FALL 2002 RAPTOR MIGRATION STUDY
NEAR CORPUS CHRISTI, TEXAS

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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 2002, HawkWatch International (HWI) conducted the 6th consecutive, full-season migration count at Hazel Bazemore County Park near Corpus Christi. The first full-season count in 1997 confirmed that the migratory flight of raptors through this region is the largest known in North America north of Mexico, with Broad-winged Hawks (see Appendix A for scientific names of all raptor species observed at the site) typically accounting for more than 90% of the total (Smith et al. 2001). To date, 29 species of raptors have been observed migrating through the area, with annual counts ranging from about 450,000 to more than 900,000 migrants. This report provides a brief summary of the 2002 count results. HWI will present a more in-depth review of the season's results in a comprehensive, multi-site report in summer 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 (17 mi) west of Corpus Christi Bay near the town of Calallen (27º52'3.0"N, 97º38'30.1"W). The HBP monitoring site is situated at an elevation of 28 m (85 ft) 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.

METHODS

Four official or designated observers (generally two on any given day, except during the peak Broad-winged Hawk flight when at least three people worked together), routinely assisted by numerous local volunteers, conducted daily counts of migrant raptors from a single traditional site at HBP. On-site project coordinator Joel Simon, with three previous full-seasons of counting experience at the site served as both a counter and the primary on-site educator, as well as providing supervision and training for the new observers. Official observer Vicki Simon also had participated in counts at the site each year of the project. This was official observer Kirsten McDonnell's first season at Corpus Christi, but third season of migration counting and educating for HWI. This was official observer Paul Sweet's first season of migration counting.

Data gathering and recording followed standardized protocols used at all HWI migration sites and as outlined in prior reports for this project (e.g., Smith 2002).

OBSERVATION EFFORT

The official observers worked on 88 of 93 possible days between 15 August and 15 November 2002 (Table 1). The number of observation days and hours (676.25) were 1% and 3% below average, respectively, with neither difference significant; however, both values represent the second lowest amount of effort for the site thus far, reflecting a relatively high prevalence of inclement weather. The 2002 average of 3.5 observers per hour (includes official and guest observers; value is mean of daily values, which are in turn means of hourly values) was an insignificant 9% higher than average.

MIGRATION SUMMARY

The observers counted 528,540 raptors of 26 species during the 2002 season, including the first ever migrant Common Black Hawk recorded at the site (Table 1, and see Appendix B for daily count records).

Broad-winged Hawks comprised 88% of the total count. Species that comprised ≥1% of the remainder included Turkey Vulture (67%), Mississippi Kite (13%), Swainson's Hawk (12%), Sharp-shinned Hawk (3%), Cooper's Hawk (1%), and American Kestrel (1%). Buteos, vultures, and kites were the predominant species groups (Figure 1). With Broad-winged Hawks excluded, the proportions of accipiters and other species (i.e., eagles, Ospreys, harriers, and caracaras) were significantly below average, whereas the proportions of all other species groups fell within the typical range of variation.

The 2002 median passage date for Broad-winged Hawks of 28 September was a significant 4 days later than average, which is illustrated in the seasonal distribution pattern as relatively high activity during the first five days of October (Figure 2). In fact, late passage was common in 2002, with seven other species (Black Vulture, Osprey, Northern Harrier, Mississippi Kite, Sharp-shinned Hawk, Cooper's Hawk, and Merlin) showing significantly later than average median passage dates and only Turkey Vultures showing significantly early timing.

The 2002 Broad-winged Hawk count was a significant 37% below average and the second lowest count to date (Table 1). The only other species that showed a significantly below-average count was the Merlin (down 38%), but counts dropped to record lows for both Merlins and Prairie Falcons. In contrast, six commonly encountered species showed significantly above-average counts in 2002 (Turkey Vulture, Swallow-tailed and Mississippi Kites, Sharp-shinned Hawks, Red-shouldered Hawks, and American Kestrels), with record-highs set for each of these species except Mississippi Kites (Table 1).

In comparing the Corpus Christi count results to those from other sites around the Gulf Coast, a considerable degree of pattern variation across species occurred in 2002. In the Florida Keys, five species showed higher than average counts (Bald Eagle, Osprey, Broad-winged Hawk, Short-tailed Hawk, and Peregrine Falcon) and 10 species below average counts (>50% below average for six species). At both of HWI's Texas sites (the other being Smith Point on Galveston Bay), roughly half of the species showed counts that were 10% or more below average and the other half above average counts. Moreover, in comparing the two Texas sites, 13 species showed highly dissimilar patterns of variation when comparing the 2002 counts against long-term averages, while only 10 species showed similar changes at the two sites. This continuing, high degree of dissimilarity between count patterns at the two Texas sites likely reflects a combination of differences in source populations (Corpus Christi drawing from a much broader geographic range) and how weather effects the counts at the two sites (Smith et al. 2001). In Veracruz, Mexico, 10 commonly encountered species showed below average counts, while six such species showed above average counts (including the four most abundant species: Turkey Vultures, Mississippi Kites, Broad-winged Hawks, and Swainson's Hawks). The only entirely consistent patterns across all four Gulf Coast sites were that Northern Harriers were down at least slightly everywhere and Peregrine Falcons were up at least slightly everywhere. For seven other species, however, the patterns were similar at three of the four sites (mostly down for Merlins and Sharp-shinned, Red-shouldered and Red-tailed Hawks; mostly up for Broad-winged Hawks and Swallow-tailed and Mississippi Kites).

VISITOR PARTICIPATION AND PUBLIC OUTREACH

During the 2002 season, 742 individuals signed the visitor logs at the site, which is one of the best visitation rates seen since 1997. Visitors originated in 19 states, 2 Canadian provinces, Germany, and Mexico. As usual, visitation was highest during the fifth annual "A Celebration of Flight" event, held in late September. Organized groups visiting the site included a local scout troop, two groups from the Annual Texas Hummingbird Festival, a Penfeathers Tours group from Houston, the Port Aransas Garden Club, the Rockport Bird and Nature Club, and the Fort Worth Audubon Society.

ACKNOWLEDGEMENTS

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members. Other contributors included the Audubon Outdoor Club of Corpus Christi, Comfort Inn at Five Points, Northwest Business Association, Corpus Christi Convention and Visitor's Bureau, H.E.B. Food Stores, and donations made in the memories of Kenneth L. Spiess and Richard W. Watts. We also extend our deepest appreciation to the Nueces County Parks and Recreation Department and their staff at Hazel Bazemore Park for providing such a magnificent place to watch hawks, and to Carol Kilgore for providing subsidized housing for our out-of-area staff. For the sixth straight year, Patty Beasley maintained a website dedicated to the project (www.ccbirding.com) and made daily posts to the Texas birding and national hawkwatch listservers. Finally, thanks to all the dedicated volunteers who assisted with the counts, provided good company and treats, and whose interest and enthusiasm made it all worthwhile. Almost three thousand hours of observation went into the 2002 count. The top volunteers were Bob Creglow (325 hours) and Jimmy Swartz (249 hours). Other volunteers included Jo Creglow, Bill and Patty Beasley, Libby Huffman, Art Olsen, Rik Britton, Glenn Swartz, Larry Jordan, David Olsovsky, and Richard Gibbons.

LITERATURE CITED

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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.

Table 1. Observation effort and raptor counts by species: 1997–2002.

	1997	1998	1999	2000	2001	Mean ± 95% CI	2002	% Change
Start date	15-Aug	15-Aug	14-Aug	15-Aug	15-Aug	15-Aug ± 0.6	15-Aug	–
End date	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov ± 0.0	15-Nov	–
Observation days	89	84	90	91	93	89 ± 3.30	89	-1
Observation hours	725.00	585.75	719.75	728.58	723.50	696.47 ± 54.444	696.47	-3
Species					Raptor Counts			
Black Vulture	431	138	1,398	491	222	536 ± 441.1	470	-12
Turkey Vulture	11,221	5,011	30,027	36,690	4,870	17,564 ± 13,001.8	42,536	+142
Total vultures	11,652	5,149	31,425	37,181	5,092	18,100 ± 13,294.5	43,006	+138
Osprey	81	179	181	88	114	129 ± 42.5	146	+14
Northern Harrier	93	180	331	153	162	184 ± 77.6	109	-41
Swallow-tailed Kite	7	6	31	0	37	16 ± 14.6	57	+252
White-tailed Kite	4	5	13	0	7	6 ± 4.2	4	-31
Mississippi Kite	2,974	3,584	5,513	4,569	10,155	5,359 ± 2,498.1	8,394	+57
Total kites	2,985	3,595	5,557	4,569	10,199	5,381 ± 2,511.3	8,455	+57
Sharp-shinned Hawk	936	1,208	1,348	929	698	1,024 ± 224.3	1,869	+83
Cooper's Hawk	418	260	1,092	555	473	560 ± 277.5	645	+15
Northern Goshawk	0	0	1	0	0	0 ± 0.4	1	+400
Unknown small accipiter[1]	–	–	–	–	298	–	26	–
Unknown large accipiter[1]	–	–	–	–	0	–	0	–
Unknown accipiter	308	316	310	379	0	263 ± 131.2	82	–
Total accipiters	1,662	1,784	2,751	1,863	1,469	1,906 ± 434.1	2,623	+38
Harris' Hawk	5	5	28	10	14	12 ± 8.3	10	-19
Red-shouldered Hawk	79	38	77	81	45	64 ± 18.2	92	+44
Broad-winged Hawk	823,602	970,025	640,258	396,774	864,355	739,003 ± 197,519.3	464,772	-37
Swainson's Hawk	300	6,790	1,246	2,085	14,260	4,936 ± 5,066.0	7,912	+60
White-tailed Hawk	4	5	13	0	7	6 ± 4.2	4	-31
Zone-tailed Hawk	2	0	6	0	1	2 ± 2.2	2	+11
Short-tailed Hawk	0	0	2	0	0	0 ± 0.8	0	-100
Common Black Hawk	0	0	0	0	0	0 ± 0.0	1	–
Red-tailed Hawk	112	121	282	237	96	170 ± 73.7	182	+7
Ferruginous Hawk	1	0	14	1	1	3 ± 5.2	2	-41
Rough-legged Hawk	1	0	4	0	0	1 ± 1.5	0	-100
Unidentified buteo	18	25	62	215	368	138 ± 132.8	80	-42
Total buteos	824,124	977,009	641,992	399,403	879,147	744,335 ± 199,944.0	473,057	-36
Golden Eagle	1	0	4	1	1	1 ± 1.3	1	-29
Bald Eagle	0	2	4	0	2	2 ± 1.5	1	-38
Unidentified eagle	0	0	1	0	0	0 ± 0.4	0	-100
Total eagles	1	2	9	1	3	3 ± 2.9	2	-38
Crested Caracara	9	1	18	4	21	11 ± 7.6	12	+13
American Kestrel	189	438	483	509	292	382 ± 119.9	811	+112
Merlin	25	29	34	31	26	29 ± 3.2	18	-38
Prairie Falcon	8	5	33	6	7	12 ± 10.4	4	-66
Peregrine Falcon	76	163	241	65	114	132 ± 63.2	176	+34
Aplomado Falcon	0	0	1	0	0	0 ± 0.4	0	-100
Unknown small falcon[1]	–	–	–	–	0	–	4	–
Unknown large falcon[1]	–	–	–	–	0	–	5	–
Unknown falcon	14	39	92	103	41	58 ± 33.3	16	–
Total falcons	312	674	884	714	480	613 ± 193.9	1,034	+69
Unidentified raptor	220	4,376	3,874	506	837	1,963 ± 1,747.8	98	-95
Grand Total	841,139	992,950	687,015	444,484	897,519	772,621 ± 187,915.5	528,540	-32
Total w/o BW	17,537	22,925	46,757	47,710	33,164	33,619 ± 11,957.3	63,768	+90

[1] Designations used consistently for the first time in 2001 (see Appendix A).

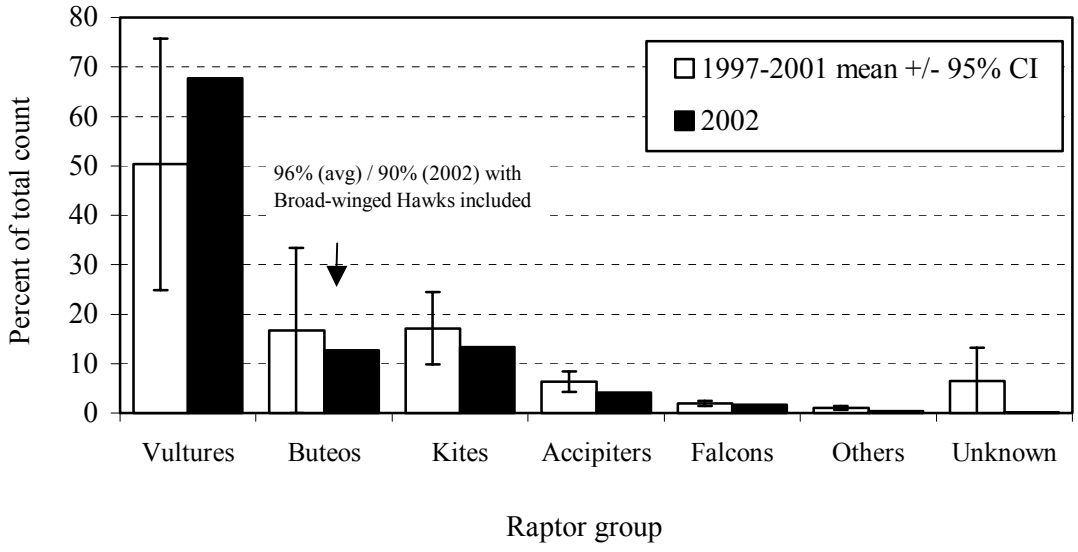

Figure 1. Composition of raptor flights by species groups: 1997–2001 versus 2002.

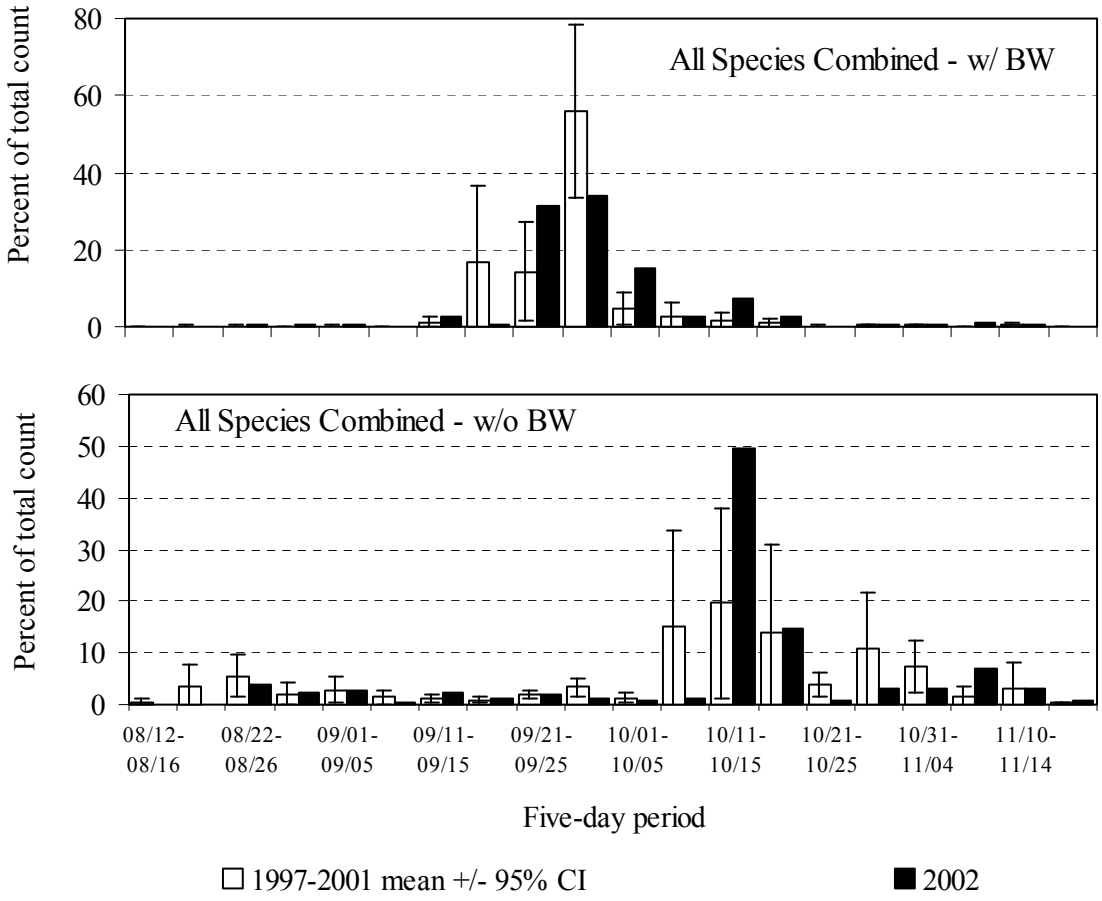

Figure 2. Combined-species flight volume by five-day periods, with and without Broad-winged Hawks: 1997–2001 versus 2002.

Appendix A. Common and scientific names, species codes, and regularly applied age, sex, and color-morph classifications for all migrant raptors observed near Corpus Christi, TX.

Common Name	Scientific Name	Species Code	Age[1]	Sex[2]	Color Morph[3]
Black Vulture	*Coragyps atratus*	BV	U	U	NA
Turkey Vulture	*Cathartes aura*	TV	U	U	NA
Osprey	*Pandion haliaetus*	OS	U	U	NA
Northern Harrier	*Circus cyaneus*	NH	A I Br U	M F U	NA
Swallow-tailed Kite	*Elanoides forficatus*	SK	U	U	NA
White-tailed Kite	*Elanus leucurus*	WK	U	U	NA
Mississippi Kite	*Ictinia mississippiensis*	MK	A I U	U	NA
Unknown kite	*see above*	UK	U	U	NA
Sharp-shinned Hawk	*Accipiter striatus*	SS	A I U	U	NA
Cooper's Hawk	*Accipiter cooperii*	CH	A I U	U	NA
Northern Goshawk	*Accipiter gentilis*	NG	A I U	U	NA
Unknown small accipiter	*A. striatus* or *cooperii*	SA	U	U	NA
Unknown large accipiter	*A. cooperii* or *gentilis*	LA	U	U	NA
Unknown accipiter	*Accipiter* spp.	UA	U	U	NA
Harris' Hawk	*Parabuteo unicinctus*	HH	A I U	U	NA
Red-shouldered Hawk	*Buteo lineatus*	RS	A I U	U	NA
Broad-winged Hawk	*Buteo platypterus*	BW	A I U	U	D L U
Short-tailed Hawk	Buteo brachyurus	ST	U	U	D L U
Swainson's Hawk	*Buteo swainsoni*	SW	U	U	D L U
White-tailed Hawk	*Buteo albicaudatus*	WT	A I U	U	NA
Zone-tailed Hawk	*Buteo albonotatus*	ZT	A I U	U	NA
Common Black Hawk	*Buteogallus anthracinus*	CB	A I U	U	NA
Red-tailed Hawk	*Buteo jamaicensis*	RT	A I U	U	D L U
Ferruginous Hawk	*Buteo regalis*	FH	A I U	U	D L U
Rough-legged Hawk	*Buteo lagopus*	RL	U	U	D L U
Unknown buteo	*Buteo* spp.	UB	U	U	D L U
Golden Eagle	*Aquila chrysaetos*	GE	A S I NA U[4]	U	NA
Bald Eagle	*Haliaeetus leucocephalus*	BE	A S2 S1 I NA U[5]	U	NA
Unknown eagle	*Aquila* or *Haliaeetus spp.*	UE	U	U	NA
Crested Caracara	*Caracara cheriway*	CC	U	U	NA
American Kestrel	*Falco sparverius*	AK	U	M F U	NA
Merlin	*Falco columbarius*	ML	AM Br	M U	NA
Prairie Falcon	*Falco mexicanus*	PR	U	U	NA
Peregrine Falcon	*Falco peregrinus*	PG	A I U	U	NA
Aplomado Falcon	*Falco femoralis*	AF	A I U	U	NA
Unknown small falcon	*F. sparverius* or *columbarius*	SF	U	U	NA
Unknown large falcon	*F. mexicanus* or *peregrinus*	LF	U	U	NA
Unknown falcon	*Falco* 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. Daily count records from Hazel Bazemore County Park: 2002.

		Species[1]																																				Birds
Date	Hours	BV	TV	OS	NH	SK	WK	MK	SS	CH	NG	SA	LA	UA	HH	RS	BW	SW	WT	ZT	ST	CB	RT	FH	RL	UB	GE	BE	UE	CC	AK	ML	PR	PG	AF	SF	LF	UF	UU	Total	/ hour
15-Aug	8.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0.4
16-Aug	8.00	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	0	0	0	0	0	0	0	0	0	1	0.1
17-Aug	8.00	0	0	0	0	12	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	1.9
18-Aug	8.00	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1.0
19-Aug	8.00	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0.6
20-Aug	8.00	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0.5
21-Aug	8.00	0	0	0	0	0	0	78	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	86	10.8
22-Aug	8.00	0	0	0	0	9	0	899	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	910	113.8
23-Aug	8.00	0	0	0	0	2	0	47	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	54	6.8
24-Aug	8.00	0	0	0	0	10	0	663	0	0	0	0	0	0	0	6	0	10	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	692	86.5
25-Aug	8.00	0	0	0	0	0	0	129	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	0	0	0	1	135	16.9
26-Aug	8.00	0	0	0	0	1	0	642	0	0	0	0	0	0	0	5	0	3	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	655	81.9
27-Aug	8.00	0	0	1	0	1	0	4	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	9	1.1
28-Aug	8.00	0	0	0	0	0	0	60	0	0	0	0	0	0	0	1	4	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70	8.8
29-Aug	8.50	0	1	2	0	0	0	372	0	1	0	0	0	0	1	1	19	6	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	405	47.6
30-Aug	8.00	0	0	0	0	1	0	988	0	0	0	0	0	0	1	0	10	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1004	125.5
31-Aug	8.00	0	0	0	0	0	0	23	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	33	4.1
1-Sep	7.75	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	56	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	83	10.7
2-Sep	8.00	0	0	1	0	0	0	15	2	1	0	0	0	0	0	0	18	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	45	5.6
3-Sep	9.00	0	0	0	0	0	0	737	0	1	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	763	84.8
4-Sep	8.00	0	0	0	0	1	0	401	0	1	0	0	0	0	0	0	18	5	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	432	54.0
5-Sep	8.25	0	0	1	0	0	0	489	0	0	0	0	0	0	0	0	55	3	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	4	554	67.2
6-Sep	8.00	0	0	0	0	0	0	116	0	0	0	0	0	0	0	0	77	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	196	24.5
7-Sep	7.50	0	0	0	0	0	0	9	0	0	0	0	0	0	1	0	3	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	32	4.3
8-Sep	4.50	0	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	0	1	0	0	0	0	0	2	0.4
9-Sep	0.00																																								
10-Sep	7.25	0	0	1	0	7	0	69	0	0	0	0	0	0	0	1	50	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	131	18.1
11-Sep	8.00	0	0	1	2	1	0	176	0	1	0	0	0	0	0	0	4592	15	0	0	0	0	0	0	0	4	0	0	0	0	2	0	0	4	0	0	0	0	0	4798	599.8
12-Sep	9.50	0	1	2	1	3	0	515	0	3	0	0	0	0	0	1	6390	8	0	0	0	0	1	0	0	1	0	0	0	0	5	0	0	0	0	0	0	0	0	6931	729.6
13-Sep	9.50	0	0	0	2	1	0	361	1	1	0	0	0	0	0	1	2003	9	0	1	0	0	1	0	0	1	0	0	0	0	3	0	0	3	0	0	0	0	2	2390	251.6
14-Sep	8.00	0	1	3	1	0	0	206	0	1	0	0	0	0	0	1	696	9	0	0	0	0	3	0	0	1	0	0	0	0	3	0	0	2	0	0	0	0	2	929	116.1
15-Sep	0.00																																							
16-Sep	5.00	0	0	0	0	0	0	19	0	2	0	0	0	0	0	0	242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	263	52.6
17-Sep	6.50	0	0	1	0	0	0	444	0	0	0	0	0	0	0	0	1434	4	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1886	290.2
18-Sep	8.00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0.8
19-Sep	8.00	0	0	1	0	0	0	15	0	0	0	0	0	0	0	0	8	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	28	3.5
20-Sep	8.00	0	0	2	1	0	0	180	1	1	0	0	0	0	0	10	524	14	1	0	0	0	1	0	0	2	0	0	0	0	11	0	0	3	0	0	0	2	0	753	94.1
21-Sep	8.00	0	3	3	2	0	0	576	7	14	0	0	0	0	1	4	25895	5	0	0	0	0	2	1	0	0	0	0	0	0	30	0	1	1	0	0	1	0	6	26552	3319.0
22-Sep	9.00	0	0	4	6	0	0	33	8	8	0	0	0	0	0	3	10283	11	0	0	0	0	4	0	0	2	0	0	0	0	23	0	0	3	0	0	0	2	0	10390	1154.4
23-Sep	7.25	0	0	6	0	0	0	61	41	14	0	0	0	1	0	2	24965	5	0	0	0	0	2	0	0	1	0	0	0	0	23	1	0	4	0	0	0	0	0	25126	3465.7
24-Sep	8.50	0	2	2	5	0	0	8	32	8	0	0	0	2	0	3	81702	8	0	0	0	1	2	0	0	2	0	0	0	0	26	1	0	3	0	0	0	0	1	81808	9624.5
25-Sep	9.00	0	5	3	2	0	0	2	66	10	0	4	0	0	1	2	22267	2	0	0	0	0	1	0	0	0	0	0	0	0	19	1	0	1	0	0	0	0	1	22387	2487.4
26-Sep	8.50	0	1	3	1	0	0	1	53	14	0	0	0	5	0	1	15137	3	0	0	0	0	2	0	0	1	0	0	0	0	27	1	0	0	0	0	0	3	4	15257	1794.9
27-Sep	9.50	0	6	6	0	0	0	1	138	39	0	9	0	0	0	4	19437	6	1	0	0	0	3	0	0	6	0	0	0	0	39	1	1	2	0	0	0	0	2	19701	2073.8
28-Sep	9.50	0	2	9	0	0	0	5	50	21	0	0	0	5	1	6	13960	1	0	0	0	0	5	0	0	5	0	0	0	0	36	0	0	18	0	0	1	2	2	14129	1487.3
29-Sep	9.50	3	7	5	0	0	0	2	26	13	0	0	0	0	0	1	124487	4	0	0	0	0	3	0	0	0	0	0	0	0	6	1	0	26	0	0	1	0	1	124586	13114.3
30-Sep	8.00	0	6	5	1	0	0	2	29	9	0	0	0	7	0	0	5041	0	0	0	0	0	2	0	0	1	0	0	0	0	8	0	0	11	0	0	0	0	0	5122	640.3
1-Oct	7.50	5	10	4	0	0	0	0	1	1	0	0	0	2	0	0	2706	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	6	0	0	0	0	0	2738	365.1
2-Oct	8.00	0	2	1	2	0	0	1	9	12	0	0	0	2	0	0	851	3	1	0	0	0	1	0	0	0	0	0	0	0	8	0	0	12	0	0	0	3	2	910	113.8

Appendix B. continued

		Species[1]																																			Birds	
Date	Hours	BV	TV	OS	NH	SK	WK	MK	SS	CH	NG	SA	LA	UA	HH	RS	BW	SW	WT	ZT	ST	CB	RT	FH	RL	UB	GE	BE	UE	CC	AK	ML	PR	PG	AF	SF	LF	UF	UU	Total	/ hour
3-Oct	8.00	10	14	10	3	0	0	0	20	11	0	0	0	0	0	5	48330	7	0	0	0	0	3	0	0	1	0	0	0	0	25	0	0	10	0	0	0	0	1	48450	6056.3
4-Oct	8.00	2	58	13	1	0	0	7	55	27	0	0	0	8	0	3	29026	12	0	0	0	0	1	0	0	1	0	0	0	0	40	0	0	4	0	0	0	1	1	29260	3657.5
5-Oct	8.00	0	0	1	0	0	0	0	16	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	1	0	3	0	0	0	0	0	41	5.1
6-Oct	8.00	4	2	7	0	0	0	2	1	4	0	0	0	3	0	0	6452	5	0	0	0	0	0	0	0	1	0	0	0	0	13	0	0	7	0	0	1	0	1	6503	812.9
7-Oct	6.00	0	79	3	2	0	0	2	13	0	0	0	0	0	0	0	8	0	0	0	0	0	1	0	0	0	0	0	0	0	34	0	0	7	0	1	0	0	1	151	25.2
8-Oct	8.00	0	1	7	0	0	0	1	9	1	0	0	0	0	0	0	2	4	0	0	0	0	1	0	0	0	0	0	0	0	15	0	0	4	0	0	0	0	0	45	5.6
9-Oct	9.00	13	9	4	1	0	1	3	42	12	0	0	0	0	1	1	1614	17	0	1	0	0	1	0	0	0	0	0	0	3	29	2	0	7	0	0	0	0	1	1762	195.8
10-Oct	9.50	7	20	1	1	0	0	0	15	7	0	0	0	1	0	0	4623	382	0	0	0	0	2	0	0	0	0	0	0	1	15	0	1	2	0	0	0	0	4	5082	534.9
11-Oct	9.00	0	249	1	2	0	0	0	25	17	0	0	0	1	0	1	2802	910	0	0	0	0	2	0	0	3	0	0	0	0	30	0	0	7	0	0	0	0	0	4050	450.0
12-Oct	8.00	2	82	10	1	0	0	0	75	14	0	0	0	2	0	1	1367	21	0	0	0	0	2	0	0	0	0	0	0	0	18	2	0	3	0	0	0	0	2	1602	200.3
13-Oct	9.00	0	3290	2	1	0	0	0	122	17	0	0	0	2	1	0	458	3277	0	0	0	0	1	0	0	0	0	0	0	2	67	1	0	2	0	0	0	0	1	7244	804.9
14-Oct	8.00	0	2924	2	2	0	0	0	48	6	0	0	0	1	0	0	2332	2217	0	0	0	0	3	1	0	0	0	0	0	0	6	0	0	0	0	0	0	0	3	7545	943.1
15-Oct	8.00	0	17153	1	6	0	0	0	94	19	0	3	0	7	0	2	221	807	0	0	0	0	5	0	0	1	0	0	0	0	44	1	1	6	0	0	0	0	10	18381	2297.6
16-Oct	8.50	3	7612	0	3	0	0	0	183	66	0	2	0	7	0	9	3555	17	0	0	0	0	14	0	0	1	0	0	0	0	38	0	0	0	0	0	1	1	8	11520	1355.3
17-Oct	8.00	3	191	3	4	0	0	0	142	36	0	0	0	10	0	1	532	3	0	0	0	0	5	0	0	1	0	0	0	0	25	0	0	0	0	0	0	0	3	959	119.9
18-Oct	5.75	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	0	0	0	0	0	0	0	0	0	0.0
19-Oct	8.00	0	30	1	0	0	0	0	5	1	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	0	38	4.8
20-Oct	8.00	1	860	2	1	0	0	0	72	26	0	0	0	2	0	0	113	2	0	0	0	0	2	0	0	0	0	0	0	0	23	1	0	0	0	0	0	0	0	1105	138.1
21-Oct	8.00	0	100	4	2	0	0	0	56	40	0	0	0	3	0	0	75	3	0	0	0	0	3	0	0	1	0	1	0	0	17	1	0	0	0	1	0	0	1	308	38.5
22-Oct	6.75	0	213	0	0	0	0	0	12	4	0	0	0	2	0	0	2	1	0	0	0	0	0	0	0	0	1	0	0	2	2	0	0	2	0	0	0	0	0	241	35.7
23-Oct	8.00	0	77	0	0	0	0	0	12	3	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	95	11.9
24-Oct	2.25	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	11	4.9
25-Oct	4.00	0	0	0	0	0	0	0	3	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	3	0.8
26-Oct	0.00																																								
27-Oct	8.00	2	137	0	0	0	0	0	11	4	0	0	0	1	0	0	3	1	0	0	0	0	3	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	1	174	21.8
28-Oct	4.00	0	7	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	0	0	0	0	0	0	8	2.0
29-Oct	8.00	15	787	0	1	0	0	0	82	19	0	0	0	5	0	0	91	5	0	0	0	0	11	0	0	3	0	0	0	0	23	0	0	1	0	1	0	0	4	1048	131.0
30-Oct	8.00	3	663	2	2	0	0	0	49	20	0	0	0	3	0	3	18	6	0	0	0	0	2	0	0	1	0	0	0	0	8	0	0	0	0	0	0	0	6	786	98.3
31-Oct	3.00	1	29	0	2	0	0	0	4	3	0	0	0	0	0	0	4	1	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	48	16.0
1-Nov	7.50	4	1795	1	4	0	0	0	73	47	1	3	0	0	0	1	142	7	0	0	0	0	11	0	0	3	0	0	0	0	4	0	0	0	0	1	0	1	5	2103	280.4
2-Nov	0.00																																							
3-Nov	3.50	0	1	0	0	0	0	0	3	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	4	1.1
4-Nov	0.00																																							
5-Nov	8.00	9	1752	2	1	0	1	0	30	10	0	1	0	0	1	1	11	0	0	0	0	0	3	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	7	1837	229.6
6-Nov	7.50	16	985	0	23	0	0	0	44	15	0	1	0	0	1	3	32	0	0	0	0	0	11	0	0	1	0	0	0	0	5	1	0	0	0	0	0	0	3	1141	152.1
7-Nov	7.50	3	400	0	15	0	0	0	28	12	0	1	0	0	0	0	1	2	0	0	0	0	13	0	0	0	0	0	0	2	1	0	0	1	0	0	0	0	1	480	64.0
8-Nov	7.50	10	448	0	0	0	0	0	7	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	470	62.7
9-Nov	7.50	102	345	0	0	0	0	0	2	1	0	1	0	0	0	1	0	2	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	457	60.9
10-Nov	7.50	29	187	0	0	0	0	0	2	4	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	225	30.0
11-Nov	7.50	65	402	0	2	0	0	0	19	6	0	0	0	0	0	3	1	1	0	0	0	0	8	0	0	1	0	0	0	1	9	1	0	1	0	0	0	0	0	520	69.3
12-Nov	7.50	7	434	0	1	0	0	0	13	5	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	474	63.2
13-Nov	7.50	33	364	0	2	0	0	0	10	4	0	1	0	0	0	0	2	3	0	0	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	426	56.8
14-Nov	7.50	34	387	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	0	0	0	0	0	0	0	0	0	422	56.3
15-Nov	7.50	84	394	1	0	0	0	0	7	6	0	0	0	0	0	1	2	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	501	66.8
Total	676.25	470	42536	146	109	57	2	8392	1869	645	1	26	0	82	10	92	464771	7912	4	2	0	1	182	2	0	80	1	1	0	12	811	18	4	176	0	4	5	16	98	528537	781.6

[1] See Appendix A for explanation of species codes.