's Hawks, and Bald Eagles showed significantly higher than average immature : adult ratios in 2000 at Lipan Point, whereas Red-tailed Hawks and Peregrine Falcons showed significantly lower than average age ratios (Table 4). For Sharp-shinned Hawks, the higher age ratio was partly due to an increase in the abundance of young birds; however, for all three species a drop in the number of adults was the primary factor behind the higher age ratios. In contrast, for Red-tailed Hawks and Peregrine Falcons, the decline in age ratios was due to the combination of a drop in immatures and an increase in adults. For six species, the age-ratio trends indicated at Yaki (Table 5) are similar to those indicated by the longer-term data from Lipan Point (Table 4). However, for Broad-winged and Ferruginous Hawks, and Golden and Bald Eagles, the two sites suggest opposite trends, which for the latter three species translates to no difference with data for the two sites combined. Overall, these statistics suggest that, for most species using the Grand Canyon migration route, juvenile recruitment was probably at best average in 2000. Moreover, consistent indicators of below average age ratios suggest that low productivity may have contributed to below average combined-site passage rates for Northern Harriers, Red-tailed Hawks, and Peregrine Falcons this season.

Six of 16 species showed significant variation in seasonal timing in 2000 at Lipan Point (Table 6). However, the only possible multi-species pattern concerns the fact that the three larger buteos showed significantly earlier than average (5–8 days) median passage dates. This pattern was due to unusually large spikes in activity in mid-September and, for red-tails, unusually low activity after mid-October (e.g., Figure 8). At Yaki Point, 9 of 16 common species showed significant variation in seasonal timing in 2000, with six species significantly earlier than average (Table 7). However, there were few similarities in pattern compared to Lipan Point, and no obvious multi-species patterns.

RESIDENT RAPTORS

Resident birds recorded at Lipan Point this season included at least 10–12 Turkey Vultures; at least 1 adult and 1 immature Sharp-shinned Hawks; at least 1 adult and 1 immature female Cooper's Hawks; at least 3–4 light morph adult, 1 immature light morph, and 1 immature dark morph Red-tailed Hawks; 2 adult, 1 subadult, and at least 1 immature Golden Eagles; possibly 1 American Kestrel; 2 adult and 1 immature Peregrine Falcons; 1 Prairie Falcon; and 8 California Condors.

Resident birds recorded at Yaki Point this season included at least 20 Turkey Vultures; possibly 1 Osprey; at least 1 adult and 1 immature Sharp-shinned Hawks; at least 1 adult and 1 immature Cooper's

Hawks; at least 1 immature Northern Goshawk; at least 3 light morph adult, 1 dark morph adult, and 2 immature light morph Red-tailed Hawks; 2 adult and 1 immature Zone-tailed Hawks; at least 1 adult and 1 immature Golden Eagles; at least 2 adult and 1 immature Peregrine Falcons; and 10–12 California Condors.

VISITOR PARTICIPATION

Programs conducted twice daily, weather permitting, by our on-site educators reached an estimated 2,230 park visitors this season, with visitation highest at Yaki Point. This level of visitor participation is about 40% greater than last season. However, visitor interaction with the observers, as measured by hourly records of visitor presence, was about average at Yaki Point and was down about 33% at Lipan Point compared to the 1991–1999 average. These data reflect positive trends. Our educational efforts are reaching a growing number of visitors, while at the same time visitor distraction of the observers is dropping because our on-site educators are able to effectively handle the majority of visitor interactions.

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Table 1. Annual observation effort, and counts and passage rates by species at Lipan Point: 1991–1999 versus 2000.

	1991–1999 ¹	2000	% CHANGE	1991–1999 ¹	2000	% CHANGE
Start date	29-Aug ± 2.6	27-Aug				
End date	4-Nov ± 0.3	5-Nov				
Observation days	66 ± 2.7	67	+1			
Observation hours	497.34 ± 26.671	511.54	+3			
SPECIES	COUNTS			RAPTORS / 100 HOURS		
Turkey Vulture	188 ± 63.1	97	-49	37.9 ± 12.19	19.0	-50
Osprey	82 ± 20.3	88	+7	16.3 ± 3.72	17.2	+5
Northern Harrier	98 ± 20.0	99	+1	19.5 ± 3.54	19.4	-1
Sharp-shinned Hawk	1566 ± 303.3	1449	-7	312 ± 55.0	283	-9
Cooper's Hawk	1323 ± 175.2	968	-27	265 ± 29.7	189	-29
Northern Goshawk	12 ± 8.8	13	+10	2.4 ± 1.71	2.5	+7
Unidentified accipiter	267 ± 55.5	252	-6	55 ± 13.2	49	-10
TOTAL ACCIPITERS	3167 ± 413.4	2682	-15	634 ± 67.1	524	-17
Red-shouldered Hawk	0 ± 0.3	0	-100	0.0 ± 0.06	0.0	-100
Broad-winged Hawk	8 ± 6.9	15	+82	1.6 ± 1.37	2.9	+82
Swainson's Hawk	31 ± 8.9	22	-30	6.2 ± 1.68	4.3	-30
Red-tailed Hawk	1889 ± 412.8	1498	-21	379 ± 77.8	293	-23
Ferruginous Hawk	8 ± 2.2	6	-23	1.6 ± 0.46	1.2	-26
Zone-tailed Hawk	0 ± 0.3	0	-100	0.0 ± 0.06	0.0	-100
Unidentified buteo	22 ± 11.1	15	-33	4.7 ± 2.68	2.9	-38
TOTAL BUTEOS	1959 ± 409.2	1556	-21	393 ± 76.9	304	-23
Golden Eagle	34 ± 8.8	9	-74	6.9 ± 1.65	1.8	-74
Bald Eagle	23 ± 8.9	11	-53	4.6 ± 1.75	2.2	-53
Unidentified eagle	1 ± 1.0	0	-100	0.2 ± 0.19	0.0	-100
TOTAL EAGLES	59 ± 13.8	20	-66	11.6 ± 2.58	3.9	-66
American Kestrel	1268 ± 132.0	1045	-18	256 ± 26.5	204	-20
Merlin	12 ± 3.2	9	-28	2.5 ± 0.57	1.8	-29
Prairie Falcon	4 ± 1.6	9	+103	0.9 ± 0.32	1.8	+100
Peregrine Falcon	7 ± 2.3	6	-17	1.4 ± 0.43	1.2	-18
Unidentified falcon	3 ± 1.9	5	+50	0.6 ± 0.37	1.0	+51
TOTAL FALCONS	1295 ± 132.9	1074	-17	261 ± 26.1	210	-20
Unidentified Raptor	81 ± 21.5	48	-41	16.4 ± 4.58	9.4	-43
GRAND TOTAL	6931 ± 925.4	5664	-18	1391 ± 158.8	1107	-20

¹ Mean of annual values ± 95% confidence interval.

Table 2. Annual observation effort, and counts and passage rates by species at Yaki Point: 1997–1999 versus 2000.

	1997–1999 ¹	2000	% CHANGE	1997–1999 ¹	2000	% CHANGE
Start date	26-Aug ± 0.7	27-Aug				
End date	4-Nov ± 0.0	5-Nov				
Observation days	69 ± 3.3	66	-5			
Observation hours	501.19 ± 49.810	513.10	+2			
SPECIES	COUNTS			RAPTORS / 100 HOURS		
Turkey Vulture	103 ± 41.1	47	-54	20.6 ± 8.31	9.2	-56
Osprey	40 ± 12.7	43	+7	8.2 ± 2.96	8.4	+3
Northern Harrier	50 ± 6.8	41	-18	10.0 ± 0.37	8.0	-20
Sharp-shinned Hawk	1523 ± 408.0	1772	+16	301.4 ± 51.53	345.4	+15
Cooper's Hawk	1056 ± 203.6	1256	+19	211.6 ± 43.02	244.8	+16
Northern Goshawk	4 ± 3.4	9	+125	0.8 ± 0.77	1.8	+109
Unidentified accipiter	114 ± 26.5	236	+106	23.1 ± 7.49	46.0	+99
TOTAL ACCIPITERS	2698 ± 511.7	3273	+21	536.9 ± 63.35	637.9	+19
Red-shouldered Hawk	0 ± 0.7	0	-100	0.1 ± 0.13	0.0	-100
Broad-winged Hawk	14 ± 5.7	6	-57	2.8 ± 1.38	1.2	-59
Swainson's Hawk	24 ± 9.7	10	-58	4.8 ± 1.79	1.9	-59
Red-tailed Hawk	933 ± 51.5	892	-4	186.8 ± 14.14	173.8	-7
Ferruginous Hawk	9 ± 2.4	10	+15	1.7 ± 0.30	1.9	+14
Rough-legged Hawk	0 ± 0.0	1	–	0.0 ± 0.00	0.2	#DIV/0!
Zone-tailed Hawk	0 ± 0.7	0	-100	0.1 ± 0.12	0.0	-100
Unidentified buteo	18 ± 4.6	8	-55	3.6 ± 1.19	1.6	-56
TOTAL BUTEOS	998 ± 59.9	927	-7	199.9 ± 16.84	180.7	-10
Golden Eagle	11 ± 13.1	11	0	2.2 ± 2.57	2.1	-3
Bald Eagle	19 ± 3.6	9	-53	3.9 ± 0.81	1.8	-55
Unidentified eagle	1 ± 0.7	0	-100	0.1 ± 0.13	0.0	-100
TOTAL EAGLES	31 ± 16.9	20	-35	6.2 ± 3.37	3.9	-37
American Kestrel	786 ± 359.7	1035	+32	154.4 ± 62.94	201.7	+31
Merlin	13 ± 1.3	5	-63	2.7 ± 0.11	1.0	-63
Prairie Falcon	6 ± 2.8	4	-37	1.3 ± 0.53	0.8	-38
Peregrine Falcon	11 ± 7.5	1	-91	2.3 ± 1.79	0.2	-92
Unidentified falcon	2 ± 2.3	3	--	0.4 ± 0.50	0.6	--
TOTAL FALCONS	819 ± 353.9	1048	+28	161.0 ± 61.24	204.2	+27
Unidentified Raptor	25 ± 13.3	10	-59	5.1 ± 3.25	1.9	-62
GRAND TOTAL	4764 ± 728.6	5409	+14	947.9 ± 51.93	1054.2	+11

¹ Mean of annual values ± 95% confidence interval.

Table 3. Comparison of 1997–1999 average and 2000 passage rates (raptors / 100 hours) for Lipan Point, Yaki Point, and both sites combined.

SPECIES	LIPAN POINT			YAKI POINT			COMBINED		
	1997-99	2000	% CHANGE	1997-99	2000	% CHANGE	1997-99	2000	% CHANGE
Turkey Vulture	43.1	19.0	-56	20.6	9.2	-56	63.8	28.1	-56
Osprey	20.6	17.2	-16	8.2	8.4	+3	28.8	25.6	-11
Northern Harrier	19.2	19.4	+1	10.0	8.0	-20	29.2	27.3	-6
Sharp-shinned Hawk	277	283	+2	301	345	+15	578	629	+9
Cooper's Hawk	291	189	-35	212	245	+16	502	434	-14
Northern Goshawk	1.0	2.5	+152	0.8	1.8	+109	1.8	4.3	+133
Unidentified accipiter	40.9	49.3	+20	23.1	46.0	+99	64.1	95.3	+49
TOTAL ACCIPITERS	610	524	-14	537	638	+19	1146	1162	+1
Red-shouldered Hawk	0.0	0.0	0	0.1	0.0	-100	0.1	0.0	-100
Broad-winged Hawk	3.4	2.9	-14	2.8	1.2	-59	6.3	4.1	-35
Swainson's Hawk	6.5	4.3	-34	4.8	1.9	-59	11.3	6.2	-45
Red-tailed Hawk	286	293	+2	187	174	-7	473	467	-1
Ferruginous Hawk	1.3	1.2	-8	1.7	1.9	+14	3.0	3.1	+5
Rough-legged Hawk	0.0	0.0	0	0.0	0.2	-	0.0	0.2	-
Zone-tailed Hawk	0.1	0.0	-100	0.1	0.0	-100	0.2	0.0	-100
Unidentified buteo	5.8	2.9	-49	3.6	1.6	-56	9.4	4.5	-52
TOTAL BUTEOS	303	304	0	200	181	-10	503	485	-4
Golden Eagle	4.9	1.8	-64	2.2	2.1	-3	7.1	3.9	-45
Bald Eagle	4.2	2.2	-49	3.9	1.8	-55	8.1	3.9	-52
Unidentified eagle	0.3	0.0	-100	0.1	0.0	-100	0.4	0.0	-100
TOTAL EAGLES	9.4	3.9	-59	6.2	3.9	-37	15.7	7.8	-50
American Kestrel	224	204	-9	154	202	+31	379	406	+7
Merlin	3.1	1.8	-44	2.7	1.0	-63	5.8	2.7	-53
Prairie Falcon	0.8	1.8	+128	1.3	0.8	-38	2.0	2.5	+25
Peregrine Falcon	1.7	1.2	-29	2.3	0.2	-92	4.0	1.4	-66
Unidentified falcon	1.3	1.0	-23	0.4	0.6	+41	1.7	1.6	-8
TOTAL FALCONS	231	210	-9	161	204	+27	392	414	+6
Unidentified Raptor	19.1	9.4	-51	5.1	1.9	-62	24.1	11.3	-53
GRAND TOTAL	1255	1107	-12	948	1054	+11	2203	2161	-2

Table 4. Counts by age class and immature : adult ratios for selected species at Lipan Point: 1991–1999 versus 2000.

SPECIES	TOTAL AND AGE-CLASSIFIED COUNTS						IMMATURE : ADULT			
	1991–1999 AVERAGE			2000			% UNKNOWN AGE		RATIO	
	TOTAL	IMM.	ADULT	TOTAL	IMM.	ADULT	1991–1999 ¹	2000	1991–1999 ¹	2000
Northern Harrier	98	19	21	99	25	26	59 ± 6.3	48	0.98 ± 0.209	0.96
Sharp-shinned Hawk	1566	262	623	1449	321	521	43 ± 4.7	42	0.45 ± 0.098	0.62
Cooper's Hawk	1323	249	394	968	239	259	51 ± 6.1	49	0.68 ± 0.181	0.92
Northern Goshawk	12	5	3	13	5	3	35 ± 15.0	38	2.01 ± 1.127	1.67
Broad-winged Hawk	8	2	2	15	5	6	17 ± 21.8	27	1.19 ± 0.716	0.83
Red-tailed Hawk	1889	175	1005	1498	137	1049	35 ± 7.1	21	0.18 ± 0.041	0.13
Ferruginous Hawk	8	1	2	6	1	1	53 ± 15.4	67	0.83 ± 0.644	1.00
Golden Eagle	34	10	11	9	3	5	40 ± 12.2	11	1.22 ± 0.625	0.60
Bald Eagle	23	4	17	11	3	7	8 ± 5.3	9	0.27 ± 0.088	0.43
Peregrine Falcon	7	1	4	6	0	2	33 ± 13.5	67	0.64 ± 0.632	0.00

¹ Mean ± 95% confidence interval. For age ratios, note that the long-term mean immature : adult ratio is an average of annual ratios and may differ from the value obtained by dividing long-term average numbers of immatures and adults. Discrepancies in the two values reflect high annual variability in the observed age ratio.

Table 5. Counts by age class and immature : adult ratios for selected species at Yaki Point: 1997–1999 versus 2000.

SPECIES	TOTAL AND AGE-CLASSIFIED COUNTS						IMMATURE : ADULT			
	1997–1999 AVERAGE			2000			% UNKNOWN AGE		RATIO	
	TOTAL	IMM.	ADULT	TOTAL	IMM.	ADULT	1997–1999 ¹	2000	1997–1999 ¹	2000
Northern Harrier	50	20	15	41	14	18	29 ± 9.3	22	1.38 ± 0.428	0.78
Sharp-shinned Hawk	1523	351	775	1772	470	798	27 ± 9.3	28	0.52 ± 0.277	0.59
Cooper's Hawk	1056	283	443	1256	436	414	31 ± 9.2	32	0.70 ± 0.393	1.05
Northern Goshawk	4	3	1	9	6	2	5 ± 9.3	11	2.00 ± 1.132	3.00
Broad-winged Hawk	14	3	9	6	2	3	15 ± 13.7	17	0.43 ± 0.235	0.67
Red-tailed Hawk	933	194	593	892	136	632	16 ± 6.2	14	0.33 ± 0.116	0.22
Ferruginous Hawk	9	2	4	10	2	5	26 ± 26.1	30	0.67 ± 0.346	0.40
Golden Eagle	11	2	5	11	3	4	40 ± 12.2	36	0.59 ± 0.904	0.75
Bald Eagle	19	4	12	9	1	8	20 ± 23.4	0	0.49 ± 0.502	0.13
Peregrine Falcon	11	2	3	1	0	0	57 ± 28.4	100	0.72 ± 0.288	–

¹ Mean ± 95% confidence interval. For age ratios, note that the long-term mean immature : adult ratio is an average of annual ratios and may differ from the value obtained by dividing long-term average numbers of immatures and adults. Discrepancies in the two values reflect high annual variability in the observed age ratio.

Table 6. First and last dates of observation, bulk passage dates, and median passage dates by species for 2000 at Lipan Point, with a comparison to 1991–1999 average median passage dates.

SPECIES	2000				1991–1999
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES ¹	MEDIAN PASSAGE DATE ²	MEDIAN PASSAGE DATE ³
Turkey Vulture	9-Sep	8-Oct	18-Sep – 3-Oct	25-Sep	27-Sep ± 2.3
Osprey	29-Aug	25-Oct	7-Sep – 5-Oct	18-Sep	17-Sep ± 2.0
Northern Harrier	29-Aug	2-Nov	14-Sep – 20-Oct	5-Oct	6-Oct ± 4.3
Sharp-shinned Hawk	28-Aug	5-Nov	17-Sep – 25-Oct	5-Oct	5-Oct ± 2.9
Cooper's Hawk	27-Aug	5-Nov	14-Sep – 9-Oct	29-Sep	26-Sep ± 2.9
Northern Goshawk	16-Sep	3-Nov	25-Sep – 31-Oct	6-Oct	9-Oct ± 4.7
Broad-winged Hawk	23-Sep	1-Oct	23-Sep – 30-Sep	27-Sep	26-Sep ± 4.7
Swainson's Hawk	4-Sep	5-Oct	7-Sep – 30-Sep	15-Sep	23-Sep ± 4.4
Red-tailed Hawk	27-Aug	5-Nov	14-Sep – 19-Oct	5-Oct	10-Oct ± 3.4
Ferruginous Hawk	12-Sep	20-Oct	12-Sep – 20-Oct	5-Oct	13-Oct ± 3.9
Golden Eagle	1-Oct	5-Nov	1-Oct – 5-Nov	19-Oct	20-Oct ± 3.9
Bald Eagle	2-Oct	5-Nov	12-Oct – 5-Nov	3-Nov	25-Oct ± 3.2
American Kestrel	27-Aug	5-Nov	7-Sep – 6-Oct	20-Sep	25-Sep ± 2.8
Merlin	4-Sep	1-Nov	4-Sep – 1-Nov	13-Oct	9-Oct ± 4.1
Prairie Falcon	16-Sep	20-Oct	16-Sep – 20-Oct	30-Sep	29-Sep ± 13.8
Peregrine Falcon	2-Sep	19-Oct	2-Sep – 19-Oct	18-Sep	22-Sep ± 6.6
All species	27-Aug	5-Nov	14-Sep – 18-Oct	30-Sep	1-Oct ± 1.7

¹ Dates between which the central 80% of the flight passed.

² Date by which 50% of the flight had passed; values are given only for species with annual counts ≥ 5 birds.

³ Mean of annual values ± 95% confidence interval in days; calculated only for species with annual counts ≥ 5 birds for ≥ 3 years.

Table 7. First and last dates of observation, bulk passage dates, and median passage dates by species for 2000 at Yaki Point, with a comparison to 1997–1999 average median passage dates.

SPECIES	2000				1997–1999
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES ¹	MEDIAN PASSAGE DATE ²	MEDIAN PASSAGE DATE ³
Turkey Vulture	28-Aug	13-Oct	6-Sep – 4-Oct	20-Sep	24-Sep ± 2.4
Osprey	1-Sep	26-Oct	8-Sep – 5-Oct	21-Sep	19-Sep ± 2.0
Northern Harrier	2-Sep	2-Nov	13-Sep – 16-Oct	30-Sep	9-Oct ± 3.6
Sharp-shinned Hawk	1-Sep	5-Nov	15-Sep – 19-Oct	5-Oct	2-Oct ± 1.7
Cooper's Hawk	28-Aug	1-Nov	12-Sep – 8-Oct	27-Sep	30-Sep ± 2.3
Northern Goshawk	18-Sep	5-Nov	18-Sep – 5-Nov	4-Oct	18-Sep ⁴
Broad-winged Hawk	19-Sep	25-Sep	19-Sep – 25-Sep	24-Sep	25-Sep ± 2.1
Swainson's Hawk	2-Sep	29-Sep	7-Sep – 29-Sep	16-Sep	24-Sep ± 6.6
Red-tailed Hawk	31-Aug	5-Nov	12-Sep – 20-Oct	6-Oct	8-Oct ± 2.3
Ferruginous Hawk	15-Sep	5-Nov	19-Sep – 5-Nov	1-Nov	16-Oct ± 6.3
Rough-legged Hawk	5-Nov	5-Nov	–	–	–
Golden Eagle	30-Sep	5-Nov	16-Oct – 5-Nov	20-Oct	23-Oct ± 8.1
Bald Eagle	1-Oct	5-Nov	1-Oct – 5-Nov	25-Oct	26-Oct ± 5.4
American Kestrel	2-Sep	1-Nov	13-Sep – 4-Oct	18-Sep	27-Sep ± 2.3
Merlin	7-Sep	4-Oct	7-Sep – 4-Oct	28-Sep	5-Oct ± 2.8
Prairie Falcon	3-Sep	16-Oct	3-Sep – 16-Oct	–	27-Sep ± 5.6
Peregrine Falcon	11-Sep	11-Sep	11-Sep – 13-Sep	–	23-Sep ± 4.3
All species	28-Aug	5-Nov	13-Sep – 17-Oct	30-Sep	1-Oct ± 2.1

¹ Dates between which the central 80% of the flight passed.

² Date by which 50% of the flight had passed; values are given only for species with annual counts ≥ 5 birds.

³ Mean of annual values ± 95% confidence interval in days; calculated only for species with annual counts ≥ 5 birds for at least 1 year.

⁴ 1998 only.

Figure 1. Map showing the Lipan Point and Yaki Point study sites in the Grand Canyon, Arizona.

Figure 2. Flight composition by raptor groups at Lipan and Yaki Points: 2000 versus long-term averages.

Figure 3. Annual passage rates for Turkey Vultures, Ospreys, and Northern Harriers at Lipan Point: 1991–2000.

Figure 4. Annual passage rates for Sharp-shinned Hawks, Cooper’s Hawks, and Northern Goshawks at Lipan Point: 1991–2000.

Figure 5. Annual passage rates for Red-tailed, Swainson's, Broad-winged and Ferruginous Hawks at Lipan Point: 1991–2000.

Figure 6. Annual passage rates for Golden and Bald Eagles at Lipan Point: 1991–2000.

Figure 7. Annual passage rates for American Kestrels, Merlins, Prairie Falcons, and Peregrine Falcons at Lipan Point: 1991–2000.

Figure 8. Passage volume by five-day periods for Red-tailed Hawks at Lipan Point: 1991–1999 versus 2000.

Appendix A. History of official observer participation in the Grand Canyon raptor migration studies: 1991–2000.

- 1991** Rotating team with at least two observers throughout at Lipan Pt.: Mark Cantrell (1), Phil West (0), Vickie O'Brien (0), Christie van Cleve (0), Don Rosie (0)
- 1992** Rotating team with at least two observers throughout at Lipan Pt.: Mark Cantrell (2), Daniel Perry (3), Christie van Cleve (1)
- 1993** Rotating team with at least two observers throughout at Lipan Pt.: Daniel Perry (4), Frank LaSorte (1), Christie van Cleve (2)
- 1994** Rotating team with at least two observers throughout at Lipan Pt. and 1–2 observers at Yaki Pt. for limited season: Daniel Perry (5), Justin Silcox (0), Amy Adams (0), Rod Adams (0), Christie van Cleve (3)
- 1995** Rotating team with at least two observers throughout at Lipan Pt.: Amy Adams (1), Elliot Swarthout (0), Christie van Cleve (4)
- 1996** Rotating team with at least two observers throughout at Lipan Pt.: Amy Adams (2), Elliot Swarthout (1), Christie van Cleve (5)
- 1997** Rotating team with at least two observers throughout at Yaki and Lipan Pts.: Sue Thomas (2), Scott Harris (2), Rusty Namitz (1), Annie Touliatos (0), Christie van Cleve (6)
- 1998** Rotating team with at least two observers throughout at Yaki and Lipan Pts.: Josh Lipton (4), Jackie Speicher (2), Stacy Prosser (1), Karen McDonald (0), Christie van Cleve (7)
- 1999** Rotating team with at least two observers throughout at Lipan Pt. and at least 1 and usually 2 observers throughout at Yaki Pt.: Scott Rush (1), Adam Hutchins (1), Steve Seibel (1), Christie van Cleve (8), Kate James (0).
- 2000** Rotating team with at least two observers throughout at Lipan Pt. and Yaki Pt.: Adam Hutchins (2), Steve Seibel (2), Geoff Evans (0), Jody Bartz (0), Christie van Cleve (9), Kate James (1).

¹ Numbers in parentheses indicate previous full seasons of observation experience.

Appendix B. Common and scientific names, species codes, and regularly applied age, sex, and color morph classifications for all raptor species observed during migration in the Grand Canyon.

COMMON NAME	SCIENTIFIC NAME	SPECIES CODE	AGE ¹	SEX ²	COLOR MORPH ³
Turkey Vulture	<i>Cathartes aura</i>	TV	U	U	NA
Osprey	<i>Pandion haliaetus</i>	OS	U	U	NA
Northern Harrier	<i>Circus cyaneus</i>	NH	A I Br U	M F U	NA
Sharp-shinned Hawk	<i>Accipiter striatus</i>	SS	A I U	U	NA
Cooper's Hawk	<i>Accipiter cooperii</i>	CH	A I U	U	NA
Northern Goshawk	<i>Accipiter gentilis</i>	NG	A I U	U	NA
Unknown accipiter	<i>Accipiter</i> spp.	UA	U	U	NA
Red-shouldered Hawk	<i>Buteo lineatus</i>	RS	A I U	U	NA
Broad-winged Hawk	<i>Buteo platypterus</i>	BW	A I U	U	D L U
Swanson's Hawk	<i>Buteo swainsoni</i>	SW	U	U	D L U
Red-tailed Hawk	<i>Buteo jamaicensis</i>	RT	A I U	U	D L U
Ferruginous Hawk	<i>Buteo regalis</i>	FH	A I U	U	D L U
Rough-legged Hawk	<i>Buteo lagopus</i>	RL	U	U	D L U
Zone-tailed Hawk	<i>Buteo albonotatus</i>	ZT	A I U	U	NA
Unknown buteo	<i>Buteo</i> spp.	UB	U	U	D L U
Golden Eagle	<i>Aquila chrysaetos</i>	GE	A 2 1 I/S U ⁴	U	NA
Bald Eagle	<i>Haliaeetus leucocephalus</i>	BE	A 3 2 1 I/S U ⁵	U	NA
Unknown eagle	<i>Aquila</i> or <i>Haliaeetus</i> spp.	UE	U	U	NA
American Kestrel	<i>Falco sparverius</i>	AK	U	M F U	NA
Merlin	<i>Falco columbarius</i>	ML	AM Br	M U	NA
Prairie Falcon	<i>Falco mexicanus</i>	PR	U	U	NA
Peregrine Falcon	<i>Falco peregrinus</i>	PG	U	U	NA
Unknown falcon	<i>Falco</i> spp.	UF	U	U	NA
Unknown raptor	Falconiformes	UU	U	U	NA

¹ Age classification codes: A = adult, I = immature (HY), Br = brown (adult female or immature), U – unknown age.

² Sex classification codes: M = male, F = female, U = unknown.

³ Color morph classification codes: D = dark or rufous, L = light, U – unknown, NA = not applicable.

⁴ Golden Eagle age codes: A = adult - no white in wings or tail; 2 = plumage class 2 - no white patch in wings, obvious white in tail; 1 = plumage class 1 - white wing patch visible below, small wing patch may be visible above, bold white in tail; I/S = unknown age immature or subadult - obvious white in tail, wings not adequately observed

⁵ Bald Eagle age codes: A = adult - completely white head and tail; 3 = plumage class 3 - head mostly white, with osprey-like dark eyeline; 2 = plumage class 2 - dark head, light belly, and/or upside-down white triangle on back; 1 = plumage class 1 - dark head, breast, and belly; I/S = unknown age immature or subadult - dark or mottled head, other plumage features not adequately observed.

Appendix C. Daily observation effort, visitation, weather, and flight-summary records for Lipan Point: 2000.

DATE	HOURS	AVG. OBSRVRS / HOUR	AVG. VISITORS / HOUR	SKY CONDITION ¹	THERMAL LIFT ²	WIND SPEED ³	WIND DIRECT	AVG. TEMP. (°C)	BARO. PRESS. (IN HG)	AVG. VISIB. E (KM)	AVG. VISIB. W (KM)	FLIGHT DIST. ⁴	RAPTORS / HOUR
27-Aug	7.33	2.3	0.0	ovc/ts/rain	4	1	w/var	22.3	30.39	63	39	2	0.7
28-Aug	5.75	2.0	0.0	pc-ovc/rain	3	2	sw-wsw	20.2	30.11	47	40	2	0.5
29-Aug	5.08	2.0	0.2	ovc	4	2	se	21.4	30.13	37	44	1	0.4
30-Aug	8.00	2.0	0.0	pc-mc	3	3	w	21.5	30.10	100	49	2	0.3
31-Aug	7.50	2.0	0.1	pc-ovc/ts/rain	3	1	w	20.1	30.11	100	66	1	0.1
1-Sep	7.50	2.0	0.0	ovc	4	4	se, sw-w	20.5	30.07	26	40	1	0.4
2-Sep	8.00	2.0	0.3	clr	2	3	sw-wnw	22.3	30.11	100	100	2	1.5
3-Sep	8.00	2.0	0.0	pc-ovc	3	3	sw-wsw	22.7	30.14	100	100	3	0.8
4-Sep	7.83	2.0	1.3	clr	2	2	ssw-w	25.0	30.15	100	85	2	2.4
5-Sep	8.00	2.0	1.3	clr-pc	2	4	sw-w	26.5	30.17	60	63	2	1.1
6-Sep	8.25	2.0	0.3	ovc, rain	4	4	s-sw	21.5	30.23	44	43	1	0.6
7-Sep	8.00	2.0	1.1	pc-ovc/ts/rain	3	2	e-se, sw-wnw	19.8	30.16	76	69	2	21.9
8-Sep	6.25	2.6	1.4	ovc/ts/rain-clr	3	2	var	19.8	30.01	100	67	2	3.2
9-Sep	8.00	3.2	1.3	clr	1	1	wsw-wnw	26.8	30.04	75	55	3	9.5
10-Sep	8.33	3.0	0.3	clr-pc	2	1	w-nw	24.0	30.16	98	73	3	5.6
11-Sep	8.50	2.6	1.4	clr	1	1	w-wnw	27.7	30.21		41	2	8.0
12-Sep	8.00	1.9	0.4	clr	1	0	var	26.8	30.25	88	85	3	8.5
13-Sep	8.25	1.6	1.0	clr	1	1	ne-e/var	29.5	30.25	75	53	2	4.5
14-Sep	9.08	3.2	0.8	clr-pc	1	0	var	28.3	30.30	98	95	var	18.6
15-Sep	8.75	2.0	0.8	clr	2	0	var	29.6	30.28	100	75	2	29.3
16-Sep	8.00	3.7	2.0	clr-pc	1	0	var	28.3	30.26	85	71	3	12.9
17-Sep	8.00	4.0	1.4	clr-ovc	2	0	var	30.1	30.21	100	86	3	16.0
18-Sep	8.33	3.1	1.1	clr	1	0	var	29.3	30.14		58	3	14.5
19-Sep	8.58	2.3	0.6	clr-mc	2	0	wnw/var	26.9	30.05	88	71	3	32.8
20-Sep	8.67	2.8	1.1	clr	2	0	var, w-nw	25.7	30.01	100	80	var	29.1
21-Sep	8.58	3.2	0.5	clr-mc	4	6	sw-wnw	23.4	29.75	75	54	2	3.0
22-Sep	9.00	2.0	0.0	clr, dust AM	3	4	sw-wnw	21.0	29.69	42	42	2	1.2
23-Sep	8.00	2.5	0.8	pc	2	5	sw-wnw	17.4	29.85	63	65	2	3.5
24-Sep	8.17	3.0	0.0	clr	2	0	var	15.5	30.26	99	79	2	3.7
25-Sep	8.00	2.6	0.5	clr	2	0	e-se, var	17.6	30.25	100	91	var	12.5
26-Sep	6.58	1.7	1.3	mc-ovc/rain	4	1	var, e-se	18.5	30.23	77	69	var	5.9
27-Sep	8.00	1.9	2.1	clr-mc	2	2	sse-se	20.6	30.29	66	53	2	12.6
28-Sep	8.58	3.3	2.4	clr-pc	2	2	var	26.5	30.21	60	62	2	27.4
29-Sep	6.83	2.8	0.2	pc-ovc, ts/rain	3	1	se-s, var, ne-se	21.8	30.12	74	64	2	17.0
30-Sep	9.08	2.0	0.0	clr-pc, scat rain	2	1	se, var	23.2	30.14	100	82	3	60.1
1-Oct	8.00	2.4	0.1	clr-pc	1	1	var, sw-nw	24.7	30.14	100	77	2	34.9
2-Oct	8.00	2.0	0.1	clr	2	4	sw-w	25.2	30.10	100	94	2	7.6
3-Oct	8.00	1.8	1.1	clr-pc	2	3	w	25.5	30.07	70	48	3	11.3
4-Oct	8.58	2.0	0.3	pc-ovc	3	1	w-nw, var	18.6	30.06	97	72	2	7.3
5-Oct	8.67	2.9	2.4	clr	2	0	ne-se	19.0	30.13	95	83	2	11.3
6-Oct	8.08	2.6	0.9	clr	2	0	var	23.9	30.12	95	80	2	44.8
7-Oct	8.17	4.8	0.0	pc-mc	2	2	se-sw	23.7	30.11	100	88	var	26.3
8-Oct	8.92	3.4	0.2	pc	2	0	sw-w, var	19.6	30.16	82	51	2	36.9
9-Oct	6.58	3.3	0.0	clr-ovc/rain	3	1	var	17.1	30.09	93	65	3	19.0
10-Oct	8.00	2.0	0.0	pc-mc, rain PM	4	6	ssw-sw	14.1	29.71	54	30	1	1.0
11-Oct	6.00	2.0	0.0	clr	4	4	ssw-w	13.0	29.82	100	100	2	2.0
12-Oct	8.00	2.0	0.0	clr	3	2	s-sw	10.4	30.02	100	92	2	10.3
13-Oct	8.58	2.8	0.0	clr	2	0	var	11.0	30.10	95	74	2	8.7
14-Oct	7.83	3.7	3.6	clr	2	0	var	15.5	30.09	97	77	2	5.7
15-Oct	8.00	2.2	0.8	clr	2	0	ne/var	17.1	30.07	80	78	2	4.3

Appendix C. continued

DATE	HOURS	AVG. OBSRVRS / HOUR	AVG. VISITORS / HOUR	SKY CONDITION ¹	THERMAL LIFT ²	WIND SPEED ³	WIND DIRECT	AVG. TEMP. (°C)	BARO. PRESS. (IN HG)	AVG. VISIB. E (KM)	AVG. VISIB. W (KM)	FLIGHT DIST. ⁴	RAPTORS / HOUR
16-Oct	8.00	2.0	0.5	clr	2	1	ne-s	18.0	30.19	100	87	1	4.9
17-Oct	8.25	3.0	1.4	clr	2	0	e/var	15.2	30.28	100	77	3	6.2
18-Oct	8.00	2.3	1.0	clr-ovc	3	0	e	17.7	30.23	100	82	2	4.1
19-Oct	8.75	2.7	0.0	pc-mc, scat rain	3	0	s-sw/var	16.9	30.14	100	77	3	11.2
20-Oct	8.33	2.7	0.7	clr	2	0	var	17.9	30.09	100	75	1	11.2
21-Oct	7.50	2.0	0.0	pc-ovc/ts/rain	3	3	sw-nw	14.7	29.78	94	67	3	5.2
22-Oct	0.00												
23-Oct	0.00												
24-Oct	7.67	2.7	0.0	ovc/fog/rain	4	1	wsw-nw	9.0	30.13	51	47	2	6.9
25-Oct	7.50	2.0	0.0	ovc/fog-pc	3	0	w	11.2	30.05	100	65	2	10.5
26-Oct	7.50	2.0	0.0	pc-ovc, dust	4	2	se-sw	12.2	29.86	39	54	1	2.0
27-Oct	0.00												
28-Oct	0.00												
29-Oct	6.67	2.0	0.1	ovc	4	4	sw-w	6.2	30.00	100	67	1	1.2
30-Oct	2.58	2.6	0.0	ovc/rain/snow	4	5	sw	7.5	29.77	75	18	1	0.4
31-Oct	6.00	1.9	0.2	mc-ovc, fog/snow	4	3	sw-nw	2.9	29.83	65	24	1	7.3
1-Nov	7.25	1.9	0.0	clr	3	1	sw-wnw	6.9	29.99	100	75	1	8.3
2-Nov	6.75	2.0	0.0	pc-ovc	3	0	nne	7.6	29.94	100	80	1	3.4
3-Nov	4.00	2.0	0.0	ovc, fog AM	4	0	sse	6.2	30.01	44	33	2	4.0
4-Nov	6.75	2.0	0.0	ovc, rain	4	0	sw-w	2.2	29.90	40	53	1	2.1
5-Nov	3.83	2.0	0.0	mc-ovc	4	5	wnw-nw	2.2	29.69	90	95	1	5.2

¹ Predominant sky condition during day: clr = clear (0-15% cloud cover); pc = partly cloudy (16-50% cover); mc = mostly cloudy (51-75% cover); ovc = overcast (76-100% cover); ts = thunder storms.

² Average of hourly ratings concerning prevalence of lift-generating thermals, based on subjective assessments of solar intensity, wind speeds, and migrant behavior: 1 = excellent, 2 = good, 3 = fair, 4 = poor.

³ Average of hourly categorical ratings: 0 = less than 1 km/h; 1 = 1–5 km/h; 2 = 6–11 km/h; 3 = 12–19 km/h; 4 = 20–28 km/h; 5 = 29–38 km/h, etc.

⁴ Average of hourly line-of-sight ratings concerning distance of flight from observation site: 1 = close, detection and identification possible with naked eye; 2 = moderate, detection possible with naked eye, but binoculars needed for identification; 3 = far, binoculars needed for both detection and identification; 4 = distant, birds detected and identified only with excellent binoculars or spotting scope and by experienced observers.

Appendix D. Daily observation effort, visitation, weather, and flight-summary records for Yaki Point: 2000.

DATE	HOURS	AVG. OBSRVRS / HOUR	AVG. VISITORS / HOUR	SKY CONDITION ¹	THERMAL LIFT ²	WIND SPEED ³	WIND DIRECT	AVG. TEMP. (°C)	BARO. PRESS. (IN HG)	AVG. VISIB. E (KM)	AVG. VISIB. W (KM)	FLIGHT DIST. ⁴	RAPTORS / HOUR
27-Aug	2.92	2.0	0.0	mc-ovc, rain	4	2	w	15.9			8		0.0
28-Aug	5.42	2.0	0.2	pc-ovc/ts/rain	3	1	s	20.2			66	2	0.4
29-Aug	6.17	2.0	0.0	ovc, ts/rain	4	3	se, sw	16.4	30.22		33		0.0
30-Aug	8.00	2.0	0.0	pc-ovc, ts	3	3	sw-nw	18.4			27		0.0
31-Aug	7.50	1.9	0.1	pc-mc, haze AM	2	1	wsw-n	22.6	30.10		43	2	1.2
1-Sep	7.50	1.8	0.0	ovc, rain PM	4	4	s-ssw	18.1	30.08		71	1	0.5
2-Sep	8.42	2.1	0.0	clr	2	3	s-ssw, nw	20.1	30.14		100	1	1.2
3-Sep	8.00	2.1	0.0	clr-pc	3	3	sw-wnw	21.9	30.16		100	1	0.4
4-Sep	8.00	2.0	0.8	clr	1	2	sw	25.5	30.15		100	2	2.3
5-Sep	8.00	1.9	0.8	clr	2	4	s-wnw	23.5	30.19		89	2	1.6
6-Sep	8.50	2.0	0.0	mc-ovc, brief rain	4	2	se-wnw	20.8	30.24		66	3	1.8
7-Sep	8.75	2.2	0.0	clr-ovc	2	0	n-ene	25.0	30.15		63	2	9.1
8-Sep	7.17	2.4	1.0	ovc/rain-clr	3	4	ssw-wsw	21.6	29.95		44	2	5.2
9-Sep	9.00	2.0	0.9	clr	2	3	s-sw	21.8	30.06		80	2	5.7
10-Sep	8.25	2.8	2.4	clr	1	3	wsw-nw	23.8	30.14		55	2	5.6
11-Sep	9.25	2.1	0.2	clr	2	1	var	22.1	30.24		64	2	9.2
12-Sep	8.67	2.0	0.0	clr	1	0	nw-ne	27.5	30.23		54	2	12.8
13-Sep	8.25	2.0	1.0	clr-pc	2	1	ne-e/var	25.9	30.26		68	3	14.1
14-Sep	8.00	2.0	0.8	clr	1	1	ne-e, sw-nw	29.3	30.28		49	2	18.9
15-Sep	8.58	2.4	2.4	clr	2	1	wnw-n, var	27.3	30.29		70	2	11.3
16-Sep	8.83	2.6	1.2	clr-pc	2	0	nw-n/var	26.5	30.28		60	2	12.1
17-Sep	8.08	2.5	1.6	clr-mc	3	1	sw-wnw/var	26.1	30.21		69	2	4.0
18-Sep	9.75	2.5	0.1	clr	2	1	nw-ne	24.0	30.16		57	var	73.3
19-Sep	10.17	1.9	0.0	clr-mc	2	1	wsw-nw	23.3	30.06		57	2	20.3
20-Sep	9.58	2.0	0.0	clr	2	2	ne-ese, w-nw	25.5	30.16		58	2	15.4
21-Sep	8.33	3.1	0.0	clr-pc	3	5	sw-wnw	22.7	29.75		47	2	4.8
22-Sep	8.17	2.0	0.0	clr	3	5	s-nw	19.1	29.69		47	2	3.5
23-Sep	8.00	1.5	1.4	mc	4	5	sw-nw	14.0	29.83		57	2	2.3
24-Sep	8.83	3.0	2.1	clr	3	1	ne, se-s	13.4	30.20		69	2	11.3
25-Sep	8.67	2.9	0.9	clr	2	1	ene-sse, var	20.1	30.25		76	1	7.4
26-Sep	7.08	2.5	0.1	mc-ovc, scat ts/rain	4	2	ne-ese	18.6	30.21		76	2	4.4
27-Sep	8.00	2.0	0.9	clr-ovc	3	2	e-se	18.6	30.24		72	3	7.0
28-Sep	8.08	2.8	0.4	pc-mc	3	3	se-wsw	21.3	30.19		79	2	13.4
29-Sep	7.83	2.0	1.7	clr-mc, scat rain	3	1	se, var	22.2	30.09		61	2	15.1
30-Sep	9.67	2.5	0.6	clr-mc, scat rain	2	2	sw-nw/var	22.1	30.11		61	2	31.2
1-Oct	8.50	2.0	0.7	clr	2	4	sw-nw	24.8	30.10		58	2	13.8
2-Oct	8.50	2.2	0.0	clr-pc	2	3	sw-nw	21.4	30.09		72	2	6.9
3-Oct	8.33	2.7	0.0	clr-mc, scat rain	2	1	sw-nw/var	21.0	30.04		73	2	7.6
4-Oct	8.58	2.0	0.0	clr-ovc, scat rain	3	2	se-ssw, nw	18.3	30.07		86	2	34.1
5-Oct	8.58	2.0	0.2	clr	2	1	ne-se	18.9	30.09		93	3	31.1
6-Oct	9.00	2.5	2.2	clr	2	0	var	20.1	30.09		78	2	19.6
7-Oct	9.17	3.4	1.2	pc-mc	3	2	var, sw-w	22.0	30.10		85	2	23.8
8-Oct	8.75	2.4	0.9	clr-pc	2	1	sw-nw	20.0	30.17		46	2	14.1
9-Oct	8.00	3.1	0.1	clr-ovc, scat rain	4	1	nw, se, nw	16.1	30.09		53	2	7.0
10-Oct	2.42	2.0	0.0	ovc/fog/rain	4	6	s-sw	12.2	29.73		16	2	0.8
11-Oct	7.00	2.0	0.0	clr	3	4	sw-wnw	12.1	29.83		96	1	5.9
12-Oct	7.67	2.3	1.0	pc-mc	3	2	var, sw-w	9.4	29.99		87	2	11.5
13-Oct	7.50	2.8	0.9	clr	2	1	sw-n	11.6	30.08		91	2	14.1
14-Oct	8.00	2.5	2.0	clr	2	1	e-ese, var, n	12.9	30.10		87	2	10.5

Appendix D. continued

DATE	HOURS	AVG. OBSRVRS / HOUR	AVG. VISITORS / HOUR	SKY CONDITION ¹	THERMAL LIFT ²	WIND SPEED ³	WIND DIRECT	AVG. TEMP. (°C)	BARO. PRESS. (IN HG)	AVG. VISIB. E (KM)	AVG. VISIB. W (KM)	FLIGHT DIST. ⁴	RAPTORS / HOUR
15-Oct	8.75	2.2	1.4	clr	2	1	ne-se, nw	13.4	30.04		71	2	9.4
16-Oct	8.42	2.0	0.8	clr	2	2	e-se, var	13.3	30.15		81	3	15.8
17-Oct	8.00	2.0	0.4	clr	2	1	ne-e	15.3	30.24		81	2	7.3
18-Oct	8.17	2.8	0.0	pc-mc	3	1	ne-e	15.2	30.19		82	2	10.8
19-Oct	8.50	2.3	0.6	ovc-clr	3	1	var	17.7	30.13		76	2	10.8
20-Oct	8.00	2.0	0.0	clr	2	1	ene-se	16.4	30.04		83	3	13.4
21-Oct	7.67	2.5	0.0	pc-ovc/ts/rain	4	3	sw-wnw	12.7	29.73		78	1	1.6
22-Oct	0.00												
23-Oct	0.00												
24-Oct	6.75	2.0	0.0	dust, rain PM	4	2	sw-w	8.4	30.10		28	2	1.0
25-Oct	7.50	2.0	0.0	ovc-clr	3	0	wnw-nw	9.2	29.99		84	2	7.7
26-Oct	7.17	2.7	0.0	pc-ovc	4	3	s-sw	11.9	29.86		87	2	1.8
27-Oct	0.00												
28-Oct	0.00												
29-Oct	7.00	2.0	0.3	ovc	4	2	s-sw	6.1	29.96		46	1	0.7
30-Oct	0.50	2.0	0.0										
31-Oct	0.00												
1-Nov	7.00	2.0	0.0	pc-mc	3	1	wsw-n	4.9	29.99		86	2	13.7
2-Nov	6.75	2.0	0.0	mc-ovc	3	0	ne	5.2	29.91		77	2	2.7
3-Nov	6.00	2.0	0.5	ovc-pc	4	2	ne	4.9	29.99		81	2	0.2
4-Nov	6.25	1.9	0.0	ovc, rain	4	0	ne/var	5.3	29.86		65		0.0
5-Nov	7.25	1.6	0.1	clr-ovc	3	4	nw, ne	7.1	29.66		84	2	3.3

¹ Predominant sky condition during day: clr = clear (0–15% cloud cover); pc = partly cloudy (16–50% cover); mc = mostly cloudy (51–75% cover); ovc = overcast (76–100% cover); ts = thunder storms.

² Average of hourly ratings concerning prevalence of lift-generating thermals, based on subjective assessments of solar intensity, wind speeds, and migrant behavior: 1 = excellent, 2 = good, 3 = fair, 4 = poor.

³ Average of hourly categorical ratings: 0 = less than 1 km/h; 1 = 1–5 km/h; 2 = 6–11 km/h; 3 = 12–19 km/h; 4 = 20–28 km/h; 5 = 29–38 km/h, etc.

⁴ Average of hourly line-of-sight ratings concerning distance of flight from observation site: 1 = close, detection and identification possible with naked eye; 2 = moderate, detection possible with naked eye, but binoculars needed for identification; 3 = far, binoculars needed for both detection and identification; 4 = distant, birds detected and identified only with excellent binoculars or spotting scope and by experienced observers.

Appendix E. Daily count records by species for Lipan Point: 2000.

DATE	OBS.		SPECIES ¹																						RAPTORS	
	HOURS	TV	OS	NH	SS	CH	NG	UA	RS	BW	SW	RT	FH	ZT	UB	GE	BE	UE	AK	ML	PR	PG	UF	UU	TOTAL	/ HOUR
27-Aug	7.33	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	5	0.7
28-Aug	5.75	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.5
29-Aug	5.08	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.4
30-Aug	8.00	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0.3
31-Aug	7.50	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.1
01-Sep	7.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3	0.4
02-Sep	8.00	0	1	0	0	3	0	0	0	0	0	6	0	0	0	0	0	0	1	0	0	1	0	0	12	1.5
03-Sep	8.00	0	0	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	2	0	0	0	0	0	6	0.8
04-Sep	7.83	0	1	0	5	2	0	0	0	0	1	3	0	0	0	0	0	0	6	1	0	0	0	0	19	2.4
05-Sep	8.00	0	1	1	1	0	0	0	0	0	0	3	0	0	0	0	0	0	2	1	0	0	0	0	9	1.1
06-Sep	8.25	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	5	0.6
07-Sep	8.00	0	4	3	6	3	0	0	0	0	6	35	0	0	0	0	0	0	117	0	0	0	0	1	175	21.9
08-Sep	6.25	0	1	0	2	8	0	1	0	0	0	7	0	0	0	0	0	0	1	0	0	0	0	0	20	3.2
09-Sep	8.00	1	3	0	10	35	0	9	0	0	0	16	0	0	1	0	0	0	1	0	0	0	0	0	76	9.5
10-Sep	8.33	0	3	0	10	17	0	0	0	0	0	10	0	0	0	0	0	0	6	0	0	0	0	1	47	5.6
11-Sep	8.50	0	0	0	16	10	0	1	0	0	1	5	0	0	0	0	0	0	34	0	0	0	0	1	68	8.0
12-Sep	8.00	1	1	2	9	12	0	2	0	0	0	6	1	0	0	0	0	0	33	0	0	0	0	1	68	8.5
13-Sep	8.25	0	0	0	1	5	0	2	0	0	0	14	1	0	0	0	0	0	14	0	0	0	0	0	37	4.5
14-Sep	9.08	7	6	3	13	16	0	3	0	0	0	54	0	0	0	0	0	0	67	0	0	0	0	0	169	18.6
15-Sep	8.75	0	5	5	27	64	0	10	0	0	7	76	0	0	3	0	0	0	57	0	0	0	0	2	256	29.3
16-Sep	8.00	0	8	0	16	19	1	3	0	0	1	37	0	0	0	0	0	0	16	0	1	0	0	1	103	12.9
17-Sep	8.00	0	5	3	26	37	0	21	0	0	0	15	0	0	1	0	0	0	19	0	0	1	0	0	128	16.0
18-Sep	8.33	6	12	4	12	7	0	16	0	0	0	19	0	0	1	0	0	0	40	0	1	1	0	2	121	14.5
19-Sep	8.58	5	2	5	52	81	0	12	0	0	1	52	0	0	0	0	0	0	61	0	1	0	2	7	281	32.8
20-Sep	8.67	2	9	2	61	54	0	11	0	0	0	50	0	0	1	0	0	0	59	0	0	0	1	2	252	29.1
21-Sep	8.58	0	1	0	8	6	0	0	0	0	1	2	0	0	0	0	0	0	8	0	0	0	0	0	26	3.0
22-Sep	9.00	0	1	0	2	0	0	3	0	0	0	1	0	0	0	0	0	0	3	0	0	0	0	1	11	1.2
23-Sep	8.00	0	2	0	9	1	0	1	0	2	0	6	0	0	0	0	0	0	5	1	0	0	0	1	28	3.5
24-Sep	8.17	0	0	2	4	5	0	1	0	0	0	6	0	0	0	0	0	0	11	0	0	0	0	1	30	3.7
25-Sep	8.00	32	0	1	13	14	2	5	0	0	0	21	0	0	1	0	0	0	10	0	1	0	0	0	100	12.5
26-Sep	6.58	0	0	3	5	6	0	0	0	5	0	15	0	0	0	0	0	0	5	0	0	0	0	0	39	5.9
27-Sep	8.00	16	0	0	22	14	0	12	0	1	0	16	0	0	3	0	0	0	13	0	0	0	0	4	101	12.6
28-Sep	8.58	0	5	1	67	53	1	9	0	3	1	61	0	0	1	0	0	0	29	0	0	0	0	4	235	27.4
29-Sep	6.83	7	2	3	13	24	0	0	0	1	0	17	0	0	0	0	0	0	48	0	0	0	0	1	116	17.0
30-Sep	9.08	0	1	6	135	115	1	50	0	2	1	120	0	0	0	0	0	0	111	1	1	0	1	1	546	60.1

Appendix E. continued

DATE	OBS.		SPECIES ¹																				RAPTORS			
	HOURS	TV	OS	NH	SS	CH	NG	UA	RS	BW	SW	RT	FH	ZT	UB	GE	BE	UE	AK	ML	PR	PG	UF	UU	TOTAL	/HOUR
01-Oct	8.00	4	2	1	106	84	0	6	0	1	0	44	0	0	0	1	0	0	28	0	0	1	0	1	279	34.9
02-Oct	8.00	0	1	1	17	12	1	6	0	0	0	8	0	0	0	1	1	0	13	0	0	0	0	0	61	7.6
03-Oct	8.00	9	0	2	31	16	0	4	0	0	0	8	0	0	0	0	0	17	0	0	0	0	0	3	90	11.3
04-Oct	8.58	4	0	0	19	13	0	0	0	0	1	8	0	0	0	0	0	17	0	1	0	0	0	0	63	7.3
05-Oct	8.67	0	2	3	25	7	0	0	0	0	1	17	1	0	0	0	0	42	0	0	0	0	0	0	98	11.3
06-Oct	8.08	2	3	9	43	50	1	14	0	0	0	195	0	0	0	0	0	43	0	0	0	0	0	2	362	44.8
07-Oct	8.17	0	0	7	45	28	1	18	0	0	0	81	0	0	0	0	0	35	0	0	0	0	0	0	215	26.3
08-Oct	8.92	1	0	7	82	49	0	9	0	0	0	157	1	0	0	1	0	17	0	1	0	0	0	4	329	36.9
09-Oct	6.58	0	0	2	24	24	1	0	0	0	0	66	0	0	0	0	0	6	0	0	0	0	0	2	125	19.0
10-Oct	8.00	0	0	1	1	0	0	4	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	8	1.0
11-Oct	6.00	0	0	0	2	5	0	2	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	12	2.0
12-Oct	8.00	0	0	1	34	15	0	4	0	0	0	22	0	0	0	0	1	4	0	0	0	0	0	1	82	10.3
13-Oct	8.58	0	0	0	38	7	1	0	0	0	0	24	0	0	0	0	1	1	2	0	0	0	0	1	75	8.7
14-Oct	7.83	0	1	0	28	3	0	4	0	0	0	6	0	0	0	0	0	3	0	0	0	0	0	0	45	5.7
15-Oct	8.00	0	0	1	20	4	0	1	0	0	0	2	1	0	0	0	0	5	0	0	0	0	0	0	34	4.3
16-Oct	8.00	0	0	2	25	4	0	2	0	0	0	5	0	0	0	0	0	1	0	0	0	0	0	0	39	4.9
17-Oct	8.25	0	0	2	35	3	0	1	0	0	0	6	0	0	2	0	0	1	0	0	0	0	0	1	51	6.2
18-Oct	8.00	0	0	1	23	0	0	0	0	0	0	5	0	0	0	0	0	3	0	0	1	0	0	0	33	4.1
19-Oct	8.75	0	1	0	44	7	0	0	0	0	0	38	0	0	0	2	0	5	0	0	1	0	0	0	98	11.2
20-Oct	8.33	0	1	5	57	6	1	0	0	0	0	12	1	0	0	1	1	5	1	1	0	0	0	1	93	11.2
21-Oct	7.50	0	0	1	15	0	0	0	0	0	0	20	0	0	0	1	1	1	0	0	0	0	0	0	39	5.2
22-Oct	0.00																									
23-Oct	0.00																									
24-Oct	7.67	0	0	1	38	5	0	0	0	0	0	6	0	0	0	0	0	2	1	0	0	0	0	0	53	6.9
25-Oct	7.50	0	1	0	64	2	0	1	0	0	0	7	0	0	0	0	0	4	0	0	0	0	0	0	79	10.5
26-Oct	7.50	0	0	1	9	0	0	0	0	0	0	4	0	0	0	0	0	1	0	0	0	0	0	0	15	2.0
27-Oct	0.00																									
28-Oct	0.00																									
29-Oct	6.67	0	0	0	6	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	8	1.2
30-Oct	2.58	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.4
31-Oct	6.00	0	0	0	22	6	1	1	0	0	0	13	0	0	0	0	0	1	0	0	0	0	0	0	44	7.3
01-Nov	7.25	0	0	4	26	1	0	1	0	0	0	27	0	0	0	0	0	0	0	1	0	0	0	0	60	8.3
02-Nov	6.75	0	0	2	10	2	0	0	0	0	0	8	0	0	1	0	0	0	0	0	0	0	0	0	23	3.4
03-Nov	4.00	0	0	0	3	0	1	0	0	0	0	9	0	0	0	0	2	0	0	0	0	0	1	0	16	4.0
04-Nov	6.75	0	0	0	1	1	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	14	2.1
05-Nov	3.83	0	0	0	4	2	0	1	0	0	0	6	0	0	0	2	4	0	1	0	0	0	0	0	20	5.2
Total	511.54	97	88	99	1449	968	13	252	0	15	22	1498	6	0	15	9	11	0	1045	9	9	6	5	48	5664	11.1

¹ See Appendix B for explanation of species codes.

Appendix F. Daily count records by species for Yaki Point: 2000.

DATE	OBS.		SPECIES ¹																				RAPTORS			
	HOURS	TV	OS	NH	SS	CH	NG	UA	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	UF	UU	TOTAL	/HOUR	
27-Aug	2.92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
28-Aug	5.42	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.4
29-Aug	6.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
30-Aug	8.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
31-Aug	7.50	1	0	0	0	3	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	9	1.2
01-Sep	7.50	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.5
02-Sep	8.42	0	0	1	2	1	0	0	0	1	1	0	0	0	0	0	0	4	0	0	0	0	0	0	10	1.2
03-Sep	8.00	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	3	0.4
04-Sep	8.00	0	1	0	5	4	0	0	0	0	5	0	0	0	0	0	0	2	0	0	0	0	0	1	18	2.3
05-Sep	8.00	0	2	0	2	5	0	2	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	13	1.6
06-Sep	8.50	4	0	0	3	1	0	0	0	0	3	0	0	0	0	0	0	4	0	0	0	0	0	0	15	1.8
07-Sep	8.75	0	0	1	19	10	0	8	0	1	17	0	0	1	0	0	0	22	1	0	0	0	0	0	80	9.1
08-Sep	7.17	0	1	1	7	5	0	4	0	0	12	0	0	0	0	0	0	7	0	0	0	0	0	0	37	5.2
09-Sep	9.00	0	2	0	9	19	0	0	0	0	17	0	0	0	0	0	0	4	0	0	0	0	0	0	51	5.7
10-Sep	8.25	0	1	0	10	9	0	0	0	0	8	0	0	0	0	0	0	18	0	0	0	0	0	0	46	5.6
11-Sep	9.25	0	0	0	22	36	0	1	0	1	10	0	0	0	0	0	0	14	0	0	1	0	0	0	85	9.2
12-Sep	8.67	0	3	1	19	37	0	18	0	0	20	0	0	0	0	0	0	13	0	0	0	0	0	0	111	12.8
13-Sep	8.25	0	1	1	17	20	0	9	0	0	2	0	0	0	0	0	0	66	0	0	0	0	0	0	116	14.1
14-Sep	8.00	0	2	1	39	66	0	16	0	1	14	0	0	0	0	0	0	11	0	1	0	0	0	0	151	18.9
15-Sep	8.58	0	0	1	35	30	0	1	0	0	9	1	0	0	0	0	0	20	0	0	0	0	0	0	97	11.3
16-Sep	8.83	0	2	6	24	28	0	13	0	2	4	0	0	3	0	0	0	25	0	0	0	0	0	0	107	12.1
17-Sep	8.08	1	0	0	6	8	0	1	0	0	10	0	0	0	0	0	0	6	0	0	0	0	0	0	32	4.0
18-Sep	9.75	12	4	2	105	150	1	8	0	2	30	0	0	1	0	0	0	396	1	0	0	0	0	3	715	73.3
19-Sep	10.17	3	0	2	51	55	1	16	2	0	25	1	0	0	0	0	0	49	0	1	0	0	0	0	206	20.3
20-Sep	9.58	3	1	2	33	44	0	13	0	1	9	0	0	0	0	0	0	40	0	0	0	0	0	2	148	15.4
21-Sep	8.33	0	1	0	2	12	0	3	0	0	4	0	0	0	0	0	0	17	0	0	0	0	0	1	40	4.8
22-Sep	8.17	0	5	0	2	9	0	0	0	0	7	0	0	0	0	0	0	6	0	0	0	0	0	0	29	3.5
23-Sep	8.00	0	1	0	2	6	1	0	0	0	4	0	0	0	0	0	0	4	0	0	0	0	0	0	18	2.3
24-Sep	8.83	0	1	0	46	25	0	9	2	0	2	0	0	0	0	0	0	15	0	0	0	0	0	0	100	11.3
25-Sep	8.67	0	1	1	17	25	0	0	2	0	10	0	0	0	0	0	0	8	0	0	0	0	0	0	64	7.4
26-Sep	7.08	0	0	0	11	11	0	4	0	0	4	0	0	0	0	0	0	1	0	0	0	0	0	0	31	4.4
27-Sep	8.00	0	1	0	20	17	1	6	0	0	6	0	0	0	0	0	0	4	0	0	0	0	0	1	56	7.0
28-Sep	8.08	0	0	0	30	43	0	4	0	0	22	0	0	0	0	0	0	8	1	0	0	0	0	0	108	13.4
29-Sep	7.83	0	2	0	33	47	0	2	0	1	13	0	0	0	0	0	0	20	0	0	0	0	0	0	118	15.1
30-Sep	9.67	12	0	2	81	84	0	3	0	0	31	0	0	0	1	0	0	88	0	0	0	0	0	0	302	31.2

Appendix F. continued

DATE	OBS.		SPECIES ¹																			RAPTORS			
	HOURS	TV	OS	NH	SS	CH	NG	UA	BW	SW	RT	FH	RL	UB	GE	BE	UE	AK	ML	PR	PG	UF	UU	TOTAL	/HOUR
01-Oct	8.50	0	2	1	39	18	0	10	0	0	18	0	0	0	0	1	0	28	0	0	0	0	0	117	13.8
02-Oct	8.50	0	0	0	27	16	0	0	0	0	8	0	0	0	0	0	0	8	0	0	0	0	0	59	6.9
03-Oct	8.33	1	2	0	24	16	0	2	0	0	6	0	0	0	1	0	11	0	0	0	0	0	63	7.6	
04-Oct	8.58	5	0	2	137	68	1	1	0	0	59	0	0	0	0	0	18	2	0	0	0	0	293	34.1	
05-Oct	8.58	1	2	3	105	78	0	30	0	0	18	0	0	0	0	0	30	0	0	0	0	0	267	31.1	
06-Oct	9.00	0	0	3	80	42	0	0	0	0	41	0	0	0	0	0	10	0	0	0	0	0	176	19.6	
07-Oct	9.17	0	0	2	78	60	0	3	0	0	66	1	0	0	0	0	7	0	0	0	0	1	218	23.8	
08-Oct	8.75	0	0	0	51	25	0	7	0	0	38	0	0	0	0	0	2	0	0	0	0	0	123	14.1	
09-Oct	8.00	0	0	0	26	9	0	12	0	0	5	0	0	0	0	0	4	0	0	0	0	0	56	7.0	
10-Oct	2.42	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.8	
11-Oct	7.00	0	0	1	23	7	1	1	0	0	7	0	0	0	0	0	1	0	0	0	0	0	41	5.9	
12-Oct	7.67	1	0	0	36	10	0	1	0	0	39	0	0	0	0	0	1	0	0	0	0	0	88	11.5	
13-Oct	7.50	1	0	2	60	18	0	2	0	0	22	0	0	0	0	0	1	0	0	0	0	0	106	14.1	
14-Oct	8.00	0	0	0	47	19	0	2	0	0	4	0	0	0	0	0	12	0	0	0	0	0	84	10.5	
15-Oct	8.75	0	0	0	49	13	0	0	0	0	15	0	0	0	0	0	4	0	0	0	1	0	82	9.4	
16-Oct	8.42	0	1	1	77	15	0	2	0	0	32	0	0	0	1	1	2	0	1	0	0	0	133	15.8	
17-Oct	8.00	0	0	0	38	7	0	1	0	0	8	0	0	0	0	0	4	0	0	0	0	0	58	7.3	
18-Oct	8.17	0	1	0	36	6	0	0	0	0	40	0	0	1	0	0	2	0	0	0	1	1	88	10.8	
19-Oct	8.50	0	0	1	41	4	0	8	0	0	32	0	0	2	1	0	3	0	0	0	0	0	92	10.8	
20-Oct	8.00	0	1	1	30	3	0	12	0	0	48	0	0	0	3	0	9	0	0	0	0	0	107	13.4	
21-Oct	7.67	0	0	0	4	2	0	0	0	0	3	0	0	0	1	0	2	0	0	0	0	0	12	1.6	
22-Oct	0.00																								
23-Oct	0.00																								
24-Oct	6.75	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	7	1.0	
25-Oct	7.50	0	0	0	35	0	1	0	0	0	19	0	0	0	1	2	0	0	0	0	0	0	58	7.7	
26-Oct	7.17	0	1	0	9	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	13	1.8	
27-Oct	0.00																								
28-Oct	0.00																								
29-Oct	7.00	0	0	0	2	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	5	0.7	
30-Oct	0.50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
31-Oct	0.00																								
01-Nov	7.00	0	0	1	47	6	0	1	0	0	33	4	0	0	2	0	2	0	0	0	0	0	96	13.7	
02-Nov	6.75	0	0	1	9	0	0	0	0	0	6	1	0	0	1	0	0	0	0	0	0	0	18	2.7	
03-Nov	6.00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.2	
04-Nov	6.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
05-Nov	7.25	0	0	0	3	0	2	0	0	0	13	1	1	0	3	1	0	0	0	0	0	0	24	3.3	
Total	513.10	47	43	41	1772	1256	9	236	6	10	892	10	1	8	11	9	0	1035	5	4	1	3	10	5409	10.5

¹ See Appendix B for explanation of species codes.

Appendix G. Summary information on observation effort and raptor count totals by year and species for Lipan Point: 1991–2000.

YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	MEAN
Start date	8-Sep	1-Sep	31-Aug	1-Sep	1-Sep	27-Aug	27-Aug	27-Aug	27-Aug	27-Aug	29-Aug
End date	5-Nov	5-Nov	5-Nov	5-Nov	5-Nov	5-Nov	5-Nov	5-Nov	5-Nov	5-Nov	4-Nov
Days of observation	57	65	66	64	64	69	70	68	71	67	66
Hours of observation	399.66	513.50	504.50	482.92	492.54	508.84	522.19	505.18	546.70	511.54	498.76
Raptors / 100 hours	1231	1957	1249	1372	1369	1574	1331	1283	1152	1107	1362
SPECIES	RAPTOR COUNTS										
Turkey Vulture	148	276	48	108	215	232	290	304	75	97	179
Osprey	26	72	73	73	77	99	135	115	72	88	83
Northern Harrier	43	131	64	111	121	111	93	81	130	99	98
Sharp-shinned Hawk	698	2472	1643	1802	1441	1680	1566	1366	1427	1449	1554
Cooper's Hawk	1077	1673	1243	974	1052	1322	1332	1715	1515	968	1287
Northern Goshawk	10	42	26	4	5	3	8	2	6	13	12
Unidentified accipiter	360	337	199	200	243	423	213	243	185	252	266
TOTAL ACCIPITERS	2145	4524	3111	2980	2741	3428	3119	3326	3133	2682	3119
Red-shouldered Hawk	0	1	0	0	0	1	0	0	0	0	0
Broad-winged Hawk	0	3	7	2	7	2	7	35	11	15	9
Swainson's Hawk	6	24	25	33	34	57	32	31	40	22	30
Red-tailed Hawk	1194	3229	1613	1898	2299	2275	1704	1390	1401	1498	1850
Ferruginous Hawk	8	15	7	11	3	6	7	6	7	6	8
Zone-tailed Hawk	0	0	0	0	0	0	1	1	0	0	0
Unidentified buteo	55	19	2	8	11	16	33	40	17	15	22
TOTAL BUTEOS	1263	3291	1654	1952	2354	2357	1784	1503	1476	1556	1919
Golden Eagle	18	62	37	36	32	47	26	22	29	9	32
Bald Eagle	5	20	49	8	38	23	25	18	24	11	22
Unidentified eagle	0	0	3	0	0	0	0	1	4	0	1
TOTAL EAGLES	23	82	89	44	70	70	51	41	57	20	55
American Kestrel	1156	1508	1209	1273	1096	1631	1340	978	1218	1045	1245
Merlin	7	14	12	10	12	8	24	12	13	9	12
Prairie Falcon	1	8	8	2	5	4	5	5	2	9	5
Peregrine Falcon	2	14	5	5	5	8	8	10	8	6	7
Unidentified falcon	0	4	4	1	1	0	6	8	6	5	4
TOTAL FALCONS	1166	1548	1238	1291	1119	1651	1383	1013	1247	1074	1273
Unidentified raptor	106	124	24	66	48	60	97	96	107	48	78
GRAND TOTAL	4920	10048	6301	6625	6745	8008	6952	6479	6297	5664	6804

Appendix H. Summary information on observation effort and raptor count totals by year and species for Yaki Point: 1997–2000.

YEAR	1997	1998	1999	2000	MEAN
Start date	27-Aug	28-Aug	27-Aug	27-Aug	26-Aug
End date	5-Nov	5-Nov	5-Nov	5-Nov	4-Nov
Days of observation	71	66	71	66	69
Hours of observation	504.97	455.41	543.20	513.10	504.17
Raptors / 100 hours	938.3	907.5	997.8	1054.2	974.4
SPECIES	RAPTOR COUNTS				
Turkey Vulture	144	88	76	47	89
Osprey	50	43	28	43	41
Northern Harrier	50	44	56	41	48
Sharp-shinned Hawk	1474	1190	1906	1772	1586
Cooper's Hawk	856	1109	1204	1256	1106
Northern Goshawk	4	7	1	9	5
Unidentified accipiter	94	140	109	236	145
TOTAL ACCIPITERS	2428	2446	3220	3273	2842
Red-shouldered Hawk	1	0	0	0	0
Broad-winged Hawk	9	19	14	6	12
Swainson's Hawk	15	25	32	10	21
Red-tailed Hawk	899	916	985	892	923
Ferruginous Hawk	8	7	11	10	9
Rough-legged Hawk	0	0	0	1	0
Zone-tailed Hawk	0	0	1	0	0
Unidentified buteo	20	20	13	8	15
TOTAL BUTEOS	952	987	1056	927	981
Golden Eagle	24	7	2	11	11
Bald Eagle	23	18	17	9	17
Unidentified eagle	1	0	1	0	1
TOTAL EAGLES	48	25	20	20	28
American Kestrel	1016	423	918	1035	848
Merlin	14	12	14	5	11
Prairie Falcon	9	4	6	4	6
Peregrine Falcon	7	19	8	1	9
Unidentified falcon	0	4	2	3	2
TOTAL FALCONS	1046	462	948	1048	876
Unidentified raptor	20	38	16	10	21
GRAND TOTAL	4738	4133	5420	5409	4925