

**FALL 2005 RAPTOR MIGRATION STUDY
NEAR CORPUS CHRISTI, TEXAS**



**HawkWatch International, Inc.
Salt Lake City, Utah**

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INTRODUCTION

The Corpus Christi Raptor Migration Project in southern Texas is an ongoing effort to monitor long-term population trends of raptors using this southern portion of the Gulf Coast migratory flyway (Smith et al. 2001). During fall 2005, HawkWatch International (HWI) conducted the ninth consecutive, full-season migration count at Hazel Bazemore County Park near Corpus Christi. Previously, volunteers conducted peak-season counts at this “Coastal Bend” site each year between 1988 and 1996, following protocols of the Hawk Migration Association of North America (HMANA). The December 1997 issue of the HMANA Journal of Hawk Migration Studies includes a summary of these counts. Since HWI began full-season counts at the site in 1997, 30 species of raptors have been observed migrating through the project area. Previous annual counts have ranged from 444,844 to 1,030,849 migrants, with Broad-winged Hawks (see Appendix A for common and scientific names of all raptor species observed at the site) comprising 88–98% of the total count each year. This report summarizes the count results from the 2005 season.

The Corpus Christi project was 1 of 13 long-term, annual migration counts conducted or sponsored by HWI in North America during 2005. The primary objective of these efforts is to track long-term population trends of diurnal raptors, emphasizing western North America and the Gulf Coast region (Smith and Hoffman 2000, Inzunza et al. 2000, Smith et al. 2001, Hoffman and Smith 2003). Raptors feed atop food pyramids, inhabit most ecosystems, occupy large home ranges, and are sensitive to environmental contamination and other human disturbances. For these reasons, they serve as important biological indicators of ecosystem health (Bildstein 2001). Moreover, due to the remoteness and widespread distribution of most raptor populations, migration counts represent one of the most cost-effective and efficient methods for monitoring the regional status and trends of multiple raptor species (Bednarz and Kerlinger 1989, Titus et al. 1989, Dunn and Hussell 1995, Dixon et al. 1998, Zalles and Bildstein 2000, Hoffman and Smith 2003).

STUDY SITE

The nine-county area around Corpus Christi is commonly called the Coastal Bend. This includes Aransas, Refugio, San Patricio, Nueces, and Kleberg counties along the coast, and Goliad, Bee, Live Oak, and Jim Wells counties to the west. The Texas coast runs from the northeast to the southwest between the Louisiana border and Corpus Christi Bay, then shifts to a north–south direction. Hazel Bazemore Park (HBP) is approximately 27 km west of Corpus Christi Bay near the town of Calallen (27°52'3.0"N, 97°38'30.1"W; Figure 1). This geographic location is ideal for monitoring the autumn raptor migration through the region. Past records show that this is a major migration path for Broad-winged Hawks (Rappole and Blacklock 1985).

The HBP monitoring site is situated at an elevation of 28 m above mean sea level, which is the highest elevation along the coast in a four-county area. The park sits on the southern bank of the Nueces River at a horseshoe bend where the river changes from a southeast to north–northwest flow. The watch site offers clear visibility through a 105° arc from the northeast to the west, but the view to the east is restricted by topography at a similar elevation. The Nueces River bottomlands feature a transitional riparian forest. Characteristic plants include hackberry (*Celtis* spp.), Mexican ash (*Fraxinus berlandieriana*), anacua (*Ehretia anacua*), black persimmon (*Diospyros texana*), chittimwood (*Bumelia lanuginosa*), and cedar elm (*Ulmus crassifolia*). Many species of raptors use this forested area for nocturnal roosting during migration (Rappole and Blacklock 1985). Open farmland predominates to the north and south, open ranchland to the west. Corpus Christi Bay, which is an industrial and urbanized area, lies to the east.

METHODS

Three official or designated observers, routinely assisted by several experienced local volunteers, conducted daily counts of migrating raptors from a single traditional observation site at HBP. On-site project coordinator Joel Simon served as one of the official observers, which he has done most years since 1997, and provided supervision and training for the other observers, the education specialist, and local volunteers (see Appendix B for a complete history of official observer participation). Official observer Dane Ferrell had previously conducted four other full-season migration counts for HWI, including three seasons in Texas. This was official observer Brian Bielfelt's first full season of migration counting, but he had gained limited previous exposure to migration monitoring in Florida. Several other experienced local volunteers, as well as full-time site educator Tara Conkling, routinely assisted with the count, as has been the case in most years.

The official observers assigned a specific task to each actively participating individual to maximize accuracy of the counts and ensure quality participation by all interested volunteers. Counters were responsible for counting large flights of raptors, usually Broad-winged Hawks. Spotters were responsible for scanning the sky for both large flights and single raptors, and notifying the counters of their sightings. Other individuals were responsible for scanning through large flights of Broad-winged Hawks and recording occurrences of other species. Other volunteer assignments included keeping up with the visitor log, taking weather observations when the primary observer was too busy with counts, and serving as data recorder on busy days.

Weather permitting, observations typically began by 0800 hrs and ended by 1600 hrs Central Standard Time (CST). The observers routinely recorded the following data:

1. Species, age, sex, and color morph of each migrant raptor, whenever possible and applicable (Appendix A 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). The observers generally tallied raptors only by species, because the demands of counting during peak flight periods usually precluded paying close attention to details other than species identification. High flight altitudes also frequently limited the attainable detail. Because of these limitations, we do not focus attention in this report on the age, sex, or color-morph data.
2. Hour of passage for each migrant; e.g., the 1000–1059 hrs CST.
3. Wind speed and direction, air temperature, percent cloud cover, predominant cloud type(s), presence or 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.

Otherwise, data gathering and recording followed standardized protocols used at all HWI migration sites (Hoffman and Smith 2003). In comparing 2005 annual statistics against means and 95% confidence intervals (mean \pm 95% CI) for 1997–2003, we equate significance with a 2005 value falling outside of the 95% CI for the associated mean.

RESULTS AND DISCUSSION

WEATHER

While 2005 was generally a devastating hurricane season for the Gulf Coast region, stormy weather was a relatively minor issue for our Corpus Christi crew in 2005, with inclement weather entirely precluding only 1 day of potential observation and reducing only 1 other day to ≤ 4 hours of observation, which is considerably less than the 1997–2004 averages for the site of 3.8 and 2.9 days, respectively (see Appendix C for daily weather records). Moreover, fair skies predominated on 40% of the active observation days, transitional weather on 49% (i.e., skies changed from fair to mostly cloudy/overcast, or vice versa, during the day), and mostly cloudy to overcast skies on 10% of the active days, which again reflects a distinct shift toward fairer weather compared to the average pattern (34% fair, 42% transitional, and 25% mostly cloudy to overcast). Nevertheless, at least scattered rain and thunderstorms occurred on 20% of the active observation days, which is slightly higher than the 1997–2004 average of 16%. The 2005 season recorded an average prevalence of visibility reducing fog and haze, mostly occurring in the morning hours (50% of active days vs. 1997–2004 average of 53%); however, continuing a recent trend, average visibility (average 8 km east and west; values are grand means of daily averages, which derive from hourly estimates) was $\sim 22\%$ less than the long-term averages of 9.8 km to the west and 10.6 km to the east.

The 2005 season was overall the calmest yet, with light winds (< 12 kph) prevailing on 75% of the active observation days and moderate winds (12–28 kph) on 25% (averages 70% light, 30% moderate, and 1% strong [≥ 29 kph]). The high prevalence of light winds in 2005 counters a distinct shift toward more moderate winds that occurred from 2001–2004, which is surprising given the chaotic 2005 hurricane season. In terms of wind directions, E–S winds prevailed throughout most or all of 40% of the active observation days, N–E winds on 26%, W–N winds on 8%, and a variety of other combinations on the remainder of the active observation days. The basic distribution of prevailing wind directions very closely matched the long-term average pattern for the site; however, the proportion of days where calm/variable conditions applied during a significant portion of the day (25%) was noticeably higher than the long-term average (16%).

Daily-average (mean of hourly readings) temperatures averaged 31.1°C and ranged from 17.1 – 36.3°C , which is the highest average recorded thus far (1997–2004 grand average of 29.1°C , range 27.5 – 29.7°C), but a typical range of daily values. Daily-average (mean of hourly readings) barometric pressure averaged 29.96 in Hg, ranging from 29.58–30.30, which are all typical values.

In 2005, 41% of the active observation days received a median thermal lift rating of good to excellent, which is slightly higher than the 1997–2004 average of 36%.

In summary, although a busy hurricane season greatly affected the overall Gulf Coast region in 2005, weather collected on site by our observers during active observation periods revealed fairer than average sky conditions, lighter winds than usual, and especially warmer temperatures, with the lighter winds and warmer temperatures contributing to above average thermal lift conditions.

OBSERVATION EFFORT

Observations occurred on 92 of 93 possible days between 15 August and 15 November (see Appendix D for daily count records). The number of observation days and hours (715.75) were 3% and 4% higher, respectively, than the 1997–2004 averages of $89 \pm 95\%$ CI of 2.4 days and 687.9 ± 35.25 hours of observation per season. The 2005 average of 3.9 observers per hour (includes official and guest observers; value is mean of daily values, which are in turn means of hourly values) was significantly higher than the 1997–2004 average of 3.5 ± 0.20 observers/hr.

MIGRATION SUMMARY

The observers tallied a record low 297,375 migrating raptors of 26 species during the 2005 season (Table 1), which stands in stark contrast to last year's record-setting first single-site raptor migration count to exceed one million birds in North America outside of Mexico! These marked variations in the total count primarily reflect fluctuations in numbers of Broad-winged Hawks, which still comprised 88% of the total count in 2005 (96% in 2004). Species that comprised 3% or more of the remainder of the 2005 count included Turkey Vulture (54%), Swainson's Hawk (17%), Mississippi Kite (16%), and Sharp-shinned Hawk (3%). Buteos, vultures, and kites were the predominant species groups (Figure 2). With Broad-winged Hawks excluded, the proportion of kites was significantly above average in 2005, whereas the proportion of other buteos was significantly below average. Besides hurricanes Katrina and Rita, other highlights of the season included the third Aplomado Falcon recorded at the site; new record-high counts of Ospreys (241; for the third year in a row), White-tailed Kites (9), White-tailed Hawks (25), Zone-tailed Hawks (10), and Short-tailed Hawks (4; only the third season this species has been recorded); and the second highest tally of Ferruginous Hawks (5).

Interannual Count Trends and Regional Comparisons

The 2005 Broad-winged Hawk count was a significant 64% lower than the 1997–2004 average, and the combined-species count excluding Broad-winged Hawks was a non-significant 13% below average (Table 1). Among 24 species observed in most years, 10 showed significantly above-average passage rates in 2005 (Osprey, Swallow-tailed, White-tailed and Mississippi Kites, Harris's, Short-tailed, White-tailed and Zone-tailed Hawks, Bald Eagle, and Peregrine Falcon), 6 showed significantly below-average passage rates (Sharp-shinned, Red-shouldered, Broad-winged, Swainson's and Red-tailed Hawks, and Prairie Falcon), and rates were within the bounds of typical variation for 8 species (Table 1).

Nine years is still too short of a period to warrant detailed attention to long-term trends (10 years of data is usually the minimum goal), especially following an irregular hurricane season. Nevertheless, a cursory examination of apparent patterns in annual passage rates is instructive, especially in comparison to data from other similar Gulf Coast projects. Species showing distinct or probable increasing patterns over the period of record at Corpus Christi include Turkey Vulture, Osprey, Swallow-tailed and Mississippi Kites, Cooper's Hawks, Harris's Hawks, White-tailed Hawks (recent upswing), Swainson's Hawks (though a low 2005 count—most likely hurricane related—substantially dampened the apparent trend for this species), American Kestrels, Merlins and Peregrine Falcons (Figures 3–6). Species showing possible decreasing trends include Red-shouldered Hawks, Broad-winged Hawks, and Prairie Falcons, though the apparent pattern for broad-wings is accentuated by the very low 2005 count, which was almost certainly hurricane related (Figures 4 and 6).

Farther to the northeast at Smith Point, Texas, the Broad-winged Hawk count (20,380) was the second lowest on record and 50% below the 1997–2004 average for that site (Smith and Neal 2006). Hurricane Rita was undoubtedly the primary reason for the comparatively low Broad-winged Hawk counts at both Smith Point and Corpus Christi. The hurricane struck just as the main wave of Broad-winged Hawks moved down through Texas from the northeast, which undoubtedly caused many birds to remain farther inland than usual and remain undetectable at both the Corpus Christi and Smith Point sites. We know this was the case because the ~1.8 million Broad-winged Hawks that eventually passed through Veracruz, Mexico essentially matched the 1992–2004 average for that site (Pronatura Veracruz, HWI, and Hawk Mountain Sanctuary unpublished data). In contrast to the situation for Broad-winged Hawks, both Texas sites tallied record high counts of Mississippi Kites and significantly above-average counts of White-tailed Hawks in 2005.

Comparing trends in passage rates over the course of the two studies (both begun in 1997), both projects show similar long-term increasing patterns for Turkey Vultures, Osprey, Mississippi and Swallow-tailed Kites, and Peregrine Falcons; both have shown at least recent increasing patterns for White-tailed Hawks;

and both have generally shown increasing patterns for Swainson's Hawks, although the count at Corpus Christi was low in 2005 while the count at Smith Point remained above average. Species that are currently showing noticeably divergent patterns at the two sites include Broad-winged Hawks (slight declining trend at Corpus Christi; overall stable pattern at Smith Point with major spike in 2001/2002), Red-shouldered Hawks (slight decreasing trend at Corpus Christi; slight increasing trend at Smith Point), American Kestrels (opposite of Red-shouldered Hawks), and Crested Caracaras (overall stable pattern at Corpus Christi; strong increasing pattern at Smith Point).

Elsewhere around the Gulf Coast, in the Florida Keys the overall southbound count was 41% below the 1999–2004 average for that site and was by far the lowest combined-species total yet recorded there (HWI unpublished data). In this case, three significant hurricanes spread out through the season directly affected both observation effort and the flow of migrants through Florida in 2005. Counts there were significantly below average for all species commonly recorded at the site, suggesting that the sequence of hurricanes most likely caused many migrants that would otherwise have ended up in south Florida to stay farther north and perhaps skirt around the northern Gulf Coast.

In Veracruz, Mexico, along the far southwestern Gulf Coast, the overall 2005 count (data from two count sites combined) was 22% above average and the third highest since the project began in 1992 (Pronatura Veracruz, HWI, and Hawk Mountain Sanctuary unpublished data). Among the four most common species, counts were 1% below average for Broad-winged Hawks, 38% above average for Turkey Vultures, 25% above average for Mississippi Kites, and 59% above average for Swainson's Hawks. In contrast, much like in 2004, counts were 0–53% below average for four that comprise the second tier of common species at this site: Osprey, Sharp-shinned and Cooper's Hawks, and American Kestrel. Similar to both Texas sites, Veracruz counts show distinct long-term increasing trends for Turkey Vultures, Mississippi and Swallow-tailed Kites, and Swainson's Hawks.

Seasonal Timing

The median passage date for the Broad-winged Hawk flight in 2005 (29 September) was a significant 3 days later than average (Table 3). This is evident as a slight shift in the overall seasonal activity pattern for the species (the dominant contributor to Figure 8, top panel) and reflects the effects of Hurricane Rita shifting the peak flight of broad-wings farther inland than usual until the hurricane dissipated around 25–26 September and allowed the tail end of the peak flight to shift back towards the coast and be counted at the site. Thirteen other commonly occurring species also showed at least slightly later than average median passage dates in 2005, though the differences were significant only for Black and Turkey Vultures, and Harris's and White-tailed Hawks (Table 3). Reasons for the delays in vulture passage are uncertain at present; peak passage for both species occurs in mid-to-late October, well after the hurricane and come and gone. In contrast, like for broad-wings, Hurricane Rita struck during a time when the first significant passage of Harris's and White-tailed Hawks normally occurs. The only species that showed at least marginally significant early timing in 2005 were Northern Harriers, Mississippi Kites, and Cooper's Hawks. For Mississippi Kites, Hurricane Katrina blasted the Gulf Coast region at the end of August and noticeably truncated the normal peak passage of this species, which usually extends across the last 10 days of August and first 10 days of October.

RESIDENT AND LOCAL RAPTOR ACTIVITY

A pair of resident White-tailed Hawks occurred in the count area for the ninth consecutive year, with two subadults seen in the area mid-season. A family group of Red-shouldered Hawks, including two adults and one juvenile, were present throughout the season. At least one adult and one immature Harris's Hawks were seen sporadically. Two potential Krider's Red-tailed Hawks were present for two days in late October. One immature Broad-winged Hawk stayed in the local area for several days in late September. A Northern Harrier took up residence in the area in mid-October. An American Kestrel was first seen in the area in mid-September and then one male and one female resided in the local area for the

rest of the season. Two Cooper's Hawks and at least two Sharp-shinned Hawks took up residence in the area beginning in late September. More Sharp-shinned and Cooper's Hawks began to congregate during early November. Two Crested Caracaras were seen regularly in the area during the first three weeks of the count; two other birds were seen frequenting the area for a short time in mid-October; and then two birds were again seen sporadically during the last three weeks of the season. A resident Osprey was seen regularly through the third week of October. Variable numbers of local Black and Turkey Vultures were present throughout the season. Estimated numbers of at least transient locals rose to as high as 40 Black and 25 Turkey Vultures from mid-September through mid-October as migrant volume increased, but the early season core group consisted of around 8 Black Vultures and 5 Turkey Vultures.

This is a typical array of resident activity for the site.

VISITOR PARTICIPATION AND PUBLIC OUTREACH

During the 2005 season, 305 individuals visited the project site, which is less than half the visitation of the last two years. Unfortunately, Hurricane Rita struck during the time when HWI normally hosts the annual *Celebration of Flight* event at the site to coincide with the peak passage period of Broad-winged Hawks. This was a great disappointment to all, as coordinator Joel Simon had, as usual, arranged for a wonderful series of special activities and presentations at the event, which typically attracts hundreds of additional visitors to the project site each year. Nevertheless, those that did visit during the season still reflected a broad diversity of geographic origins (13 states besides Texas); and were treated to a variety of rare sightings and informative interactions with our crew, especially on-site educator Tara Conkling. Organized groups that visited the site in 2005 included a local fifth grade class and high school science class. The local Audubon society had scheduled three field trips to the site in September, but all were thwarted by the complicated hurricane season. In early October, the Texas Ornithological Society held their annual meeting at Port Aransas and included two field trips to the site, which were attended by 31 people.

Besides the extensive on-site education and public outreach that occurred at the project site in 2005, seasonal education specialist Tara Conkling also conducted 71 educational programs in area schools, including attending booths at two school science fairs, which reached a total of 2,307 students and 315 parents and teachers. Similar to 2004, this level of off-site programming is among the highest achieved for the project to date. Tara's work benefited greatly from three new standardized education programs and slide shows tailored to different age groups, which last year's educator Amanda Morrison developed and Tara continued to refine.

In 2005, 774 hourly assessments of visitor disturbance resulted in no days when the official observers felt that the presence of visitors detracted from their primary focus of tallying the migration. This continued very low level of visitor disturbance experienced by the official observers is apt testimony to the benefits of having a full-time education specialist on the field crew and a large cadre of highly dedicated and knowledgeable local volunteers regularly available to assist with the count and facilitate visitor interactions.

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LITERATURE CITED

- Bednarz, J. C., and P. Kerlinger. 1989. Monitoring hawk populations by counting migrants. Pages 328–342 in B. Pendleton, editor. *Proceedings of the Northeast Raptor Management Symposium and Workshop*. National Wildlife Federation, Washington, D.C., USA.
- Bildstein, K. L. 2001. Why migratory birds of prey make great biological indicators. Pages 169–179 in K. L. Bildstein and D. Klem (Editors). *Hawkwatching in the Americas*. Hawk Migration Association of North America, North Wales, Pennsylvania, USA.
- Dixon, P. M., A. R. Olsen, and B. M. Kahn. 1998. Measuring trends in ecological resources. *Ecological Applications* 8:225–227
- Dunn, E. H., and D. J. T. Hussell. 1995. Using migration counts to monitor landbird populations: review and evaluation of status. Pages 43–88 in D. M. Power, editor. *Current Ornithology*, Vol. 12. Plenum Press, New York, New York, USA.
- Hoffman, S. W., and J. P. Smith. 2003. Population trends of migratory raptors in western North America, 1977–2001. *Condor* 105:397–419.
- Inzunza, E. R., S. W. Hoffman, L. J. Goodrich, and R. Tingay. 2000. Conservation strategies for the world's largest known raptor migration flyway: Veracruz the River of Raptors. Pages 591–596 in R. D. Chancellor and B.-U. Meyburg, editors. *Raptors at risk*. World Working Group on Birds of Prey and Owls, Berlin, Germany, and Hancock House Publishers, British Columbia and Washington.
- Rappole, J. H., and G. W. Blacklock. 1985. *Birds of the Texas coastal bend*. Texas A & M University Press, College Station, Texas, USA.
- Smith, J. P. 2005. Fall 2004 raptor migration study at Smith Point, Texas. HawkWatch International, Salt Lake City, Utah, and Gulf Coast Bird Observatory, Lake Jackson, Texas, USA. 25 pp.
- Smith, J. P., and S. W. Hoffman. 2000. The value of extensive raptor migration monitoring in western North America. Pages 597–615 in R. D. Chancellor and B.-U. Meyburg, editors. *Raptors at risk*. Proceedings of the Vth World Working Group on Birds of Prey and Owls, Midrand, Johannesburg, South Africa, 4–11 August 1998. World Working Group on Birds of Prey and Owls, Berlin, Germany, and Hancock House Publishers, British Columbia and Washington.
- Smith, J. P., J. Simon, S. W. Hoffman, and C. Riley. 2001. New full-season autumn hawkwatches in coastal Texas. Pages 67–91 in K. L. Bildstein and D. Klem, editors. *Hawkwatching in the Americas*. Hawk Migration Association of North America, North Wales, Pennsylvania, USA.
- Titus, K., M. R. Fuller, and J. L. Ruos. 1989. Considerations for monitoring raptor population trends based on counts of migrants. Pages 19–32 in B. U. Meyburg and R. D. Chancellor, editors. *Raptors in the modern world*. Proceedings of the III World Conference on Birds of Prey and Owls, Eilat, Israel, 1987. World Working Group on Birds of Prey and Owls, Berlin, Germany.
- Zalles, J. I., and K. L. Bildstein (Editors). 2000. *Raptor watch: a global directory of raptor migration sites*. BirdLife Conservation Series No. 9. BirdLife International, Cambridge, United Kingdom, and Hawk Mountain Sanctuary Association, Kempton, Pennsylvania, USA.

Table 1. Fall counts and passage rates by species for migrating raptors at Hazel Bazemore Park near Corpus Christi, Texas: 1997–2004 versus 2005.

SPECIES	COUNTS			RAPTORS/100 HOURS		
	1997–2003 ¹	2004	% CHANGE	1997–2003 ¹	2004	% CHANGE
Black Vulture	551 ± 302.4	445	-19	78.4 ± 41.7	62.2	-21
Turkey Vulture	21,376 ± 9,855.7	19,090	-11	3,083.2 ± 1,408.7	2,667.1	-13
Unidentified vulture	1 ± 2.2	0	-100	0.2 ± 0.3	0.0	-100
TOTAL VULTURES	21,927 ± 9,970.6	19,535	-11	3,161.6 ± 1,423.1	2,729.3	-14
Osprey	149 ± 34.5	241	+61	22.1 ± 5.7	33.7	+52
Northern Harrier	154 ± 54.7	157	+2	22.4 ± 7.7	21.9	-2
Hook-billed Kite	0 ± 0.2	0	-100	0.0 ± 0.0	0.0	-100
Swallow-tailed Kite	24 ± 13.4	56	+131	3.5 ± 1.9	7.8	+123
White-tailed Kite	3 ± 1.4	9	+188	0.5 ± 0.2	1.3	+172
Mississippi Kite	6,173 ± 1,969.6	10,004	+62	901.3 ± 291.2	1,397.7	+55
TOTAL KITES	6,200 ± 1,977.0	10,069	+62	905.2 ± 292.3	1,406.8	+55
Sharp-shinned Hawk	1,134 ± 251.9	880	-22	167.0 ± 40.4	122.9	-26
Cooper's Hawk	626 ± 211.6	815	+30	91.0 ± 31.4	113.9	+25
Northern Goshawk	0 ± 0.3	0	-100	0.0 ± 0.0	0.0	-100
Unidentified accipiter	289 ± 56.7	174	-40	42.3 ± 8.7	24.3	-42
TOTAL ACCIPITERS	2,050 ± 362.7	1,869	-9	300.3 ± 56.8	261.1	-13
Common Black Hawk	0 ± 0.2	0	-100	0.0 ± 0.0	0.0	-100
Harris' Hawk	13 ± 6.0	25	+98	1.8 ± 0.8	3.5	+94
Red-shouldered Hawk	58 ± 19.0	37	-36	8.3 ± 2.6	5.2	-38
Broad-winged Hawk	729,320 ± 153,501.4	263,101	-64	107,323.0 ± 25,346.5	36,758.8	-66
Short-tailed Hawk	0 ± 0.5	4	+967	0.1 ± 0.1	0.6	+963
Swainson's Hawk	6,622 ± 3,854.2	1,347	-80	972.7 ± 545.5	188.2	-81
White-tailed Hawk	7 ± 4.2	25	+245	1.1 ± 0.6	3.5	+232
Zone-tailed Hawk	3 ± 1.8	10	+300	0.4 ± 0.3	1.4	+283
Red-tailed Hawk	175 ± 44.4	103	-41	25.4 ± 6.0	14.4	-43
Ferruginous Hawk	3 ± 3.2	5	+82	0.4 ± 0.4	0.7	+81
Rough-legged Hawk	1 ± 1.0	0	-100	0.1 ± 0.1	0.0	-100
Unidentified buteo	112 ± 83.3	34	-70	15.8 ± 11.4	4.8	-70
TOTAL BUTEOS	736,313 ± 155,400.4	264,691	-64	108,348.9 ± 25,611.2	36,980.9	-66
Golden Eagle	1 ± 0.8	2	+45	0.2 ± 0.1	0.3	+42
Bald Eagle	2 ± 1.0	4	+146	0.2 ± 0.1	0.6	+135
Unidentified eagle	0 ± 0.2	0	-100	0.0 ± 0.0	0.0	-100
TOTAL EAGLES	3 ± 1.8	6	+92	0.5 ± 0.2	0.8	+86
Crested Caracara	11 ± 5.7	11	-1	1.6 ± 0.8	1.5	-4
American Kestrel	493 ± 163.2	485	-2	73.0 ± 25.7	67.8	-7
Merlin	32 ± 7.9	36	+14	4.6 ± 1.3	5.0	+9
Prairie Falcon	10 ± 7.0	3	-70	1.4 ± 1.0	0.4	-71
Peregrine Falcon	144 ± 39.9	230	+60	21.2 ± 6.1	32.1	+52
Aplomado Falcon	0 ± 0.3	1	+300	0.0 ± 0.0	0.1	+280
Unknown small falcon	3 ± 2.2	1	-69	0.5 ± 0.3	0.1	-71
Unknown large falcon	4 ± 4.3	0	-100	0.5 ± 0.7	0.0	-100
Unidentified falcon	43 ± 24.8	5	-88	6.2 ± 3.4	0.7	-89
TOTAL FALCONS	725 ± 196.5	761	+5	107.0 ± 31.2	106.3	-1
Unidentified raptor	1,267 ± 1,238.6	35	-97	193.6 ± 197.4	4.9	-97
GRAND TOTAL	768,800 ± 146,294.0	297,375	-61	113,063.4 ± 24,458.9	41,547.3	-63

¹ Mean ± 95% confidence interval.

Table 2. First and last observed, bulk-passage, and median-passage dates by species for migrating raptors at Hazel Bazemore Park near Corpus Christi, Texas in 2005, with a comparison of 2005 and 1997–2004 average median passage dates.

SPECIES	2005				1997–2004	
	FIRST OBSERVED	LAST OBSERVED	BULK PASSAGE DATES ¹	MEDIAN PASSAGE DATE ²	MEDIAN PASSAGE DATE ^{2,3}	
Black Vulture	5-Sep	15-Nov	4-Oct – 15-Nov	9-Nov	27-Oct	± 6.5
Turkey Vulture	4-Sep	15-Nov	17-Oct – 28-Oct	25-Oct	20-Oct	± 4.3
Osprey	15-Aug	15-Nov	16-Sep – 9-Oct	29-Sep	28-Sep	± 2.3
Northern Harrier	22-Aug	15-Nov	19-Sep – 28-Oct	4-Oct	11-Oct	± 6.9
Swallow-tailed Kite	17-Aug	18-Sep	18-Aug – 27-Aug	25-Aug	25-Aug	± 3.0
White-tailed Kite	28-Aug	6-Nov	28-Aug – 6-Nov	7-Oct	04-Oct	± 8.8
Mississippi Kite	18-Aug	8-Oct	22-Aug – 30-Aug	25-Aug	30-Aug	± 3.7
Sharp-shinned Hawk	28-Aug	10-Nov	29-Sep – 16-Oct	9-Oct	08-Oct	± 4.6
Cooper's Hawk	21-Aug	13-Nov	22-Sep – 21-Oct	3-Oct	08-Oct	± 4.0
Harris' Hawk	16-Aug	10-Nov	18-Aug – 7-Nov	13-Oct	01-Oct	± 9.1
Red-shouldered Hawk	17-Aug	14-Nov	27-Aug – 24-Oct	8-Oct	02-Oct	± 9.2
Broad-winged Hawk	21-Aug	4-Nov	22-Sep – 30-Sep	29-Sep	26-Sep	± 2.0
Short-tailed Hawk	2-Sep	18-Oct	–	–	–	–
Swainson's Hawk	16-Aug	14-Nov	7-Sep – 15-Oct	6-Oct	10-Oct	± 4.3
White-tailed Hawk	16-Aug	11-Nov	21-Aug – 7-Nov	9-Oct	24-Sep	± 7.2
Zone-tailed Hawk	14-Sep	14-Oct	14-Sep – 2-Oct	26-Sep	25-Sep	± 1.0
Red-tailed Hawk	15-Aug	14-Nov	16-Sep – 10-Nov	22-Oct	18-Oct	± 9.3
Ferruginous Hawk	27-Sep	1-Nov	27-Sep – 1-Nov	8-Oct	05-Oct	⁴
Golden Eagle	6-Oct	15-Oct	–	–	–	–
Bald Eagle	22-Sep	28-Oct	–	–	–	–
Crested Caracara	17-Aug	9-Nov	30-Aug – 2-Nov	14-Oct	11-Oct	± 10.7
American Kestrel	31-Aug	1-Nov	23-Sep – 16-Oct	10-Oct	03-Oct	± 3.0
Merlin	18-Sep	2-Nov	28-Sep – 21-Oct	1-Oct	30-Sep	± 4.1
Prairie Falcon	8-Oct	1-Nov	–	–	02-Oct	± 5.7
Peregrine Falcon	27-Aug	15-Nov	19-Sep – 12-Oct	1-Oct	01-Oct	± 2.2
Aplomado Falcon	21-Oct	21-Oct	–	–	–	–
ALL SPECIES	15-Aug	15-Nov	20-Sep – 30-Sep	29-Sep	26-Sep	± 2.0

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

² Date by which 50% of the flight had passed the lookout.

³ Mean of annual values ± 95% confidence interval in days; unless otherwise indicated, values are given only for species with annual counts ≥5 birds for ≥3 years.

⁴ Data for 1999 only.

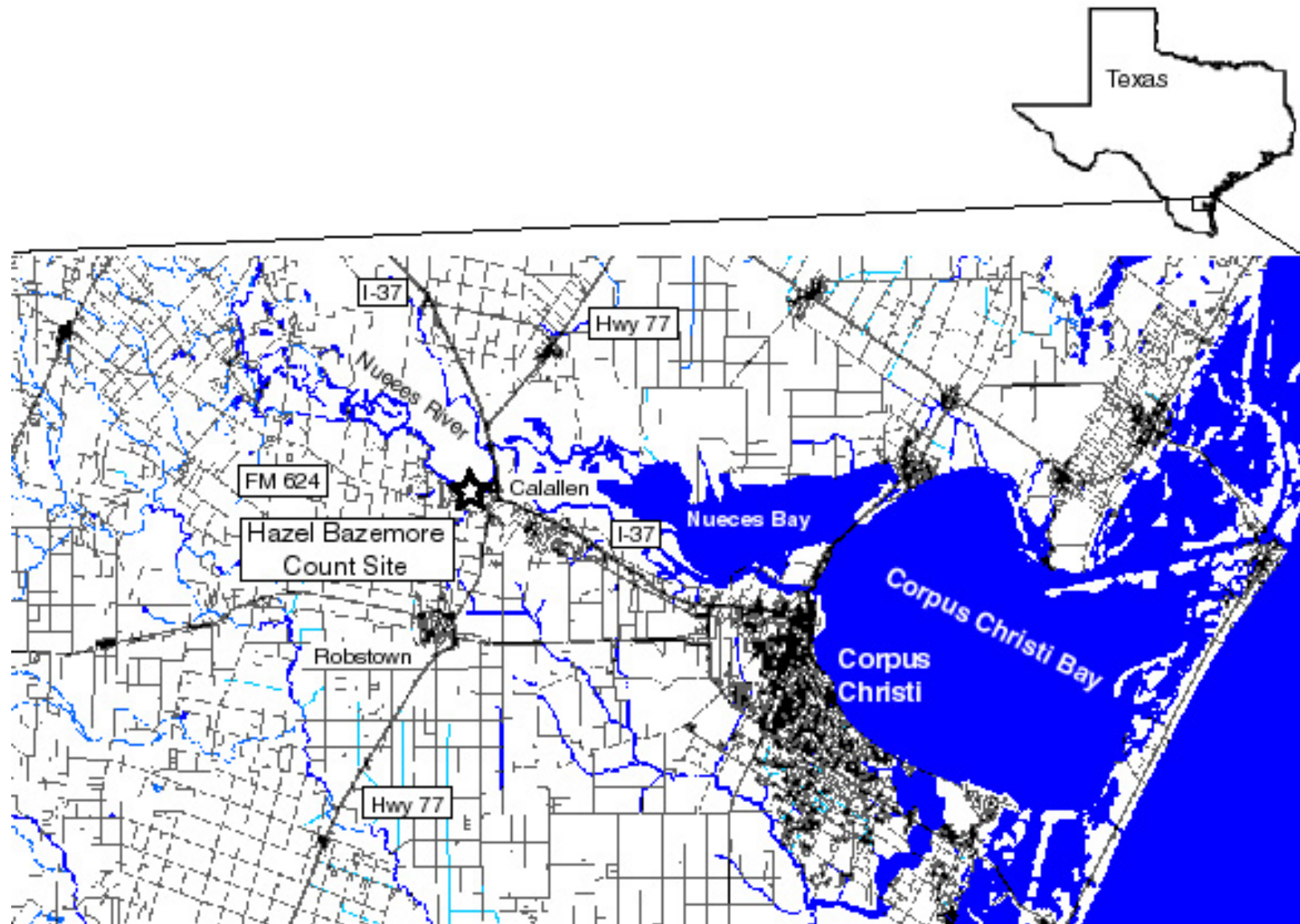


Figure 1. Location of Hazel Bazemore County Park count site near Corpus Christi, Texas.

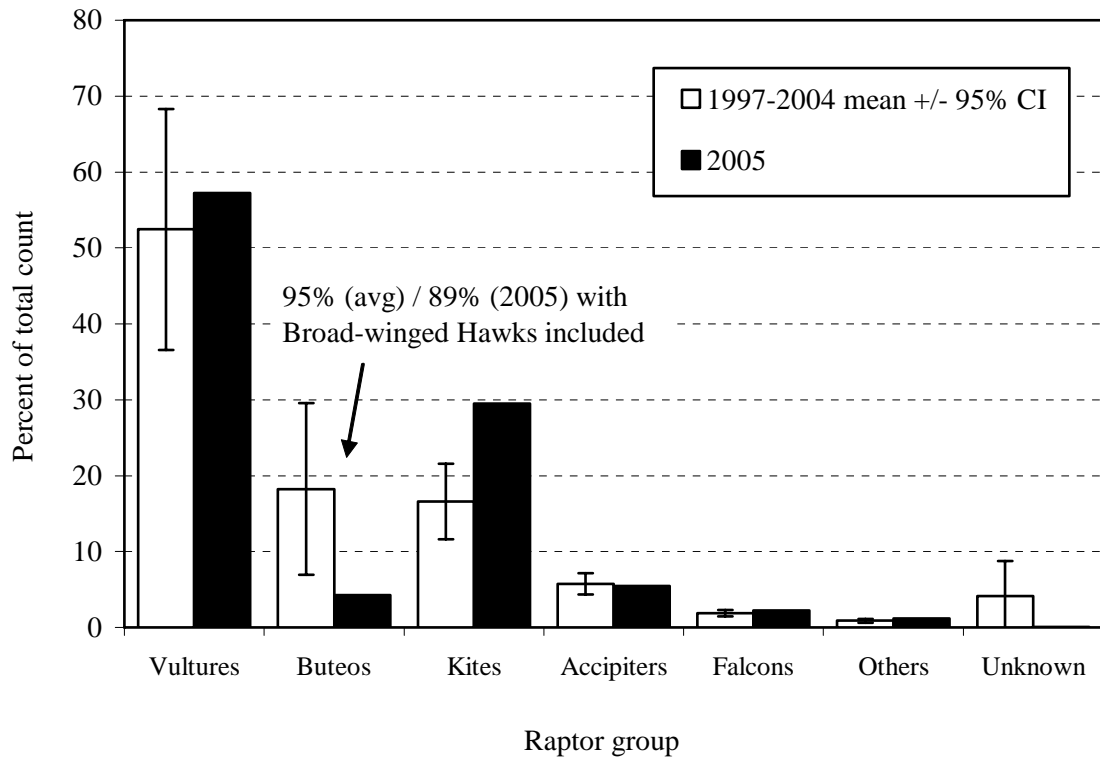


Figure 2. Composition of the fall raptor migration by species groups at Hazel Bazemore Park near Corpus Christi, Texas: 1997–2004 versus 2005.

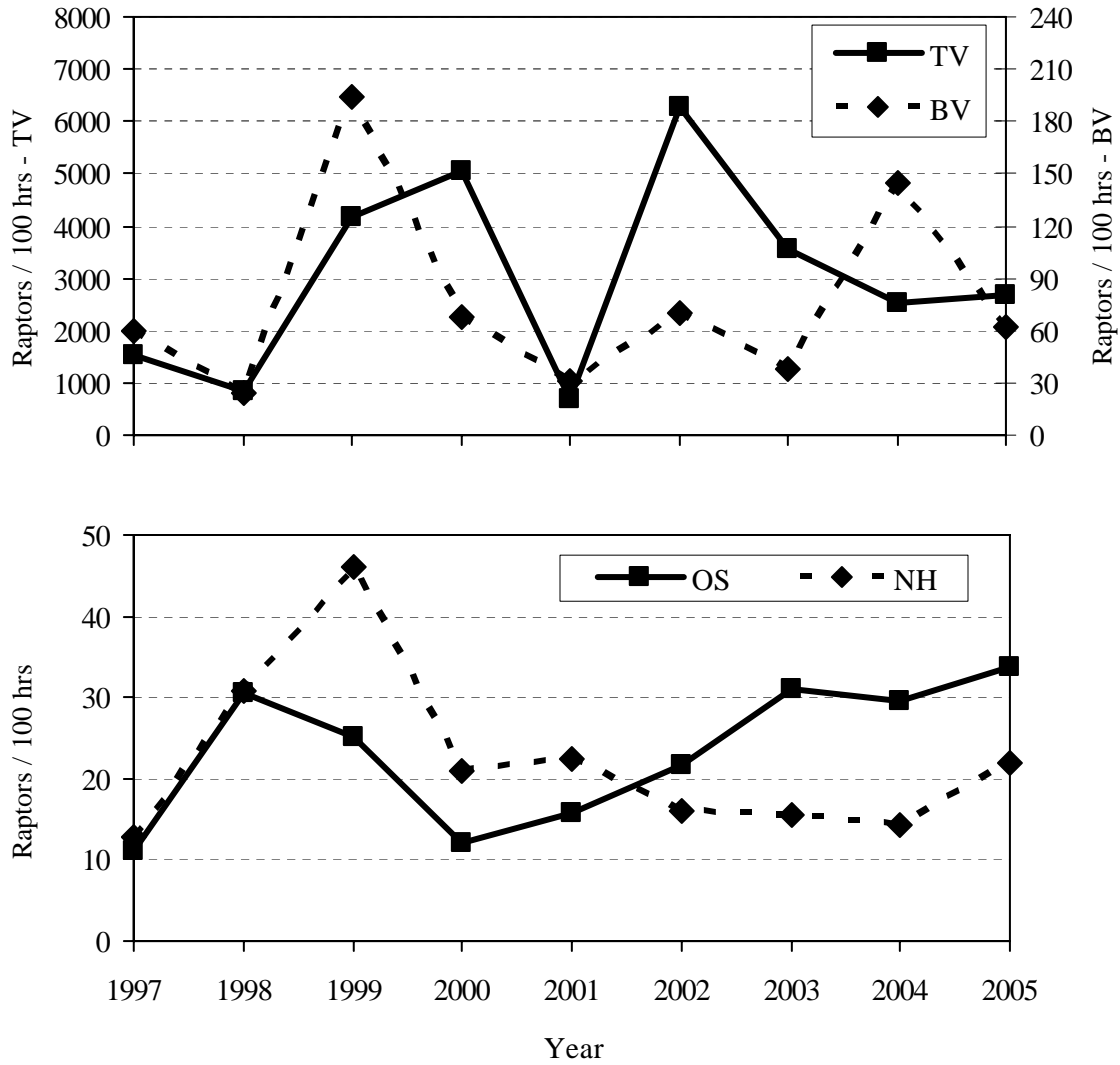


Figure 3. Annual fall-migration passage rates of Turkey and Black Vultures, Ospreys, and Northern Harriers at Hazel Bazemore Park near Corpus Christi, Texas: 1997–2005.

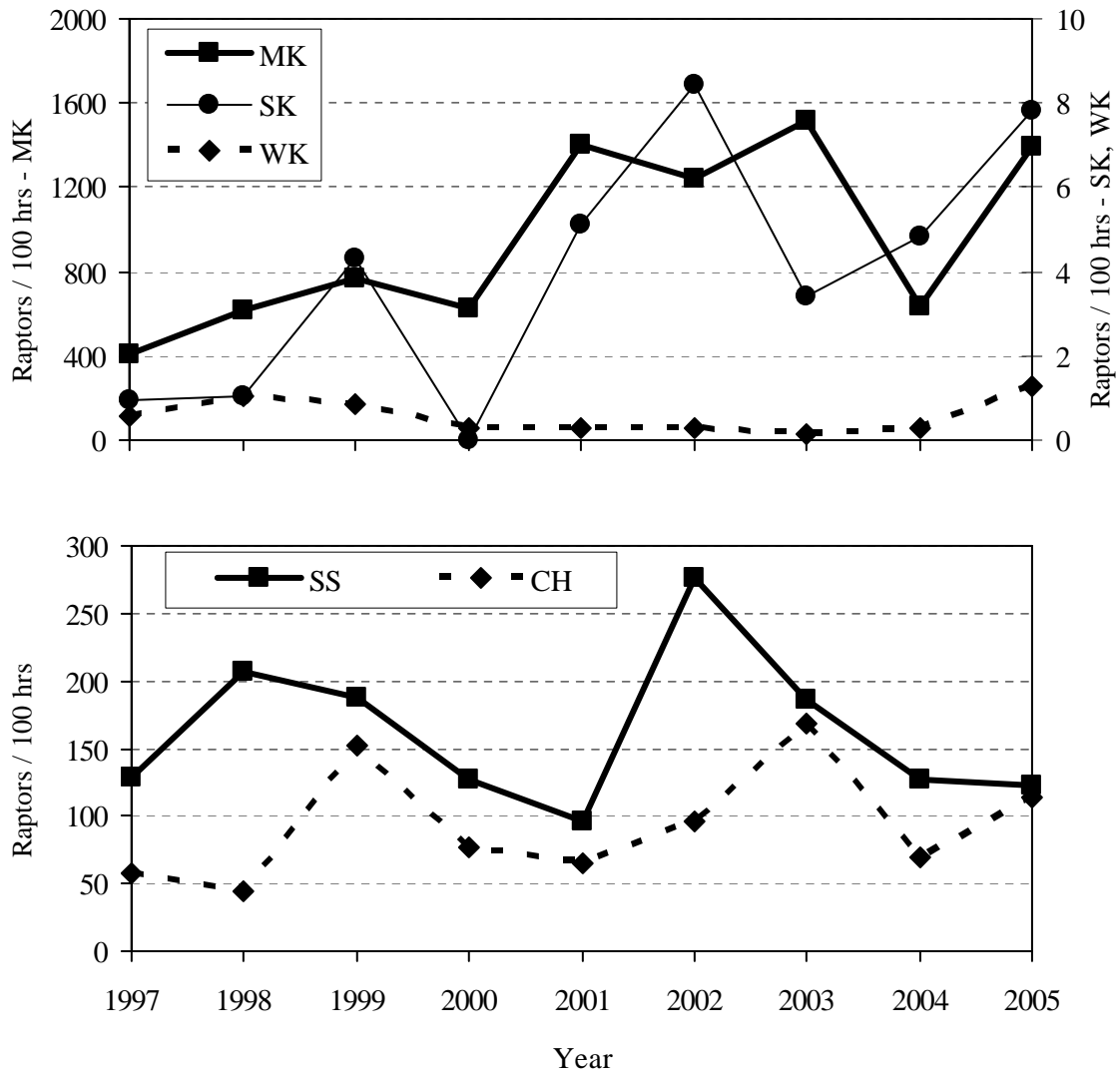


Figure 4. Annual fall-migration passage rates of Mississippi, Swallow-tailed and White-tailed Kites, and Sharp-shinned and Cooper's Hawks at Hazel Bazemore Park near Corpus Christi, Texas: 1997–2005.

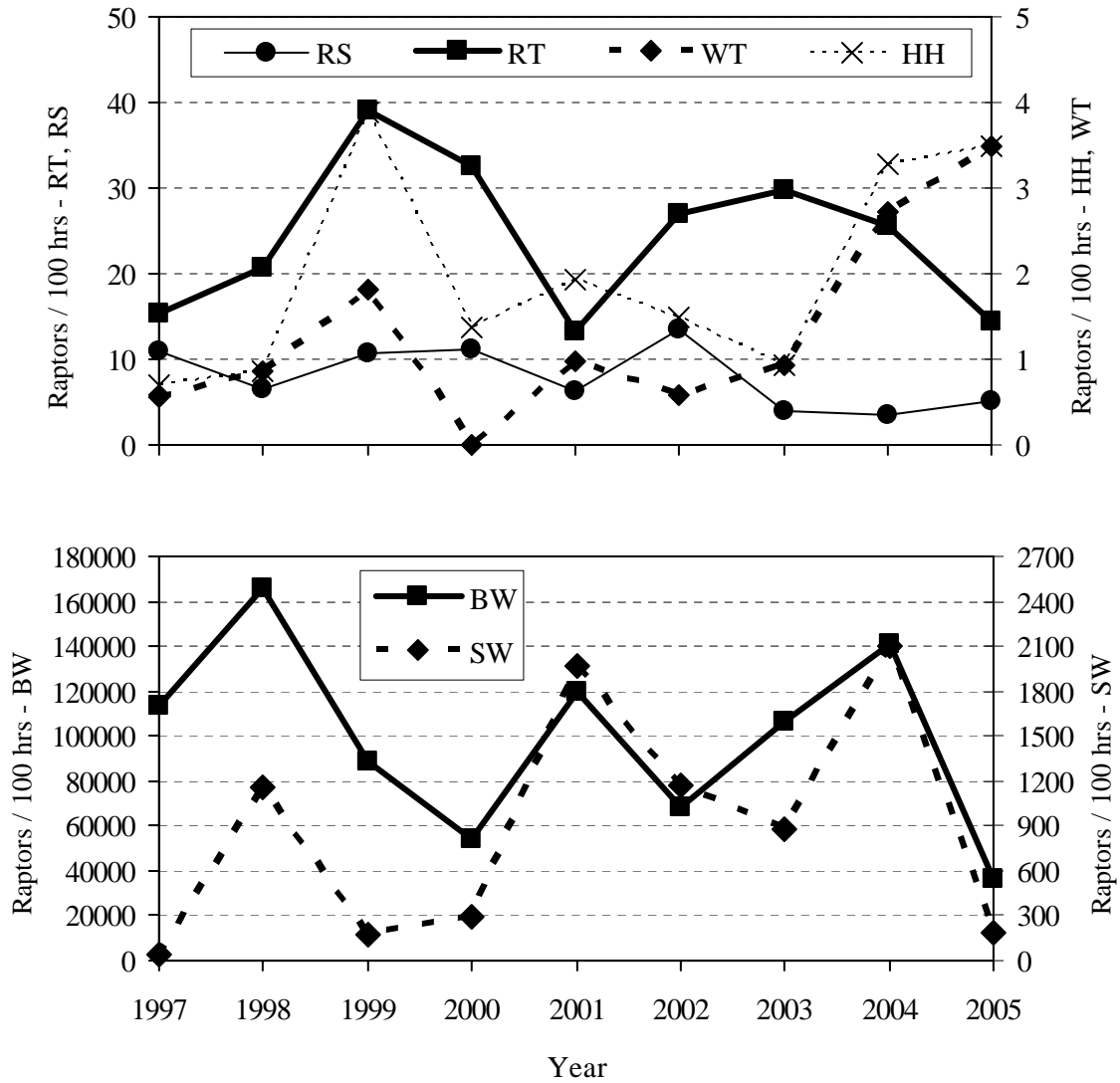


Figure 5. Annual fall-migration passage rates of Red-shouldered, Red-tailed, White-tailed, Broad-winged, and Swainson's Hawks at Hazel Bazemore Park near Corpus Christi, Texas: 1997–2005.

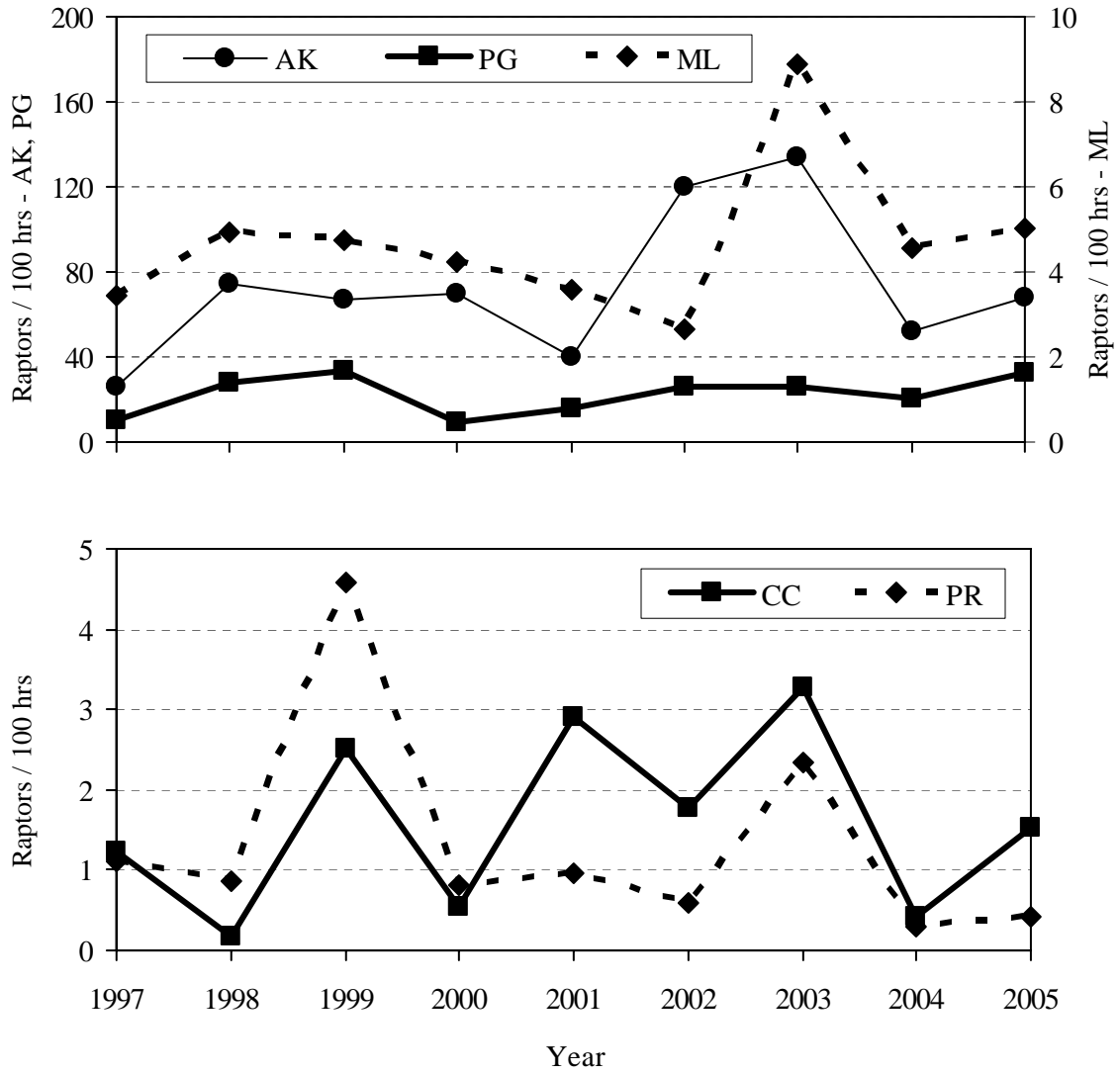


Figure 6. Annual fall-migration passage rates of American Kestrels, Merlins, Peregrine Falcons, Prairie Falcons, and Crested Caracaras at Hazel Bazemore Park near Corpus Christi, Texas: 1997–2005.

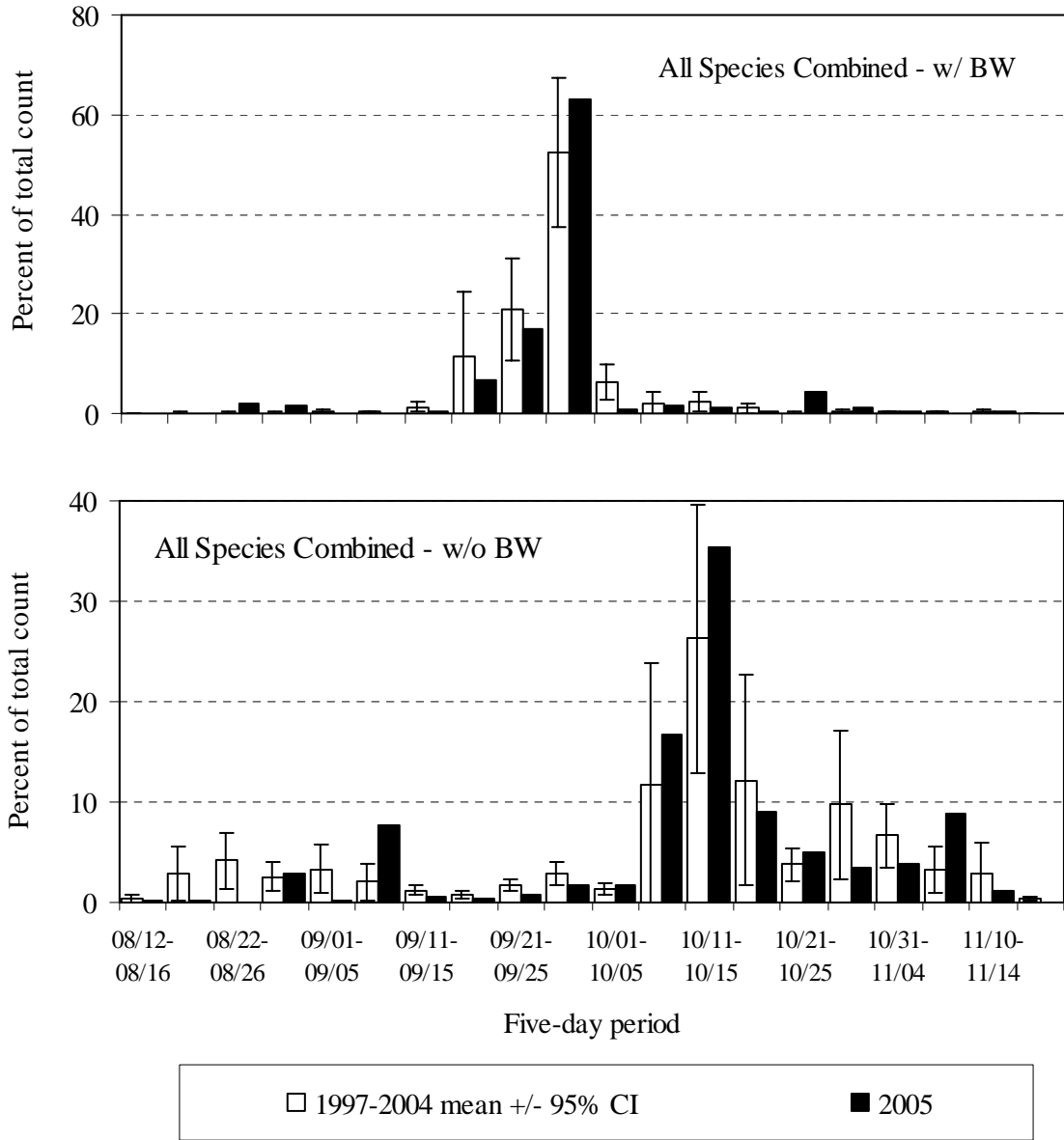


Figure 7. Combined-species flight volume by five-day periods, with and without Broad-wing Hawks, for the fall raptor migration at Hazel Bazemore Park near Corpus Christi, Texas: 1997–2004 versus 2005.

Appendix A. Common and scientific names, species codes, and regularly applied age, sex, and color-morph classifications.

Common Name	Scientific Name	Species Code	Age ¹	Sex ²	Color Morph ³
Black Vulture	<i>Coragyps atratus</i>	BV	U	U	NA
Turkey Vulture	<i>Cathartes aura</i>	TV	U	U	NA
Unknown vulture	see above	UV	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
Hook-billed Kite	<i>Chondrohierax uncinatus</i>	HK	A I U	AM AF U	D L U
Swallow-tailed Kite	<i>Elanoides forficatus</i>	SK	U	U	NA
White-tailed Kite	<i>Elanus leucurus</i>	WK	U	U	NA
Mississippi Kite	<i>Ictinia mississippiensis</i>	MK	A I U	U	NA
Unknown kite	see above	UK	U	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
Common Black Hawk	<i>Buteogallus anthracinus</i>	CB	A I U	U	NA
Harris' Hawk	<i>Parabuteo unicinctus</i>	HH	A I 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
Short-tailed Hawk	<i>Buteo brachyurus</i>	ST	U	U	D L U
Swainson's Hawk	<i>Buteo swainsoni</i>	SW	U	U	D L U
White-tailed Hawk	<i>Buteo albicaudatus</i>	WT	A I U	U	NA
Zone-tailed Hawk	<i>Buteo albonotatus</i>	ZT	A I U	U	NA
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
Unknown buteo	<i>Buteo</i> spp.	UB	U	U	D L U
Golden Eagle	<i>Aquila chrysaetos</i>	GE	A S I NA U ⁴	U	NA
Bald Eagle	<i>Haliaeetus leucocephalus</i>	BE	A S2 S1 I NA U ⁵	U	NA
Unknown eagle	<i>Aquila</i> or <i>Haliaeetus</i> spp.	UE	U	U	NA
Crested Caracara	<i>Caracara cheriway</i>	CC	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	A I U	U	NA
Aplomado Falcon	<i>Falco femoralis</i>	AF	A I U	U	NA
Unknown falcon	<i>Falco</i> spp.	UF	U	U	NA
Unknown raptor	Falconiformes	UU	U	U	NA

¹ A = adult, I = immature (HY), Br = brown (adult female or immature), U = unknown age.

² M = male, F = female, U = unknown.

³ D = dark or rufous, L = light, U = unknown, NA = not applicable.

⁴ Golden Eagle age codes: I = immature, first-year bird, bold white wing patch visible below (small patch may be visible above), bold white in the tail, no molt; S = subadult, white wing patch variable or absent, obvious white in the tail, molt or tawny bar on upper wing visible; NA = not adult, unknown age immature/subadult, obvious white in wing or tail, but rest of plumage not adequately observed; A = adult, no obvious white on wing or tail; U = plumage not adequately observed to make an age determination.

⁵ Bald Eagle age codes: I = immature, first-year bird, dark breast and tawny belly; S1 = young subadult, Basic I and II plumages, light belly or upside-down white triangle on the back; S2 = older subadult, Basic III plumage, head mostly white with osprey-like dark eye line and dark band on tail; NA = not adult, unknown age immature/subadult; A = adult, includes near-adult with dark flecks in head and dark tip to tail (may be hard to see in field) and adult with pure white head and tail; U = plumage not adequately observed to make an age determination.

Appendix B. History of official observer participation in the Corpus Christi Raptor Migration Project: 1997–2005.

1997: Two observers throughout: Glenn Swartz (6 partial at this site) and Joel Simon (0), regularly assisted by several other dedicated volunteers.

1998: Two observers throughout: Glenn Swartz (1 plus 6 partial at this site) and Joel Simon (1), regularly assisted by several other dedicated volunteers.

1999: Three observers throughout: Joel Simon (2), Fernando Rincon (1), and Ryan Wagner (0), regularly assisted by several other dedicated volunteers.

2000: Rotating team working two at a time except during peak Broad-winged Hawk flight when all three worked together: Scott Rush (2), Beth Hahn (1), and Jo Creglow (several partial at this site), regularly assisted by several other dedicated volunteers.

2001: Rotating team working two at a time except during the peak Broad-winged Hawk flight when all three worked together: Greg Greene (limited experience in Idaho), Devin Taylor (0), and Karen Johnson (0), regularly assisted by several other dedicated volunteers.

2002: Rotating team working two at a time except during the peak Broad-winged Hawk flight when all three worked together: Joel Simon (3), Vicki Simon (regular volunteer on project since 1997), Kirsten McDonnell (2), Paul Sweet (0), regularly assisted by several other dedicated volunteers.

2003: Rotating team working two at a time except during the peak Broad-winged Hawk flight when all three worked together: Joel Simon (4), Ricardo Perez (0, but relevant experience in PA and El Salvador), Taylor Ellis (0, but relevant experience in FL), regularly assisted by several other dedicated volunteers.

2004: Rotating team working two at a time except during the peak Broad-winged Hawk flight when all three worked together: Joel Simon (5), Dane Ferrell (2), Scott Loss (1), regularly assisted by several other dedicated volunteers.

2005: Rotating team working two at a time except during the peak Broad-winged Hawk flight when all three worked together: Joel Simon (6), Dane Ferrell (4), Brian Bielfelt (1), regularly assisted by several other dedicated volunteers.

¹ Numbers in parentheses indicate the number of previous full-seasons of experience counting migratory raptors.

Appendix C. Daily observation effort, visitor disturbance ratings, and predominant weather conditions during the fall raptor migration at Hazel Bazemore Park near Corpus Christi, TX: 2005.

DATE	OBS. HOURS	NUMBER OBSRVRS ¹	VISITOR DISTURB ²	SKY CONDITION ³	WIND SPEED (KPH) ¹	WIND DIRECTION	TEMP. (°C) ¹	BARO. PRESS. (IN HG) ¹	MEDIAN THERMAL LIFT ⁴	VISIB. EAST (KM) ¹	VISIB. WEST (KM) ¹	FLIGHT DIST. ⁵	RAPTORS / HOUR
15-Aug	8.00	3.3	0	pc-ovc	9.2	e-se	32.2	30.00	2	9	9	3	0.4
16-Aug	8.50	4.1	0	pc	7.6	e-se	34.3	30.07	2	9	10	2	1.3
17-Aug	8.50	3.6	0	pc-mc, scat haze/ts	6.7	e-s	34.1	29.96	3	7	12	2	1.3
18-Aug	8.00	3.7	0	clr-mc, AM haze	5.4	se-s	34.4	29.93	3	8	9	2	2.3
19-Aug	8.00	2.9	0	clr-mc, AM haze	7.4	se-s	35.0	29.98	3	9	9	3	0.6
20-Aug	8.00	4.9	0	clr-pc, AM haze	8.8	sse	34.4	30.05	2	8	10	3	2.3
21-Aug	8.00	4.0	0	clr-mc, AM haze	4.9	calm, e	34.6	30.03	2	8	9	2	5.6
22-Aug	8.00	2.5	0	clr-pc, AM haze	4.4	calm, e, s	34.3	29.88	2	6	7	2	413.0
23-Aug	8.00	3.2	0	clr-pc, AM haze	3.9	calm, e-se	34.3	29.90	2	6	7	3	63.5
24-Aug	8.00	3.0	0	clr-mc	6.2	e-s	34.6	29.88	2	8	9	3	52.6
25-Aug	9.00	2.5	0	pc-ovc, AM haze	4.3	calm, e-s	34.6	29.94	2	7	8	3	101.9
26-Aug	8.00	2.7	0	clr-ovc, AM haze	3.8	calm, e, s-sw	34.6	29.91	2	7	9	3	24.1
27-Aug	8.00	3.8	0	clr-mc, AM haze	4.4	e-s, nnw	35.0	29.80	1	8	7	3	183.8
28-Aug	8.25	3.7	0	clr-mc, haze	7.0	nw	33.7	29.69	2	5	7	2	104.0
29-Aug	7.50	3.3	0	ovc-clr, scat rain, haze	5.7	w-nw	33.4	29.69	2	5	6	3	47.3
30-Aug	8.50	2.4	0	clr-mc, haze	4.6	var	35.6	29.74	2	4	5	3	156.1
31-Aug	7.00	3.8	0	clr-ovc, haze	5.3	calm/var	35.1	29.79	3	2	3	3	26.1
01-Sep	8.00	3.1	0	clr-ovc, AM haze, PM ts/rain	3.4	calm, n-e	31.7	29.92	3	3	4	2	5.1
02-Sep	7.00	2.3	0	pc-ovc/ts	2.6	calm, e, n	31.4	30.01	4	5	6	2	13.0
03-Sep	8.00	3.0	0	clr-ovc, AM fog, scat ts	6.7	ne-e, nw	31.9	30.04	4	6	8	2	7.3
04-Sep	8.00	4.7	0	clr-mc, haze	6.3	ne	33.3	30.01	3	3	4	3	6.3
05-Sep	8.00	3.7	0	ovc-pc/haze, AM fog	5.4	nne-e	32.7	30.02	4	2	3	3	14.3
06-Sep	5.50	2.2	0	clr-ovc/haze, AM fog, PM rain	6.3	calm, ne	30.1	30.06	4	0	1	2	8.9
07-Sep	8.00	3.0	0	clr-mc, haze	10.4	n-ne	32.3	30.05	3	2	4	3	18.9
08-Sep	7.00	2.8	0	pc-ovc/haze	5.6	n-e	30.0	30.03	4	2	3	1	0.9
09-Sep	7.00	3.2	0	mc-ovc, scat ts/rain	5.0	calm, ne-e	29.9	29.99	4	4	4	1	1.7
10-Sep	8.00	4.0	0	pc-ovc, AM fog	4.0	e-se	30.6	29.93	4	7	7	2	2.4
11-Sep	0.00			ts/rain									
12-Sep	7.50	3.3	0	clr-ovc, AM fog, PM ts/rain	3.4	calm, e	30.0	30.01	4	7	5	3	2.5
13-Sep	8.00	3.0	0	clr-mc	6.1	e-sw	32.5	29.93	2	9	11	3	110.1
14-Sep	8.00	3.9	0	clr-pc	6.0	s-sw	33.2	29.90	3	8	10	3	12.6
15-Sep	8.00	3.1	0	clr-mc	6.8	s	33.7	29.92	3	7	8	3	6.4
16-Sep	8.00	3.2	0	pc	3.9	s	34.7	30.01	2	8	9	3	60.5
17-Sep	8.50	3.7	0	pc	6.8	s, ese	33.8	29.97	2	8	9	3	76.0
18-Sep	8.00	3.5	0	clr-pc	8.5	calm, e-s	34.0	29.94	3	9	9	3	456.8
19-Sep	8.50	3.0	0	clr-pc, AM fog/haze	5.8	calm, e-se	33.0	30.04	2	6	6	3	863.3
20-Sep	8.50	3.8	0	clr-pc, AM haze	4.2	e-se	33.3	30.09	2	8	9	3	897.8
21-Sep	8.00	6.8	0	ovc-clr, AM fog/haze	4.6	nw, ne-e	34.1	29.96	2	7	7	3	267.6
22-Sep	9.00	7.2	0	clr-pc, AM haze	4.6	calm, nnw-ne	34.6	29.80	2	3	6	2	4958.4
23-Sep	8.00	6.2	0	clr-pc, AM haze	8.4	nw	35.8	29.58	3	8	9	3	172.3
24-Sep	8.00	10.0	0	clr	5.0	w	36.3	29.65	2	13	13	3	239.8
25-Sep	8.00	7.1	0	clr, fog/haze	5.6	e-se, s-ssw	36.0	29.79	2	1	3	3	39.6
26-Sep	8.00	9.1	0	mc-clr, haze	5.3	var	34.0	29.91	2	5	6	3	2287.8
27-Sep	9.00	9.3	0	clr-pc	4.0	var	34.3	29.93	2	6	8	3	2514.2
28-Sep	8.00	8.1	0	clr	6.2	ne-e, ssw	35.2	29.85	2	10	11	3	1041.8
29-Sep	9.25	10.4	0	clr-pc, AM haze	4.6	nne-e	34.6	29.94	3	8	8	2	7100.5
30-Sep	8.50	9.7	0	clr-ovc	4.6	ne-ese	31.7	29.91	2	6	9	3	8496.8
01-Oct	8.00	12.1	0	clr-mc	4.3	e-se	33.3	29.90	4	8	9	2	23.6
02-Oct	8.00	8.9	0	clr-mc	7.2	e-se	32.9	29.92	4	12	13	3	104.4
03-Oct	8.25	5.6	0	pc-mc, scat rain	8.0	nne-e	32.9	29.94	4	14	14	3	28.1
04-Oct	8.00	4.9	0	mc-ovc	4.6	ene-e	30.8	29.89	4	8	7	2	21.1
05-Oct	8.00	2.9	0	clr-ovc, scat rain	2.5	n-ese	33.0	29.88	4	11	11	3	61.1
06-Oct	9.00	4.0	0	clr-pc, AM haze	1.9	nnw-ne	32.6	29.88	2	8	9	3	334.6
07-Oct	8.00	4.8	0	ovc, PM haze	3.9	nw	19.4	30.03	4	7	7	2	6.5
08-Oct	8.00	4.0	0	ovc-clr	1.1	nw-n	24.8	29.93	2	12	12	3	80.3
09-Oct	8.00	4.2	0	clr-ovc	1.2	calm, ne-e	28.6	29.82	3	12	12	3	37.6
10-Oct	8.00	3.0	0	clr-ovc, haze, scat ts	1.9	e-ssw	31.9	29.73	4	6	7	2	94.6
11-Oct	2.00	2.2	0	ovc/ts	0.3	sw	30.0	29.86	4	4	4	1	0.5

Appendix C. continued

DATE	OBS. HOURS	NUMBER OBSRVRS ¹	VISITOR DISTURB ²	SKY CONDITION ³	WIND SPEED (KPH) ¹	WIND DIRECTION	TEMP. (°C) ¹	BARO. PRESS. (IN HG) ¹	MEDIAN THERMAL LIFT ⁴	VISIB. EAST (KM) ¹	VISIB. WEST (KM) ¹	FLIGHT DIST. ⁵	RAPTORS / HOUR
12-Oct	8.50	3.0	0	clr-ovc, AM haze	1.6	n-ese	28.5	29.93	3	4	7	2	249.2
13-Oct	8.00	3.8	0	mc-ovc/haze, AM fog, PM rain	2.4	ne-e	29.2	29.99	4	5	5	3	68.5
14-Oct	8.50	2.8	0	mc-ovc, haze	1.3	n-ne	29.4	30.11	4	6	6	3	88.9
15-Oct	8.00	3.0	0	clr-mc, haze	1.8	n-e	29.4	30.04	2	5	6	2	41.8
16-Oct	8.00	3.8	0	clr-pc, haze	1.0	ne-ese	29.7	30.04	2	7	7	3	19.8
17-Oct	8.00	2.8	0	clr, AM haze	0.7	ne-e	28.9	30.02	3	9	9	3	17.0
18-Oct	7.00	2.8	0	clr, AM haze	0.8	se-sw	30.4	29.99	2	9	9	3	17.6
19-Oct	8.00	2.9	0	clr	0.8	se-sw	30.4	29.94	2	12	13	3	30.8
20-Oct	8.00	2.9	0	clr	1.3	ne-s	30.4	29.87	3	12	12	2	14.0
21-Oct	8.75	2.4	0	pc-ovc	1.1	nnw-ne	29.6	29.96	3	10	10	3	71.8
22-Oct	7.50	4.0	0	clr	1.4	ne	26.3	29.97	3	12	12	3	50.8
23-Oct	8.00	2.4	0	clr-pc, AM haze	1.7	ne-e	28.2	29.90	2	8	8	2	38.8
24-Oct	7.00	2.7	0	ovc-clr, AM scat rain	3.3	w-n	17.1	30.28	4	8	8	2	82.1
25-Oct	8.00	2.8	0	clr	0.4	calm, wsw-wnw	23.4	30.18	3	12	12	2	1303.6
26-Oct	8.00	2.8	0	clr	2.1	ne-ese	25.2	30.01	3	12	11	3	256.4
27-Oct	6.50	2.9	0	mc-ovc, scat rain	4.3	e	26.4	30.03	4	6	7	2	0.9
28-Oct	7.50	3.9	0	clr, AM haze	3.9	nne-e	24.3	30.23	4	9	9	2	116.4
29-Oct	7.50	5.0	0	clr-pc	1.6	n-e	25.5	30.23	3	8	8	3	24.7
30-Oct	8.00	2.8	0	clr-ovc, AM haze	0.8	se	28.0	30.17	4	8	8	3	12.9
31-Oct	7.50	2.5	0	mc	1.4	ese-ssw	29.5	30.07	4	7	8	2	10.3
01-Nov	7.50	3.0	0	clr	1.6	calm, nw	22.3	30.30	3	14	14	1	20.4
02-Nov	8.00	2.5	0	clr-pc	0.9	ne-ese	23.7	30.28	3	11	11	2	22.5
03-Nov	7.50	3.3	0	clr	1.3	calm, se-s	25.5	30.16	2	10	10	2	6.9
04-Nov	8.00	2.4	0	clr-pc	1.1	se-s	28.4	29.95	3	13	13	2	24.6
05-Nov	6.50	3.1	0	pc	1.7	ssw	29.1	29.85	3	7	8	2	5.1
06-Nov	6.50	2.0	0	clr-mc	0.9	s, ese	29.9	30.00	3	9	10	2	6.0
07-Nov	7.75	2.1	0	missing weather data								2	17.4
08-Nov	7.50	2.9	0	mc, scat fog/rain	1.0	sse	31.0	30.08	3	8	8	1	17.7
09-Nov	7.50	2.8	0	pc, AM scat rain	0.9	s	31.3	30.07	2	11	11	3	30.7
10-Nov	6.00	3.2	0	mc-ovc, PM rain	0.4	calm, ene, nw	29.9	30.13	3	7	8	2	67.2
11-Nov	7.00	2.4	0	ovc-pc, AM scat rain	0.8	sse	30.0	30.05	4	8	8	2	4.4
12-Nov	7.00	1.9	0	pc	1.9	s	31.0	29.82	4	10	10	3	25.6
13-Nov	7.00	2.9	0	pc-ovc	1.3	s, e	30.4	30.04	3	7	8	2	7.7
14-Nov	7.00	4.2	0	clr-pc, AM fog/haze	0.9	sse-s	31.3	29.98	3	8	9	3	6.3
15-Nov	7.00	3.7	0	pc-mc	1.6	s-sw	31.9	29.86	3	10	10	2	13.6

¹ Average of hourly records.

² Median hourly visitor-disturbance rating (subjective assessment by observers): 0 = none, 1 = low, 2 = moderate, 3 = high.

³ 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 = thunderstorms.

⁴ Median hourly rating 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.

⁵ Median hourly rating concerning line-of-sight 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 fall raptor migration counts by species at Hazel Bazemore Park near Corpus Christi, Texas: 2005.

DATE	OBSERV.		SPECIES ¹																								BIRDS									
	HOURS	BV	TV	OS	NH	SK	WK	MK	SS	CH	UA	HH	RS	BW	ST	SW	WT	ZT	RT	FH	UB	GE	BE	CC	AK	ML	PR	PG	AF	SF	UF	UU	TOTAL	/ HOUR		
15-Aug	8.00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.4
16-Aug	8.50	0	0	0	0	0	0	0	0	0	0	2	0	0	0	4	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	11	1.3
17-Aug	8.50	0	0	0	0	2	0	0	0	0	0	0	3	0	0	5	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	11	1.3	
18-Aug	8.00	0	0	1	0	6	0	1	0	0	0	1	0	0	0	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	2.3	
19-Aug	8.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5	0.6	
20-Aug	8.00	0	0	0	0	0	0	8	0	0	0	0	0	0	0	8	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	18	2.3	
21-Aug	8.00	0	0	1	0	4	0	21	0	2	0	0	0	5	0	8	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	45	5.6	
22-Aug	8.00	0	0	0	1	11	0	3255	0	3	0	0	0	9	0	20	1	0	2	0	1	0	0	0	0	0	0	0	0	0	1	0	3,304	413.0		
23-Aug	8.00	0	0	0	0	0	0	486	0	1	0	0	0	13	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	508	63.5		
24-Aug	8.00	0	0	0	0	1	0	404	0	0	0	1	0	14	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	421	52.6	
25-Aug	9.00	0	0	1	1	17	0	875	0	1	0	0	0	12	0	8	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	917	101.9	
26-Aug	8.00	0	0	0	0	5	0	171	0	1	1	0	0	11	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	193	24.1	
27-Aug	8.00	0	0	1	0	9	0	1405	0	4	0	0	1	41	0	8	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1470	183.8		
28-Aug	8.25	0	0	0	0	0	1	850	1	0	0	0	0	2	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	858	104.0	
29-Aug	7.50	0	0	1	0	0	0	342	0	0	0	0	0	9	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	355	47.3	
30-Aug	8.50	0	0	3	0	0	0	1306	0	2	0	0	0	6	0	7	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1327	156.1		
31-Aug	7.00	0	0	2	0	0	0	149	0	1	0	0	0	19	0	3	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	7	183	26.1		
1-Sep	8.00	0	0	0	0	0	0	35	0	0	0	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	41	5.1		
2-Sep	7.00	0	0	1	0	0	0	76	0	0	0	0	0	10	1	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	91	13.0		
3-Sep	8.00	0	0	0	0	0	0	39	1	5	0	0	0	6	0	5	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	58	7.3			
4-Sep	8.00	0	1	2	0	0	0	17	0	1	0	0	0	21	0	6	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	50	6.3		
5-Sep	8.00	1	1	3	1	0	0	20	1	4	0	0	1	62	0	15	0	0	1	0	2	0	0	0	2	0	0	0	0	0	0	0	114	14.3		
6-Sep	5.50	0	0	1	1	0	0	8	3	0	0	0	1	31	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	8.9		
7-Sep	8.00	0	0	1	0	0	0	16	0	0	0	0	1	128	0	3	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	151	18.9		
8-Sep	7.00	0	0	0	0	0	0	5	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0.9		
9-Sep	7.00	0	0	1	0	0	0	9	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	12	1.7		
10-Sep	8.00	0	0	1	1	0	0	0	0	0	0	0	0	13	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	19	2.4		
11-Sep	0.00																																			
12-Sep	7.50	0	0	0	2	0	0	2	0	1	0	0	0	11	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	2.5		
13-Sep	8.00	4	0	2	1	0	0	76	0	2	0	0	0	787	1	2	0	0	0	0	0	0	0	1	0	0	3	0	0	0	2	881	110.1			
14-Sep	8.00	0	0	0	1	0	0	6	0	3	0	0	0	77	0	11	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	101	12.6			
15-Sep	8.00	12	7	1	1	0	0	5	1	0	0	0	0	20	0	1	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	51	6.4			
16-Sep	8.00	5	0	1	0	0	0	73	0	0	0	0	0	399	0	1	0	0	3	0	0	0	0	1	0	0	1	0	0	0	0	484	60.5			
17-Sep	8.50	0	0	3	0	0	0	39	1	0	0	0	0	594	0	1	0	1	1	0	0	0	0	0	0	0	6	0	0	0	0	646	76.0			
18-Sep	8.00	1	0	15	0	1	2	41	4	0	1	0	1	3,558	0	14	0	1	3	0	2	0	0	3	1	0	6	0	0	0	0	3,654	456.8			

Appendix D. continued

DATE	OBSERV.		SPECIES ¹																								BIRDS							
	HOURS	BV	TV	OS	NH	SK	WK	MK	SS	CH	UA	HH	RS	BW	ST	SW	WT	ZT	RT	FH	UB	GE	BE	CC	AK	ML	PR	PG	AF	SF	UF	UU	TOTAL	/ HOUR
19-Sep	8.50	0	4	8	7	0	0	81	1	4	1	0	0	7,219	1	3	0	0	0	0	0	0	0	0	5	0	0	4	0	0	0	0	7,338	863.3
20-Sep	8.50	0	1	4	4	0	0	2	1	4	1	0	2	7,595	0	6	0	0	2	0	0	0	0	0	4	0	0	3	0	0	0	2	7,631	897.8
21-Sep	8.00	0	0	1	3	0	0	39	6	31	8	1	3	2,026	0	3	1	0	0	0	0	0	0	2	13	1	0	3	0	0	0	0	2141	267.6
22-Sep	9.00	0	0	4	1	0	0	23	8	19	1	0	0	44,546	0	8	0	0	0	0	0	0	2	0	8	0	0	4	0	0	1	1	44,626	4,958.4
23-Sep	8.00	0	0	5	0	0	0	5	4	8	0	0	0	1,345	0	1	0	1	0	0	0	0	0	7	0	0	1	0	0	0	1	1378	172.3	
24-Sep	8.00	0	0	1	3	0	0	2	5	15	3	0	0	1,884	0	3	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1918	239.8	
25-Sep	8.00	0	0	6	2	0	0	4	0	0	0	0	0	298	0	3	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	317	39.6	
26-Sep	8.00	2	11	2	2	0	0	15	3	8	0	3	0	18,247	0	2	0	1	1	0	1	0	0	0	4	0	0	0	0	0	0	0	18,302	2,287.8
27-Sep	9.00	0	32	16	5	0	0	23	9	18	1	0	0	22,471	0	19	0	1	0	1	0	0	0	23	0	0	8	0	0	0	1	22,628	2,514.2	
28-Sep	8.00	2	33	30	12	0	0	31	5	19	3	0	0	8,125	0	37	0	0	0	0	4	0	0	0	12	7	0	13	0	0	0	1	8,334	1,041.8
29-Sep	9.25	0	26	7	14	0	0	21	108	114	18	0	0	65,275	0	16	0	0	0	0	2	0	0	0	51	5	0	21	0	1	0	1	65,680	7,100.5
30-Sep	8.50	8	12	20	5	0	0	14	38	76	5	1	1	71,998	0	9	0	1	2	0	1	0	0	0	15	2	0	14	0	0	0	1	72,223	8,496.8
1-Oct	8.00	6	4	18	5	0	0	2	22	27	9	1	1	39	0	5	0	1	2	0	1	0	0	0	4	4	0	37	0	0	0	1	189	23.6
2-Oct	8.00	1	14	12	4	0	0	1	15	18	9	0	0	729	0	5	1	1	0	0	0	0	0	0	8	2	0	14	0	0	1	0	835	104.4
3-Oct	8.25	0	8	4	0	0	0	0	43	22	6	0	0	118	0	1	1	0	0	0	1	0	0	0	5	1	0	16	0	0	0	6	232	28.1
4-Oct	8.00	5	18	2	5	0	0	0	51	35	4	0	0	19	0	4	0	0	1	0	1	0	0	0	6	1	0	16	0	0	1	0	169	21.1
5-Oct	8.00	0	9	8	3	0	1	0	40	42	10	0	2	333	0	5	0	0	0	0	1	0	1	0	21	1	0	10	0	0	0	2	489	61.1
6-Oct	9.00	0	58	21	12	0	0	0	33	40	14	0	0	2,140	0	672	1	0	1	0	1	1	0	0	13	0	0	3	0	0	0	1	3,011	334.6
7-Oct	8.00	0	9	0	2	0	1	0	7	5	0	2	1	2	0	17	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	52	6.5
8-Oct	8.00	8	342	0	1	0	0	1	14	20	12	0	3	187	0	44	0	0	1	2	0	0	0	0	4	0	1	2	0	0	0	0	642	80.3
9-Oct	8.00	0	39	6	12	0	0	0	21	20	7	0	2	167	0	6	2	0	2	0	0	0	0	0	16	0	0	1	0	0	0	0	301	37.6
10-Oct	8.00	17	221	3	3	0	0	0	41	16	6	0	1	363	0	42	0	0	2	0	0	0	0	0	31	0	0	11	0	0	0	0	757	94.6
11-Oct	2.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0.5	
12-Oct	8.50	8	54	2	4	0	0	0	135	47	6	0	1	1,678	0	111	0	0	2	0	1	0	0	0	54	3	0	12	0	0	0	0	2,118	249.2
13-Oct	8.00	0	170	1	1	0	0	0	71	22	6	2	0	219	0	5	0	0	3	0	0	0	0	0	43	2	0	2	0	0	0	1	548	68.5
14-Oct	8.50	1	581	1	2	0	0	0	47	29	3	0	2	38	0	8	1	1	4	0	0	0	0	1	37	0	0	0	0	0	0	0	756	88.9
15-Oct	8.00	0	164	2	3	0	0	0	46	12	11	0	1	50	0	15	0	0	1	0	2	1	0	0	24	1	0	1	0	0	0	0	334	41.8
16-Oct	8.00	0	75	4	1	0	0	0	9	5	1	0	2	37	0	10	0	0	2	1	0	0	0	9	0	0	0	0	0	0	0	2	158	19.8
17-Oct	8.00	0	101	0	0	0	0	0	6	3	5	0	0	12	0	3	1	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	136	17.0
18-Oct	7.00	0	103	0	0	0	0	0	0	3	0	0	0	3	1	3	1	0	5	0	0	0	0	0	3	0	0	1	0	0	0	0	123	17.6
19-Oct	8.00	0	216	0	0	0	0	0	5	6	0	0	0	7	0	8	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	246	30.8
20-Oct	8.00	0	95	0	1	0	0	0	2	4	0	0	0	4	0	3	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	112	14.0
21-Oct	8.75	2	472	2	3	0	1	0	9	16	9	1	0	20	0	67	1	0	3	0	0	0	0	0	17	2	1	1	1	0	0	0	628	71.8
22-Oct	7.50	0	334	0	4	0	1	0	2	6	2	1	2	15	0	5	0	0	3	0	1	0	0	0	5	0	0	0	0	0	0	0	381	50.8
23-Oct	8.00	9	252	1	3	0	0	0	15	10	2	1	1	5	0	3	0	0	1	0	0	0	0	0	7	0	0	0	0	0	0	0	310	38.8

Appendix D. continued

DATE	OBSERV.			SPECIES ¹																								BIRDS								
	HOURS	BV	TV	OS	NH	SK	WK	MK	SS	CH	UA	HH	RS	BW	ST	SW	WT	ZT	RT	FH	UB	GE	BE	CC	AK	ML	PR	PG	AF	SF	UF	UU	TOTAL	/ HOUR		
24-Oct	7.00	1	541	0	2	0	0	0	10	9	0	0	1	7	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	575	82.1
25-Oct	8.00	1	10,404	0	0	0	0	0	4	2	1	1	0	5	0	4	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10,429	1,303.6
26-Oct	8.00	0	2030	0	1	0	1	0	7	6	1	0	0	4	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2051	256.4
27-Oct	6.50	0	0	0	1	0	0	0	1	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0.9	
28-Oct	7.50	0	843	0	1	0	0	0	5	10	0	1	0	7	0	1	0	0	1	0	0	0	1	0	1	0	0	2	0	0	0	0	0	873	116.4	
29-Oct	7.50	10	158	1	2	0	0	0	2	3	5	2	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	185	24.7	
30-Oct	8.00	0	95	2	0	0	0	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	103	12.9	
31-Oct	7.50	0	76	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	0	0	0	1	77	10.3	
1-Nov	7.50	5	137	0	0	0	0	0	2	2	0	1	0	0	0	0	0	0	3	1	0	0	0	0	1	0	1	0	0	0	0	0	0	153	20.4	
2-Nov	8.00	5	145	1	2	0	0	0	2	7	0	0	0	0	0	9	2	0	4	0	0	0	0	2	0	1	0	0	0	0	0	0	0	180	22.5	
3-Nov	7.50	0	51	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52	6.9	
4-Nov	8.00	11	182	0	0	0	0	0	1	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	197	24.6	
5-Nov	6.50	0	33	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	0	0	0	0	33	5.1	
6-Nov	6.50	0	37	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	6.0	
7-Nov	7.75	12	112	0	0	0	0	0	3	0	0	1	0	0	0	0	4	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	135	17.4	
8-Nov	7.50	71	52	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	133	17.7	
9-Nov	7.50	126	91	1	1	0	0	0	0	1	0	0	0	0	0	2	0	0	6	0	0	0	0	1	0	0	0	1	0	0	0	0	0	230	30.7	
10-Nov	6.00	12	348	0	9	0	0	0	5	9	2	2	2	0	0	4	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	403	67.2	
11-Nov	7.00	0	29	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	4.4	
12-Nov	7.00	15	162	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	179	25.6	
13-Nov	7.00	19	30	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	54	7.7	
14-Nov	7.00	1	39	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	44	6.3	
15-Nov	7.00	64	28	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	95	13.6		
Total	715.75	445	19,090	241	157	56	9	10,004	880	815	174	25	37	263,101	4	1,347	25	10	103	5	34	2	4	11	485	36	3	230	1	1	5	35	297,375	415.5		

¹ See Appendix A for explanation of species codes.

Appendix E. Annual observation effort and fall raptor migration counts by species at Hazel Bazemore Park near Corpus Christi, Texas: 1997–2005.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	MEAN
Start date	15-Aug	15-Aug	14-Aug	15-Aug	15-Aug	15-Aug	15-Aug	15-Aug	15-Aug	15-Aug
End date	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov
Observation days	89	83	90	91	93	89	86	93	92	90
Observation hours	725.00	585.50	719.75	728.58	723.50	676.50	643.00	701.00	715.75	690.95
Species										
Black Vulture	431	138	1,398	491	222	470	241	1,016	445	539
Turkey Vulture	11,221	5,011	30,027	36,690	4,870	42,536	22,900	17,750	19,090	21,122
Unidentified vulture	0	0	0	0	0	0	0	9	0	1
Total vultures	11,652	5,149	31,425	37,181	5,092	43,006	23,141	18,766	19,535	21,661
Osprey	81	179	181	88	114	146	199	207	241	160
Northern Harrier	93	180	331	153	162	109	100	101	157	154
Hook-billed Kite	0	0	0	0	0	0	1	0	0	0
Swallow-tailed Kite	7	6	31	0	37	57	22	34	56	28
White-tailed Kite	4	6	6	2	2	2	1	2	9	4
Mississippi Kite	2,974	3,584	5,513	4,569	10,155	8,394	9,753	4,441	10,004	6,599
TOTAL KITES	2,985	3,596	5,550	4,571	10,194	8,453	9,776	4,477	10,069	6,630
Sharp-shinned Hawk	936	1,208	1,348	929	698	1,869	1,193	892	880	1,106
Cooper's Hawk	418	260	1,092	555	473	645	1,083	483	815	647
Northern Goshawk	0	0	1	0	0	1	0	0	0	0
Unidentified accipiter	308	316	310	379	298	108	344	252	174	277
TOTAL ACCIPITERS	1,662	1,784	2,751	1,863	1,767	2,649	2,620	1,627	1,869	2,030
Common Black Hawk	0	0	0	0	0	1	0	0	0	0
Harris' Hawk	5	5	28	10	14	10	6	23	25	14
Red-shouldered Hawk	79	38	77	81	45	92	26	24	37	55
Broad-winged Hawk	823,602	970,025	640,258	396,774	864,355	464,772	684,815	989,957	263,101	677,518
Short-tailed Hawk	0	0	2	0	0	0	0	1	4	1
Swainson's Hawk	300	6,790	1,246	2,085	14,260	7,912	5,633	14,751	1,347	6,036
White-tailed Hawk	4	5	13	0	7	4	6	19	25	9
Zone-tailed Hawk	2	0	6	0	1	2	7	2	10	3
Red-tailed Hawk	112	121	282	237	96	182	192	180	103	167
Ferruginous Hawk	1	0	14	1	1	2	1	2	5	3
Rough-legged Hawk	1	0	4	0	0	0	0	0	0	1
Unidentified buteo	18	25	62	215	368	80	71	53	34	103
TOTAL BUTEOS	824,124	977,009	641,992	399,403	879,147	473,057	690,757	1,005,012	264,691	683,910
Golden Eagle	1	0	4	1	1	1	2	1	2	1
Bald Eagle	0	2	4	0	2	1	1	3	4	2
Unidentified eagle	0	0	1	0	0	0	0	0	0	0
TOTAL EAGLES	1	2	9	1	3	2	3	4	6	3
Crested Caracara	9	1	18	4	21	12	21	3	11	11
American Kestrel	189	438	483	509	292	811	860	365	485	492
Merlin	25	29	34	31	26	18	57	32	36	32
Prairie Falcon	8	5	33	6	7	4	15	2	3	9
Peregrine Falcon	76	163	241	65	114	176	169	144	230	153
Aplomado Falcon	0	0	1	0	0	0	1	0	1	0
Unknown small falcon	-	-	-	-	0	4	5	4	1	3
Unknown large falcon	-	-	-	-	0	5	9	0	0	3
Unidentified falcon	14	39	92	103	41	25	47	11	5	39
TOTAL FALCONS	312	674	884	714	480	1,043	1,163	554	761	729
Unidentified raptor	220	4,376	3,874	506	837	98	133	89	35	1,130
GRAND TOTAL	841,139	992,950	687,015	444,484	897,519	528,540	727,900	1,030,849	297,375	716,419