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ASSESSING CHANGES IN THE DISTRIBUTION AND ABUNDANCE OF BURROWING OWLS IN CALIFORNIA, 1993-2007[1]

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Abstract. The Western Burrowing Owl (*Athene cunicularia hypugea*) has declined in recent decades across much of its range, including California, where it is classified as a Species of Special Concern. During 2006-2007, we surveyed the entire breeding range of the species in California, except the Channel Islands. Relying largely on volunteers, we surveyed 860 5km x 5km blocks, and documented exact locations of 1,758 pairs. Using data from randomly-selected blocks, we extrapolated a statewide, breeding-season population of 9,187 (SE = 2,346) pairs. For all of the species' California range, except the Modoc Plateau and the Mojave and Sonoran deserts, we compared results with those of DeSante et al. (2007) using identical methods and study area boundaries during 1991-1993. Our 2006-2007 estimate of 8,128 (SE = 2,391) pairs was 10.9% lower than the previous estimate, but the difference was not statistically significant. The major patterns of Burrowing Owl occurrence across California appeared to be relatively unchanged since 1993, although non-significant declines were apparent in numerous regions. Burrowing Owls appear to have declined particularly sharply in two urban areas: the San Francisco Bay Area and Bakersfield. Our surveys of previously unsurveyed portions of the species' California range yielded few or no owls in the Modoc Plateau/Great Basin, Northern Mojave/eastern Sierra Nevada, eastern Mojave, and Sonoran Desert regions (excluding the Palo Verde Valley) but detected larger aggregations in the Palo Verde Valley and the western Mojave Desert region.

Key words: Burrowing Owl, California, Athene cunicularia, *citizen science*

EVALUAR LOS CAMBIOS EN LA DISTRIBUCIÓN Y ABUNDANCIA DEL BÚHO LLANERO EN CALIFORNIA, 1993-2007

Resumen. El Búho Llanero (*Athene cunicularia hypugea*) ha disminuido en las últimas décadas en gran parte de su distribución, incluyendo a California, donde está clasificado como una especie de interés especial. Durante el periodo 2006-2007, encuestamos a todo el rango reproductivo de la especie en California, con la excepción de las Channel Islands.

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Dependimos en gran medida de voluntarios para contar búhos en 860 bloques de 5 km x 5 km, y para documentar la ubicación exacta de 1,758 parejas. Usando datos de los bloques seleccionados al azar, extrapolamos una población para la temporada de reproducción en todo el estado de 9,187 (SE = 2,346) pares. En toda la distribución de la especie de California, con excepción de la Modoc Plateau y los Mojave y Sonoran Deserts, se compararon los resultados con los de DeSante et al. (2007) utilizando métodos idénticos y los límites del área de estudio durante 1991-1993. Nuestra 2006-2007 estimación de 8,128 (SE = 2,391) pares fue 10.9% inferior a la estimación anterior, pero la diferencia no fue estadísticamente significativa. Los principales patrones de ocurrencia del Búho Llanero a través de California parece no haberse cambiado desde 1993. Aunque hubo disminuciones evidentes en numerosas regiones, éstas no fueron estadisticamente significativas. La disminución del Búho Llanero fue especialmente marcada en dos áreas urbanas: el San Francisco Bay Area y Bakersfield. Nuestro estudio de las regiones préviamente no investigadas de distribución de la especie de California dio pocos o ningunos búhos en la Modoc Plateau/Great Basin, el norte de Mojave/este de Sierra Nevada, el este de Mojave, y regiones del Sonoran Desert (excluyendo el Palo Verde Valley), pero detectó mayor agregaciones en el Palo Verde Valley y la región occidental del Mojave Desert.

Palabras clave: Búho Llanero, California, *Athene cunicularia*, ciencia ciudadana

INTRODUCTION

Burrowing Owls (*Athene cunicularia hypugea*) in California breed in natural grasslands and a variety of human-modified habitats, including areas of intense agriculture (Cuolombe 1971, DeSante et al. 2004), as well as airports (Thomsen 1971, Barclay 2007b) and other open areas in urban environments (Trulio 1997, Trulio and Chromczak 2007). Once considered "abundant" and "common" throughout California (Baird 1870, Keeler 1891, Grinnell 1915, Dawson 1923), the species has been declining since at least the 1940s (Grinnell and Miller 1944, Remsen 1978, James and Ethier 1989, DeSante et al. 2007) and is now classified as a Species of Special Concern (Gervais et al. 2008, Shuford and Gardali 2008). The species has declined throughout much of its range (Wedgwood 1978, James and Ethier 1989, Sheffield 1997a, Holroyd et al. 2001, Wellicome and Holroyd 2001) with suggested causes including conversion of grassland habitats to urbanization and inhospitable forms of agriculture (DeSante et al. 2007, Gervais et al. 2008), eradication of fossorial mammals (Zarn 1974, Remsen 1978, Holroyd et al. 2001) and perhaps exposure to pesticides and other contaminants (James and Fox 1987, Haug et al. 1993, Sheffield 1997b; but see also Gervais and Anthony 2003).

In the early 1990s, DeSante et al. (2007) coordinated a survey of the species' entire California breeding range, except for the Modoc Plateau/Great Basin region and the Mojave and Sonoran deserts. At that time Burrowing Owl populations in the southern San Francisco Bay region and in the northern and central portions of the Central Valley appeared to have been declining rapidly, and populations elsewhere in the census area, including the coastal slope of central and southern California, had virtually disappeared. DeSante et al. (2007) estimated that the entire survey area contained >9,000 pairs, with 71% of the estimated population occupying the Imperial Valley south of the Salton Sea (an area comprising just 2.5% of the state) and 24% occupying the Central Valley, primarily in the southern portion of the San Joaquin Valley. Prior to the present study, adequate information to assess Burrowing Owl population trends since 1993 was not available, and in the Great Basin and Mojave and Sonoran desert regions no systematic assessment of population size had ever been made.

Local-scale demographic studies of four focal populations (Imperial Valley, Carrizo Plain, Naval Air Station Lemoore, and the San Jose area) suggest highly variable demographic rates (Gervais 2002, Ronan 2002, Gervais and Anthony 2003, Rosenberg and Haley 2004). Breeding Bird Survey (Sauer et al. 2008) trend results for California exist but are difficult to interpret, because the great majority of detections are clustered on a small number of

routes in the Imperial Valley, home to one of the largest concentrations of the species anywhere (DeSante et al. 2007).

We undertook the present study to assess how Burrowing Owl distribution and abundance in California may have changed since 1993, and to determine the status of Burrowing Owl populations in the previously unsurveyed Modoc Plateau and desert regions of the state.

METHODS

STUDY AREA

For their 1991-1993 study, DeSante et al. (2007) defined and surveyed 11 distinct geographic regions, comprising the entire California breeding range, except for the Sonoran and Mojave deserts and the Modoc Plateau. To maximize comparability, we retained all of the region boundaries established by DeSante et al. (2007; Fig. 1).

We re-surveyed 8 of the 11 regions defined for the early 1990s survey (Table 1); because populations in the San Francisco Bay Area Coast, Central-western Coast, and Southwestern Coast regions were well studied and known to be very small or extirpated entirely, we opted not to devote volunteer resources to surveying those, but instead to rely on published literature and/or local experts for population estimates.

In addition to resurveying most of the DeSante et al. (2007) regions, we also targeted the state's Modoc/Great Basin and desert, in order to assess the species' heretofore largely unknown abundance and distribution within these areas, and to better understand their relative importance to the state's overall Burrowing Owl population. DeSante et al. (2007) omitted these areas from the 1991-1993 survey because adequate numbers of local volunteer surveyors were not available. We were able to include these regions in the 2006-2007 effort by surveying them with a crew of full-time field technicians, rather than relying on local volunteers.

We divided the previously unsurveyed portions of the California breeding range into five new regions, four of which are described in greater detail in Wilkerson and Siegel (*in press*; Fig. 1): Northern Mojave Desert/Eastern Sierra Nevada, Western Mojave Desert, Eastern Mojave Desert, Sonoran Desert. The fifth, the Modoc Plateau/Great Basin region (Fig. 1), matches the geographic boundaries of the "Jepson area" mapped as "Modoc Plateau" by Hickman (1993) and the California Gap Analysis Project (1998). The region lies entirely above the 610m elevation contour, which was used as the upper limit for high elevation subregions in ten of the 12 regions defined by DeSante et al. (2007). We therefore did not stratify our sampling within this region by elevation. Rather, we classified the entire region as "upland". Because of the presence of large tracts of forested areas that are not suitable Burrowing Owl habitat, we used the Forest Multi-source Landcover Data (California Department of Forestry and Fire Protection 2002) in conjunction with Burrowing Owl habitat characterizations produced for the region by Cull and Hall (2007) to assess the extent of potential habitat within each survey block. All land area above 1,830m was excluded from the sample frame because it consists of mountainous and forested habitat. We classified the remaining survey blocks as having either greater than or less than 50% suitable Burrowing Owl habitat, and then drew our random sample of blocks such that 2/3 had >50% suitable habitat cover and 1/3 had <50% suitable habitat cover. Survey blocks with <5% suitable habitat cover were not included.

SURVEY DESIGN

Within each region previously surveyed by DeSante et al. (2007), we used the grid defined for their 1991-1993 survey, which divides all the land in the study area into 5-km by 5-km blocks, oriented and referenced according to the Universal Transverse Mercator (UTM) system. Each block was classified as belonging primarily to the lowland subregion or the upland subregion, using a set of classification rules that varied slightly by region (see details in DeSante et al. 2007). Survey effort was stratified by elevational subregion because Burrowing Owl densities are generally much higher in lowland areas throughout California than in upland areas (DeSante et al. 2007). For logistical reasons, we discarded the small number of blocks that could not be accessed anywhere by roads, and then stratified sampling effort among the remaining blocks by region and subregion, randomly selecting as many blocks as we

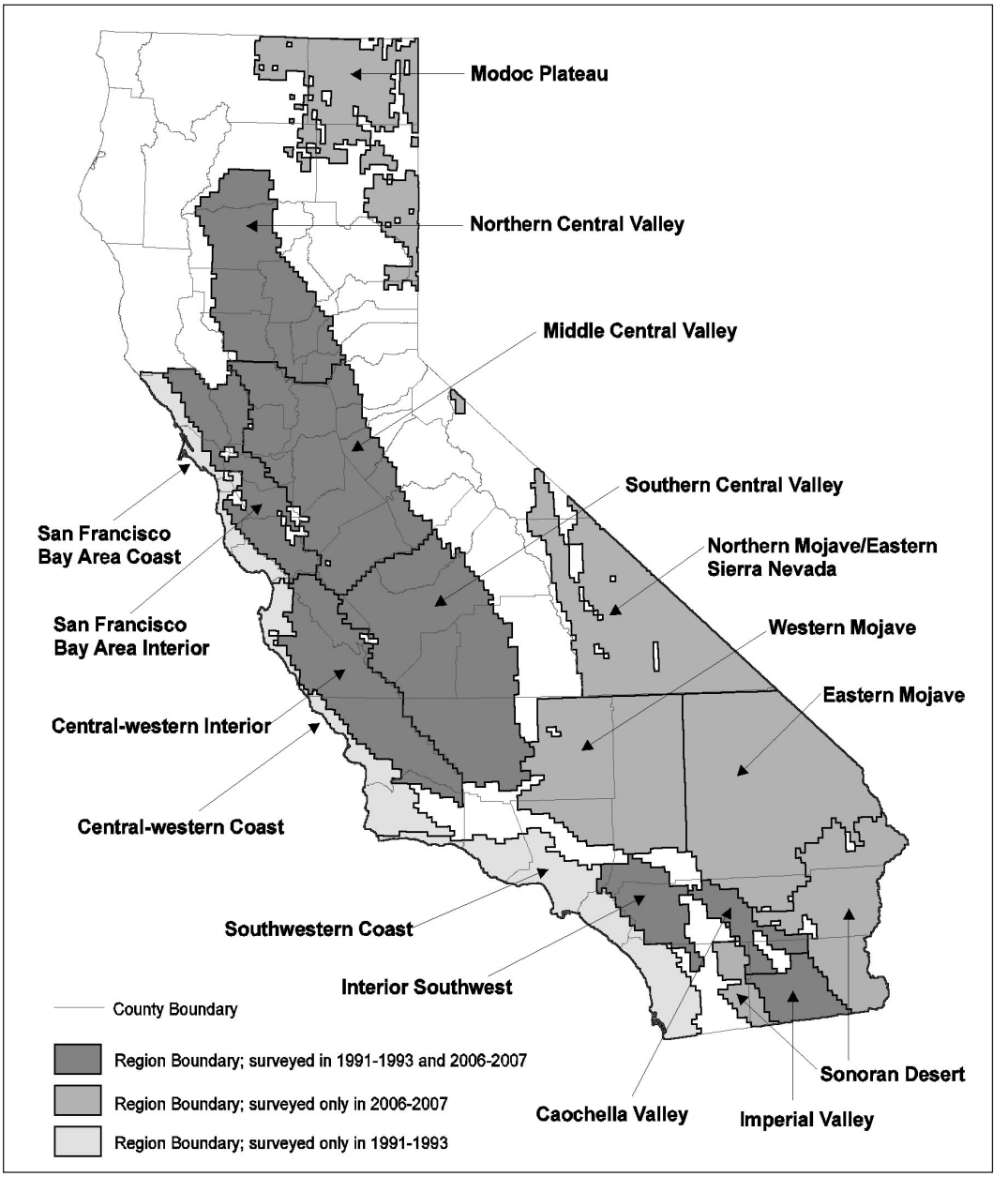

FIGURE 1. Burrowing Owl regions delineated and surveyed for The Institute for Bird Populations' 1991-1993 and/or 2006-2007 statewide Burrowing Owl surveys.

thought we would have the manpower to survey. Blocks in each region were then assigned to be surveyed in a randomly determined order to avoid bias if our volunteers and field crew were unable to survey all of the selected blocks.

We used Geographic Information System (GIS) software to define grids of 5-km by 5-km blocks covering each of the four new regions in a manner consistent with the previously established grid. The 1991-1993 survey drew from a sampling frame of 5,990 blocks (DeSante et al. 2007). The five new survey regions

TABLE 1. Regions of California defined and surveyed for The Institute for Bird Populations' California Burrowing Owl surveys during 1991-1993 and/or 2006-2007.

Region	Status during 2006-2007 survey
Regions surveyed during the 1991-1993 survey	
Northern Central Valley	Resurveyed
Middle Central Valley	Resurveyed
Southern Central Valley	Resurveyed
San Francisco Bay Area Interior	Resurveyed
San Francisco Bay Area Coast	Not resurveyed – population extirpated
Central-western Interior	Resurveyed
Central-western Coast	Not resurveyed – population likely extirpated
Southwestern Coast	Not resurveyed – small, well-known population
Southwestern Interior	Resurveyed
Coachella Valley	Resurveyed
Imperial Valley	Resurveyed
Regions not previously surveyed	
Modoc Plateau/Great Basin	Surveyed for the first time
Northern Mojave Desert/Eastern Sierra Nevada	Surveyed for the first time
Western Mojave Desert	Surveyed for the first time
Eastern Mojave Desert	Surveyed for the first time
Sonoran Desert	Surveyed for the first time

contained an additional 4,991 blocks. After removing those regions from the 1991-1993 survey we decided not to survey, our sampling frame contained a total of 9,823 blocks.

Random sample blocks were selected separately by region and elevation stratum. The selected number of blocks to be visited in each subregion was proportional to its size and amount of estimated surveyor effort available over the two-year survey period. Because Burrowing Owls are known to be more abundant in the lower elevation strata throughout our sample area (DeSante et al. 2007), low elevation blocks comprised 2/3 of the random sample selected to be visited while high elevation substrata blocks comprised 1/3 of selected random sample blocks in all survey regions.

We also identified additional blocks (hereafter, "historic breeding blocks") where Burrowing Owls were known to have been detected during the breeding season in any year since 1981. Historic breeding blocks were identified by querying or consulting the following sources for historical detections: the database compiled by DeSante et al. (2007), which includes Burrowing Owls detected during the 1991-1993 survey as well as historical detections gathered from multiple sources from the decade prior to that survey; the California Natural Diversity Database (CNDDB; California Dept. Fish and Game 2006); and knowledgeable researchers and birders with local expertise throughout the state.

Based on previous knowledge from the 1991-1993 survey, we estimated that it was feasible to visit approximately 670 blocks in the eight regions being resurveyed, and 230 blocks in the five new survey regions, for a total of 900 blocks. Prior to the 2006 field season, we identified 500 historic breeding blocks (459 historic breeding blocks in the eight regions surveyed in 1991-1993 and 41 historic breeding blocks in the five new survey regions); a few additional historic blocks were identified during the course of our two-year survey. We also selected 520 random blocks to be surveyed: 340 in regions scheduled to be resurveyed and 180 in the new regions, of which 47 also happened to be historic breeding blocks in which Burrowing Owls had been detected during the 1991-1993 survey. The total number of blocks drawn for surveying during 2006-2007 was 973 (slightly more than we thought we could survey, in case some selected blocks proved to be inaccessible or we were able to sample more blocks than we anticipated).

All selected blocks were assigned to a randomly generated order. In each subregion, half of all blocks in each elevation stratum and each category (random or historic) were

TABLE 2. Number of blocks surveyed, Burrowing Owl pairs found, and population estimate for each geographic region surveyed during 2006-2007 that was also surveyed in 1991-1993 by DeSante et al. (2007). For each region and elevational subregion, we considered our "best estimate" of the number of pairs in 2006-2007 to be the larger of a) the extrapolated estimate of pairs, based only on results from randomly-selected blocks, or b) the actual number of pairs counted, pooling data from randomly-selected blocks and historic breeding blocks.

		All blocks			Random blocks only				
Region	Total area of region (km2)	Random & historic breeding blocks surveyed	Square km surveyed	No of pairs found	Random blocks surveyed	Square km surveyed	No. of pairs found	Estimated no. of pairs (SE)	"Best estimate"of no. of pairs (SE)[a]
Northern Central Valley									
Lowland	10,900	37	822	12	22	497	0	0	12
Upland	8,975	11	252	0	11	252	0	0	0
All	19,875	48	1,074	12	33	749	0	0	12
Middle Central Valley									
Lowland	16,400	174	3,903	339	59	1,265	34	502 (209)	502 (209)
Upland	10,858	25	433	43	12	236	0	0	43
All	27,258	199	4,336	382	71	1,501	34	502 (209)	545 (209)
Southern Central Valley									
Lowland	18,650	121	2,902	204	63	1,544	72	968 (342)	968 (342)
Upland	13,025	43	714	32	18	323	3	145 (118)	145 (118)
All	31,675	164	3,616	236	81	1,867	75	1,113 (460)	1,113 (460)
San Francisco Bay Area Interior									
Lowland	4,903	69	1,592	98	20	447	0	0	98
Upland	6,275	21	515	14	12	290	1	21 (21)	21 (21)
All	11,178	90	2,107	112	32	737	1	21 (21)	119
Central-western Interior									
Lowland	5,325	20	308	8	17	276	0	0	8
Upland	11,225	24	477	13	13	233	2	76 (51)	76 (51)
All	16,550	44	785	21	30	509	2	76 (51)	84
Southwestern Interior									
Lowland	1,250	12	301	37	3	75	1	17 (17)	37
Upland	5,050	56	1,265	113	8	173	0	0	113
All	6,300	68	1,566	150	11	248	1	17 (17)	150
Coachella Valley									
Lowland	1,615	10	245	12	4	100	1	16 (16)	16 (16)
Upland	2,350	10	251	37	4	100	0	0	37
All	3,965	20	496	49	8	200	1	16 (16)	53

TABLE 2. Continued.

Region	Total area of region (km2)	All blocks			Random blocks only				"Best estimate" of no. of pairs (SE)[a]
		Random & historic breeding blocks surveyed	Square km surveyed	No of pairs found	Random blocks surveyed	Square km surveyed	No. of pairs found	Estimated no. of pairs (SE)	
Imperial Valley									
Lowland	2,810	12	301	499	5	126	254	5,701 (2,244)	5,701 (2,244)
Upland	1,780	3	53	22	2	50	17	707 (140)	707 (140)
All	4,590	15	354	521	7	176	271	6,408 (2,384)	6,408 (2,384)

[a] For each subregion we considered our "best estimate" of the number of Burrowing Owl pairs to be the larger of a) the extrapolated estimate of pairs, based only on results from randomly-selected blocks, or b) the actual number of pairs counted, pooling data from randomly-selected blocks and historic breeding blocks. We then summed the "best estimate" for each subregion to obtain "best estimates" for each region.

assigned to observers for sampling in year one (2006) based on the firing order. All random and historic blocks not sampled in 2006 were assigned to be surveyed in 2007. Most blocks were sampled during one of the two years in our survey period. In the few instances that a block was surveyed during both years (generally because volunteer observers became interested in "their" blocks during 2006 and independently chose to resurvey them in 2007), we used data from the first survey year (2006) in our analysis.

DATA COLLECTION

Adhering to the strategy developed by DeSante et al. (2007), we relied largely upon volunteer observers, many associated with local California Audubon Society chapters, to collect our field data in the regions that were surveyed during 1991-1993. We also deployed a crew of full-time field biologist technicians to a) survey some of the blocks in regions where the number of volunteer observers was inadequate to reasonably survey all the selected blocks, and b) survey all of the selected blocks in the Sonoran, Mojave, and Great Basin regions, where potential volunteers were very scarce.

Volunteer surveyors and IBP field crews surveyed blocks using the field methodology developed for the 1991-1993 survey (DeSante et al. 2007). For most regions, surveyors were instructed to visually scan all of the area in their blocks at least once during morning (dawn to 10:00 AM) or late-afternoon (4:00 PM to dusk) during the two-month period between May 15 and July 15, when breeding Burrowing Owls are likely to be feeding nestlings or recently-fledged young. The survey season was shifted two weeks earlier in the Western and Eastern Mojave Desert, Sonoran Desert, Southwestern Interior, and the Coachella and Imperial Valley regions to account for phenological differences among areas.

We provided surveyors with 1:24,000 scale topographic maps with survey block boundaries and clearly marked locations of any owls known or suspected to have bred anytime since 1981. Surveyors delineated the extent of appropriate habitat in their block, visually scanned all areas of appropriate habitat for owls, and plotted the locations of any detections on their maps. For each detection location, observers provided a

count of all owls seen (identified to age and sex, if possible), an estimate of the number of breeding pairs present, and standardized habitat information. The latter included information on vegetation community type and structure, land use, distance to irrigation canals, local abundance of ground squirrels, and other variables. Finally, observers provided a detailed assessment of how much of their block they were actually able to survey adequately. In some cases this was <100%, due to private property restrictions or physiographic barriers.

For each region (except for the Modoc Plateau and desert regions where we relied strictly on IBP field crews) we recruited one or more local area coordinators, who helped recruit volunteers and coordinate their efforts. Prior to the start of the first field season, we developed a training presentation to explain the rationale and goals of the survey, provide tips for identifying Burrowing Owls and determining their age and sex, and teach volunteers how to conduct the survey and complete data forms in a standardized manner. We gave the presentation at eight live meetings and workshops, and also posted it as an online presentation on our website so that it was available to volunteers who could not attend a local training session. We also prepared a detailed data collection protocol which was provided to all observers prior to data collection.

STATISTICAL ANALYSES

We estimated the number of breeding pairs in each subregion and region surveyed. First we calculated the density of breeding pairs on each randomly-selected surveyed block, as the quotient of the number of pairs observed divided by the area of the block that was adequately surveyed. Densities were then averaged across all randomly-selected blocks surveyed in each subregion. Estimates are presented with standard errors, except in cases where the estimate was zero pairs and the SE could not be calculated.

For each subregion and region, we also totaled the actual number of pairs detected, as the sum of all pairs found on randomly-selected blocks plus all pairs found on historic breeding blocks. We present these totals without standard errors, since they are minimum counts rather than statistical estimates.

For each subregion, we considered our "best estimate" of the number of Burrowing Owl pairs to be the larger of a) the extrapolated estimate of pairs, based only on results from randomly-selected blocks, or b) the minimum number of pairs counted, pooling data from randomly-selected blocks and historic breeding blocks (in other words, we only used the minimum count as our "best estimate" if it was larger than the extrapolated estimate). We then summed the "best estimate" for each subregion to obtain "best estimates" of the number of pairs in each region, and across the state.

For subregions and regions surveyed in the 1990s, we compared the 2006-2007 population estimate (no. of pairs) with the estimate obtained for 1991-1993 by a) using Levene's Test to determine whether variances for the two estimates were similar, and then b) using F-tests to assess statistical significance of differences between the estimates (Zar 1984). Such comparisons were only possible when our best estimate for the number of pairs in a region was derived from randomly-selected sample blocks; in cases where our "best estimate" was the actual number of pairs counted (aggregating results from randomly-selected blocks and historic breeding blocks) there was no variance associated with the estimate, so we provide only qualitative, rather than statistical, assessments of population change since the early 1990s.

We used ArcMap to determine land ownership (public versus private) or land managing agency (various federal agencies, state government, local government, tribal areas) at all occupied sites, based on the California Department of Fish and Game Region 6 Spatial Data Framework's Public and Conservation Lands shapefile ("govconfee_1").

We used a paired t-test to assess whether owl abundance changed between the 1991-1993 and 2006-2007 surveys for historic breeding blocks where owls were detected during 1991-1993. We used logistic regression to assess whether the probability of detecting owls on these blocks during 2006-2007 was related to the number of owl pairs detected on them during 1991-1993.

RESULTS

With the help of 21 local coordinators, we recruited 394 volunteers to participate in

surveying one or more blocks during the 2006 or 2007 field season. These volunteers spent over 6,400 hr surveying blocks and completing data forms. Their efforts were augmented by our full-time crews of field biologist technicians, who largely focused their efforts in the new survey regions, where few volunteers were available, and in the southern Central Valley, where the large number of historic breeding blocks surpassed the survey capacity of the local pool of volunteers.

During our 2006-2007 efforts we were able to complete surveys at 453 of the 500 historic breeding owl blocks identified prior to the start of the 2006 field season; 47 historic breeding blocks thus went unsurveyed. However, 24 of those unsurveyed historic breeding blocks were surveyed but yielded no owl detections during the 1991-1993 survey. In other words, the occupancy records were from before 1991-1993, and occupancy could not be confirmed during the 1991-1993 survey. Thus, only 26 historic blocks known to have owls during the 1991-1993 survey went unsurveyed during 2006-2007.

We completed surveys of 860 blocks during 2006-2007. Of these, 444 were randomly selected, and 453 were historic breeding blocks (37 of which were also randomly selected and were treated as random blocks in our analysis). During the course of this survey, we documented the exact locations of 1,758 Burrowing Owl pairs, and have provided this information to the California Department of Fish and Game for their conservation planning purposes.

INDIVIDUAL REGIONS

NORTHERN CENTRAL VALLEY

We surveyed 33 randomly-selected and 15 historic breeding blocks in this region (Fig. 2). We detected no burrowing owls in the random blocks and 10 pairs in the historic breeding blocks; 2 pairs were incidentally detected outside our targeted blocks. All pairs were detected on lowland blocks in Tehama and Yuba counties.

Our random-sample based population estimate for this region is zero. Using our criteria stated earlier, the "best estimate" is 12 pairs for the lowland subregion and zero for upland subregion. The number of Burrowing Owl pairs detected in the region declined only moderately, from 18 pairs to 12 pairs between the 1991-1993 and 2006-2007 surveys, but because 11 pairs were found on randomly-selected blocks during 1991-1993 (compared to no owls detected on randomly-selected blocks during 2006-2007), DeSante et al. (2007) extrapolated their early 1990s findings to estimate that 231 pairs were present in the region, a number greatly in excess of both our estimate of zero pairs extrapolated from random blocks only ($\chi^2_1 = 4.274$, $P = 0.039$; Table 3) and our "best estimate" of 12 pairs, reflecting the actual number of pairs we detected on all blocks surveyed (Table 4).

MIDDLE CENTRAL VALLEY

We surveyed 71 randomly-selected blocks and 128 historic breeding blocks in this region (Fig. 3). Surveys of random blocks yielded 34 Burrowing Owl pairs, and surveys of historic breeding blocks yielded 348 pairs, for a total of 382 pairs. Substantial concentrations of owls were located in lowland areas of Yolo, Solano, Sacramento, Contra Costa, and San Joaquin counties. However we found only two pairs in all of Stanislaus County, and detected only one pair incidentally in Merced County. We found no Burrowing Owls in the upland (foothill) blocks of western El Dorado, Amador, Calaveras, Tuolumne, and Merced counties.

In the 59 randomly-selected lowland blocks surveyed, we found 34 owl pairs, yielding a random-sample based estimate of 502 ± 209 pairs. This estimate was greater than the total number of pairs we actually found in the lowland subregion (34 pairs on randomly-selected blocks plus 305 pairs on historic breeding blocks), so it serves as our "best estimate" for the upland subregion. No owls were detected on randomly-selected upland blocks anywhere in the region, so our random-sample based estimate for the upland subregion is zero pairs. However, we found 43 pairs on upland historic breeding blocks, so our "best estimate" for the upland subregion is the actual number of pairs we found in upland blocks: 43 pairs. Summing our estimate of 502 ± 209 pairs in the lowland subregion and our count of 43 pairs on the upland blocks surveyed, our estimate for the Middle Central Valley region is 545 pairs, 8.2% fewer than the 594 pairs DeSante et al. (2007) estimated to be present in the early 1990s (Table 4).

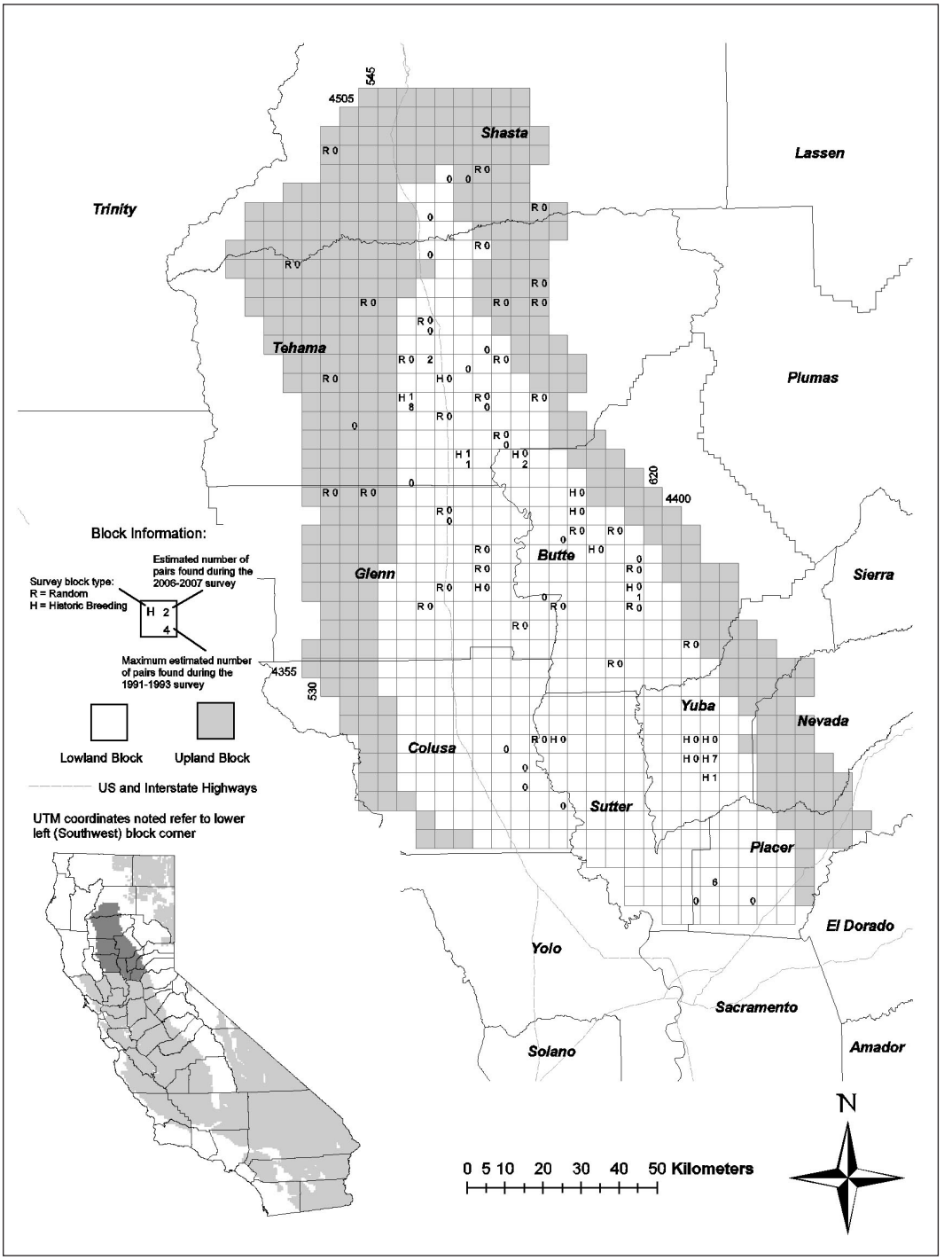

FIGURE 2. Results from the Northern Central Valley region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Northern Central Valley region are shown in the inset.

TABLE 3. Comparison of Burrowing Owl regional population estimates extrapolated from randomly-selected blocks for regions that were surveyed during both the 1991-1993 and 2006-2007 surveys. Although we present extrapolated population estimates for all regions here, in many cases the extrapolated number of pairs based on random blocks only was not judged to be the "best estimate" of the regional population.

	1991-1993 survey		2006-2007 survey			
Region	No. of random blocks surveyed	Extrapolated no. of pairs (SE)	No. of random blocks surveyed	Extrapolated no. of pairs (SE)	Change in estimated no. of pairs	Percent change in estimated no. of pairs
Northern Central Valley						
Lowland	22	231 (153)	22	0	-231	-100%
Upland	2	0	11	0	0	n/a
All	24	231 (153)	33	0	-231	-100%
Middle Central Valley						
Lowland	163	577 (122)	59	502 (209)	-75	-13.0%
Upland	28	17 (17)	12	0	-17	-100%
All	191	594 (139)	71	502 (209)	-92	-15.5%
Southern Central Valley						
Lowland	41	1,000 (410)	63	968 (342)	-32	-3.2%
Upland	11	396 (182)	18	145 (118)	-251	-61.4%
All	52	1,396 (592)	81	1,113 (460)	-283	-20.3%
Entire Central Valley	267	2,221 (884)	185	1,615 (669)	-606	-27.3%
San Francisco Bay Area Interior						
Lowland	86	41 (20)	20	0	-41	-100%
Upland	25	0	12	21 (21)	+21	n/a
All	111	41 (20)	32	21 (21)	-20	-51.2%
Central-western Interior						
Lowland	14	0	17	0	0	n/a
Upland	16	31 (27)	13	76 (51)	+45	+145.2%
All	30	31 (27)	30	76 (51)	+45	+145.2%
Southwestern Interior						
Lowland	4	100 (100)	3	17 (17)	-83	-83%
Upland	10	127 (81)	8	0	-127	-100%
All	14	227 (181)	11	17 (17)	-210	-95.2%
Coachella Valley						
Lowland	5	0	4	16 (16)	+16	n/a
Upland	6	0	4	0	0	n/a
All	11	0	8	16 (16)	+16	n/a
Imperial Valley						
Lowland	15	6,429 (1,135)	5	5,701 (2,244)	-728	-11.32%
Upland	1	142	2	707 (140)	+565	+397.9%
All	16	6,577	7	6,408 (2,384)	-163	-2.6%

SOUTHERN CENTRAL VALLEY

We surveyed 81 randomly-selected blocks and 83 historic breeding blocks in this region (Fig. 4). Surveys of random blocks yielded 75 Burrowing Owl pairs, and surveys of historic breeding blocks yielded 161 pairs, for a total of 236 pairs.

Owls were considerably more abundant in the southern portion of this region than in the northern portion. We found Burrowing Owls in only one survey block in Madera County (though it had 12 pairs), and our detections were nearly as sparsely distributed in Fresno and Kings counties. We found substantial concentrations only in Tulare and Kern counties. As in the other Central Valley regions, the great majority of owls we found were in lowland blocks; in the upland blocks covering the Sierra foothills we found owls in just one block in each

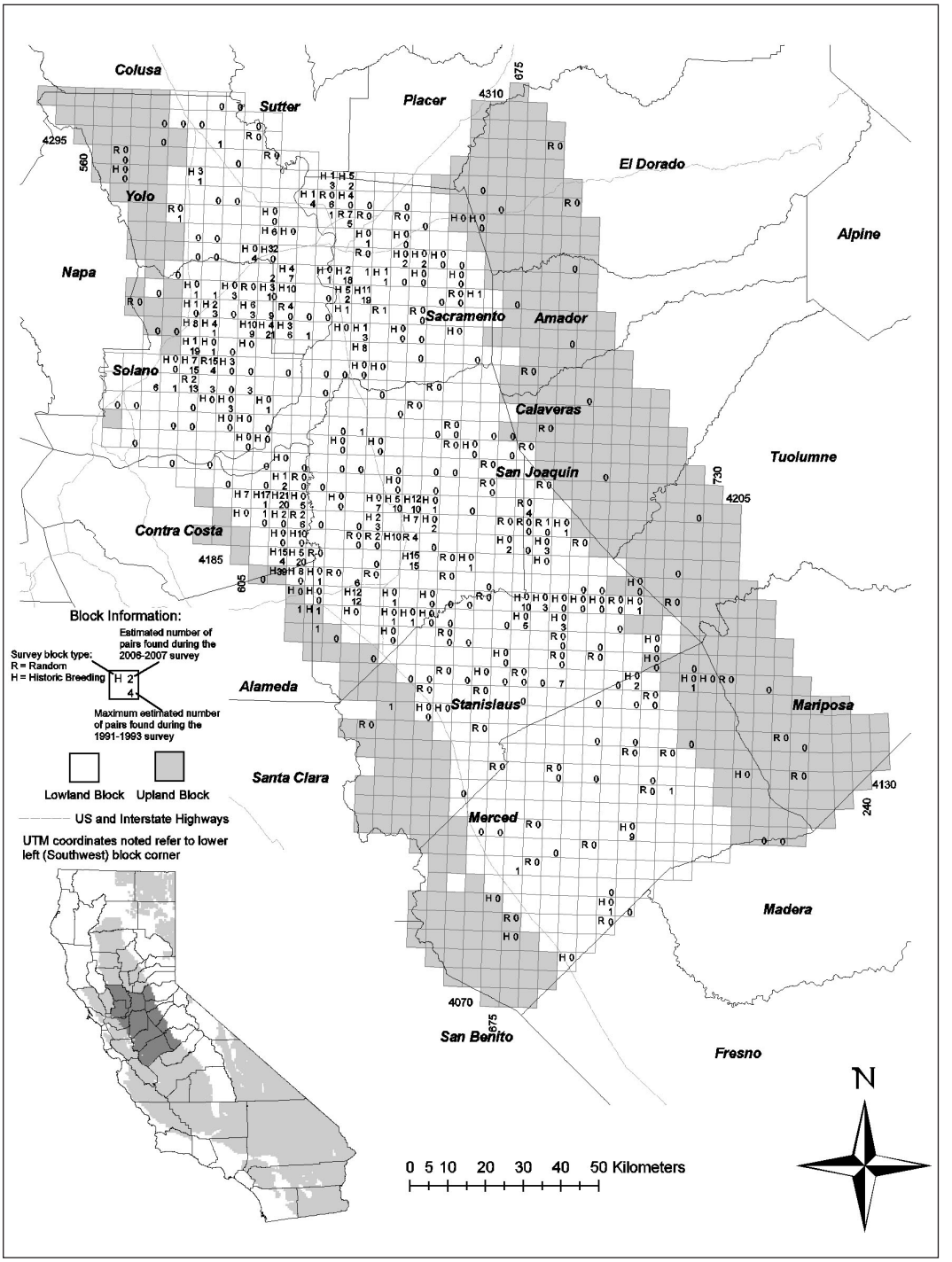

FIGURE 3. Results from the Middle Central Valley region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Middle Central Valley region are shown in the inset.

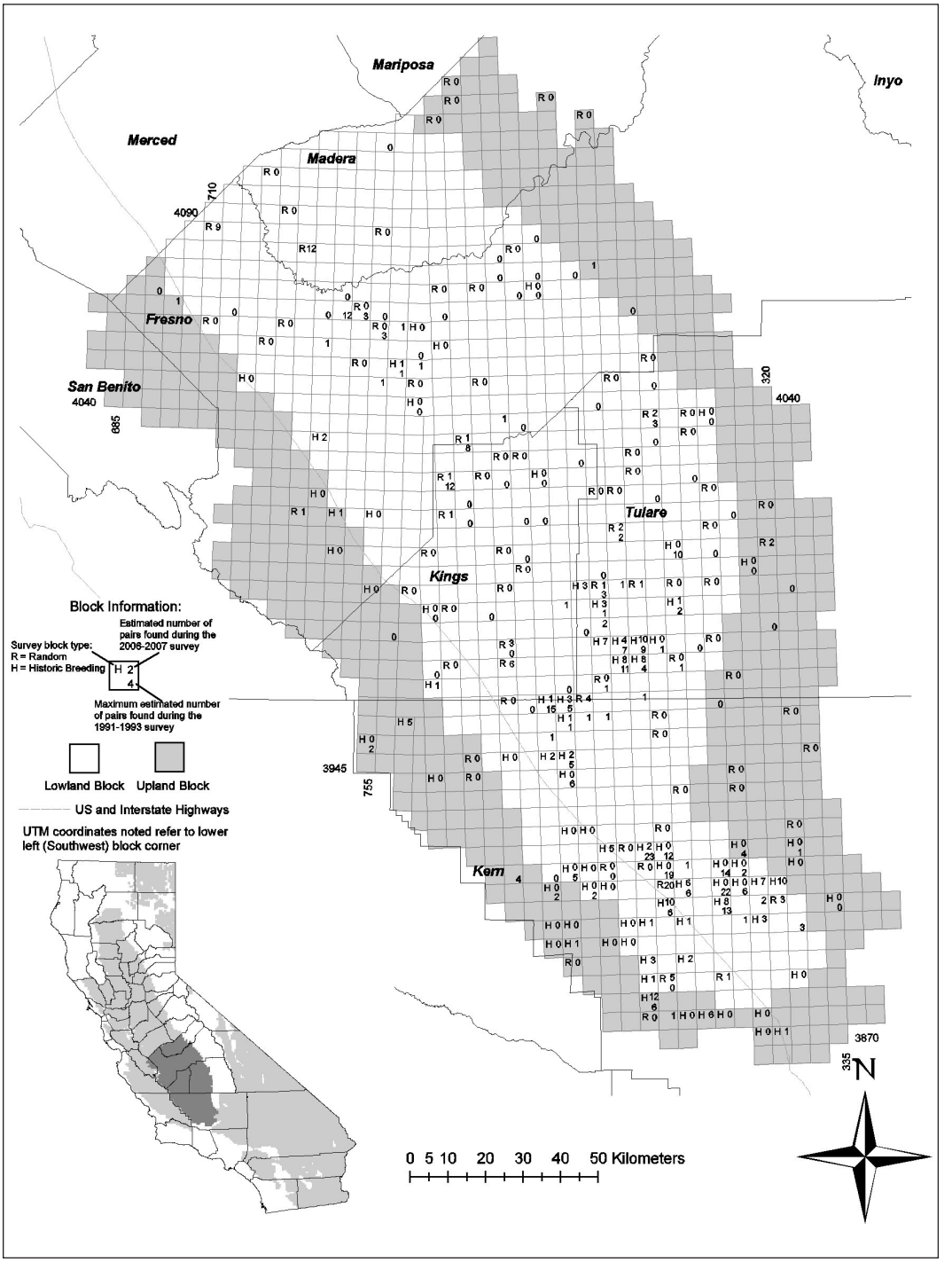

FIGURE 4. Results from the Southern Central Valley region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Southern Central Valley region are shown in the inset.

TABLE 4. Comparison of regional and statewide "best estimates" of population size from the 1991-1993 and 2006-2007 Burrowing Owl surveys.

	1991-1993 survey		2006-2007 survey			
Region	No. of pairs found	"Best estimate" of pairs in region[a]	No. of pairs found	"Best estimate" of pairs in region[a]	Change in estimated no. of pairs	Percent change in estimated no. of pairs
Northern Central Valley						
Lowland	18	231 (153)	12	12	-219	-94.8%
Upland	0	0	0	0	0	n/a
All	18	231 (153)	12	12	-219	-94.8%
Middle Central Valley						
Lowland	404	577 (112)	339	502 (209)	-75	-13.0%
Upland	1	17 (17)	43	43	+26	+152.9%
All	405	594 (129)	382	545	-49	-8.2%
Southern Central Valley						
Lowland	259	1,000 (410)	204	968 (342)	-32	-3.2%
Upland	19	396 (182)	32	145 (118)	-251	-63.4%
All	278	1,396 (592)	236	1,113 (460)	-283	-20.3%
San Francisco Bay Area Interior						
Lowland	154	154	98	98	-56	-36.4%
Upland	11	11	21	21	+10	+90.9%
All	165	165	119	119	-46	-27.9%
San Francisco Bay Area Coast[b]						
Lowland	0	0	0	0	0	n/a
Upland	0	0	0	0	0	n/a
All	0	0	0	0	0	n/a
Central-western Interior						
Lowland	7	7	8	8	+1	+14.3%
Upland	3	31 (27)	13	76 (51)	+45	+145.2%
All	10	38	21	84	+46	+121.1%
Central-western Coast[c]						
Lowland	8	8	0	0	-8	-100%
Upland	0	0	0	0	0	n/a
All	8	8	0	0	-8	-100%
Southwestern Coast[d]						
Lowland	8	36 (36)	16	16	-20	-55.6%
Upland	0	0	26	26	+26	n/a
All	8	36 (36)	42	42	+6	+16.7%
Southwestern Interior						
Lowland	12	100 (100)	37	37	-63	-63%
Upland	6	127 (81)	113	113	-14	-11.0%
All	18	227 (181)	150	150	-77	-33.9%
Coachella Valley						
Lowland	0	0	12	16 (16)	+16	n/a
Upland	0	0	37	37	+37	n/a
All	0	0	49	53	+53	n/a
Imperial Valley						
Lowland	1,041	6,429 (1,135)	499	5,701 (2,244)	-728	-11.3%
Upland	4	142	22	707 (140)	+565	+397.9%
All	1,045	6,571	521	6,408 (2,384)	-163	-2.5%
Modoc Plateau/Great Basin						
All	Not surveyed		0	0	n/a	n/a
Northern Mojave/Eastern Sierra Nevada[e]						
Lowland	Not surveyed		1	1	n/a	n/a
Upland	Not surveyed		0	0	n/a	n/a
All	Not surveyed		1	1	n/a	n/a

TABLE 4. Continued.

Region	1991-1993 survey: No. of pairs found	1991-1993 survey: "Best estimate" of pairs in region[a]	2006-2007 survey: No. of pairs found	2006-2007 survey: "Best estimate" of pairs in region[a]	Change in estimated no. of pairs	Percent change in estimated no. of pairs
Western Mojave Desert[e]						
Lowland	Not surveyed		94	560 (268)	n/a	n/a
Upland	Not surveyed		0	0	n/a	n/a
All	Not surveyed		94	560 (268)	n/a	n/a
Eastern Mojave Desert[e]						
Lowland	Not surveyed		1	32 (32)	n/a	n/a
Upland	Not surveyed		0	0	n/a	n/a
All	Not surveyed		1	32 (32)	n/a	n/a
Sonoran Desert[e]						
All	Not surveyed		179	179	n/a	n/a
Statewide, excluding "new" regions						
Number of pairs found	1,955		1,532		-423	-21.6%
Extrapolated no. of pairs		9,127 (1,243)		8,128 (2,391)	-999	-10.9%
"Best estimate" of no. of pairs		9,266		8,526	-740	-8.0%
Statewide, including "new" regions						
Number of pairs found			1,758			
Extrapolated no. of pairs				9,187 (2,346)		
"Best estimate"				9,298		

[a] Numbers in parenthesis indicate the standard error of the estimate. Estimates lacking a standard error indicate the actual count of breeding pairs detected in a subregion and are presented as the "best estimate" in cases where the count is higher than the region's calculated population estimate, which is based on randomly-selected blocks only and excludes data from historic breeding blocks that were not randomly selected

[b] The San Francisco Bay Area Coast region was not surveyed as part of this study in 2006-2007. Our "best estimate" of zero pairs in both the lowland and upland subregions is based on local knowledge (D. DeSante, *pers. comm.*) and information in Townsend and Lenihan (2007).

[c] The Central-western Coast region was not surveyed as part of this study in 2006-2007. Our "best estimate" of zero pairs in both the lowland and upland subregions is based on local knowledge (D. Roberson, *pers. comm.*).

[d] The Southwestern Coast region was not surveyed as part of this study in 2006-2007. Our "best estimates" of 16 pairs in the lowland subregion and 26 pairs in the upland subregion are based on information in Lincer and Bloom (2007) and Kidd et al. (2007).

[e] Reported in Wilkerson and Siegel (*in press*).

of Fresno, Tulare, and Kern counties.

In the 63 randomly-selected lowland blocks surveyed, we found 72 pairs of owls, yielding a random-sample based estimate of 968 ± 342 pairs. This estimate was greater than the total number of pairs found in the lowland subregion (72 pairs on randomly-selected blocks plus 132 pairs on historic breeding blocks), so it serves as our "best estimate" for the lowland subregion. In the 18 randomly-selected upland blocks surveyed, we found three pairs of owls, yielding a random-sample based estimate of 145 ± 118 pairs in the upland subregion. This estimate is greater than the total number of pairs found in the upland subregion (three pairs on randomly-selected blocks plus 32 pairs on historic breeding blocks), so it serves as our "best estimate" for the upland subregion. Summing our extrapolated estimates for the lowland and upland subregions, our estimate for the Southern Central Valley region is 1,113 ± 460 pairs (Table 3), 20.3 % fewer than the 1,396 pairs DeSante et al. (2007) estimated in the early 1990s (Table 4), but not a statistically significant difference ($F_{1,131}$ = 0419, P = 0.838).

Examining blocks that contained Burrowing Owls in the early 1990s and were resurveyed during 2006-2007 indicates two areas in the region where substantial, concentrated losses appear to have occurred: six blocks in western

Bakersfield lost a total of 53 breeding pairs, and further west, in agricultural land located west of Rosedale and south of Shafter, 42 fewer pairs were detected on three survey blocks (Fig. 5). Concentrated losses of Burrowing Owls on the western edge of Bakersfield occurred in blocks where substantial urban land conversion occurred between 1992 and 2001 (Multi-resolution Land Characteristics Consortium 2001).

SAN FRANCISCO BAY AREA INTERIOR

We surveyed 32 randomly-selected blocks and 58 historic breeding blocks in this region (Fig. 6). The relatively large proportion of historic breeding blocks reflects the excellent pre-survey information available about the region's Burrowing Owls. Surveys of random blocks yielded only a single pair, located on an upland block in northeastern Alameda County, north of Livermore. Pooling data from random and historic breeding blocks, we found 119 pairs.

All of the Burrowing Owls detected in the region were in Alameda or Santa Clara counties. During the 1990s survey small numbers of Burrowing Owl pairs were also detected in San Mateo County (one pair) and Sonoma County (two pairs), but our surveyors were unable to find owls in these or other locations throughout those counties.

In Alameda County, we detected no Burrowing Owls in the western, lowland portion adjacent to San Francisco Bay, where 34 pairs were found distributed across nine blocks in the early 1990s (Fig. 7). In contrast, we found 14 pairs of owls in the upland blocks of the eastern half of the county (compared with 11 pairs found in the early 1990s) along the Highway 580 corridor between Dublin and Livermore and in the Altamont Hills northeast of Livermore, an area where relatively large numbers of breeding Burrowing Owls have recently been observed (Barclay and Harman 2007). The richest area in Alameda County was the south-central lowland portion; we observed 25 pairs on a single block at Don Edwards San Francisco Bay National Wildlife Refuge. Two pairs were detected on the same block during the 1991-1993 survey. Nine additional pairs were distributed across two historic breeding blocks to the north of this area, apparently in urban park or industrial yard settings in the cities of Fremont and Newark.

In Santa Clara County, detections were restricted to the lowland area in the northwestern corner, as they were during the early 1990s. We detected 56 pairs on two blocks in San Jose and two blocks in Mountain View (Fig. 7), reduced from 97 pairs in the early 1990s.

We detected no pairs on randomly-selected lowland blocks anywhere in the San Francisco Bay Area Interior region, resulting in a zero population estimate for the lowland subregion. We detected 98 pairs on lowland historic breeding blocks, resulting in our "best estimate" of 98 pairs for the lowland subregion. On the 12 randomly-selected upland blocks surveyed, we found one owl pair, yielding a random-sample based estimate of 21 ± 21 pairs throughout the upland subregion. This estimate was greater than the total number of pairs we found on surveyed blocks in the upland subregion (one pair on randomly-selected blocks plus 13 pairs on historic breeding blocks), so it serves as our best estimate for owl pairs in the upland subregion. Summing our count from the lowland blocks and our estimate in the upland subregion, our "best estimate" for the number of Burrowing Owl pairs in the San Francisco Bay Area Interior region is 119. This estimate represents a nearly 28% reduction from the 165 pairs estimated from the 1991-1993 survey (Table 4). Like our estimate, the early 1990s estimate was also an actual count of all pairs found, rather than an extrapolated estimate based on randomly-selected blocks only, so the statistical significance of the apparent decline cannot be tested. However, because the region is very well known by the local birding community (which helped us identify historical breeding blocks), it seems unlikely that there could be more than a few pairs that went undetected during either survey.

SAN FRANCISCO AREA COAST

DeSante et al. (2007) were unable to find any Burrowing Owls in this region during the 1990s survey (Table 4). This relatively small region is well-monitored and well-known by the local birding community. We did not resurvey the region for the 2006-2007 study, as consultation with local experts as well as information in Townsend and Lenihan (2007) strongly indicates that the species remains extirpated from the region.

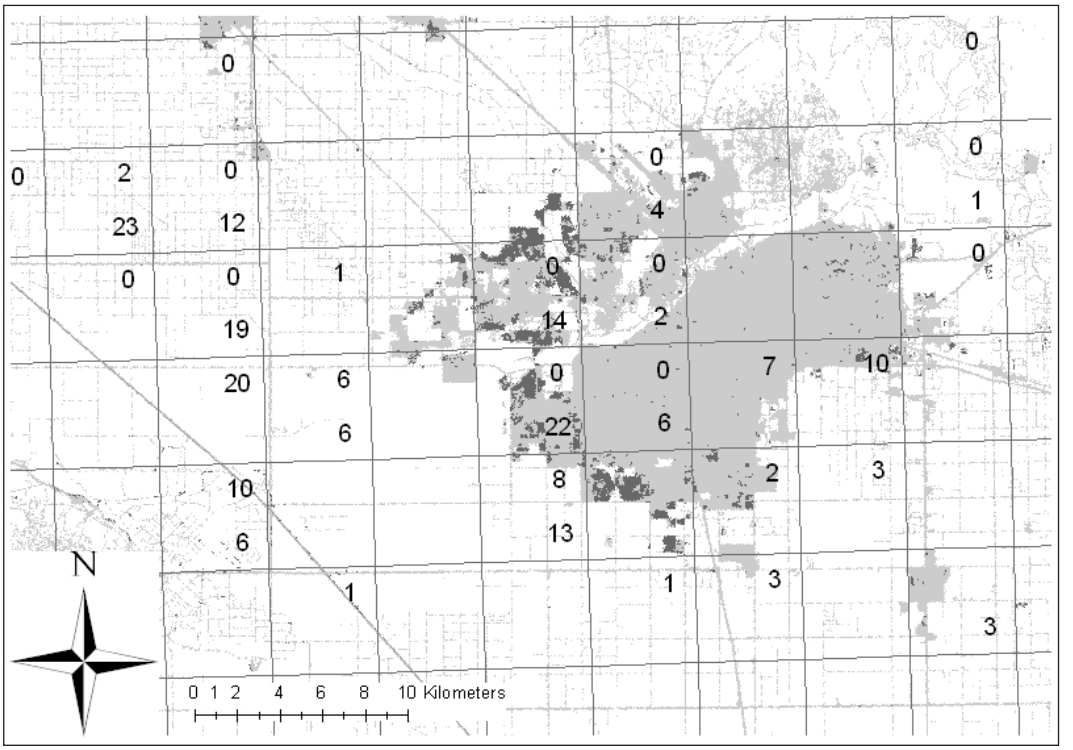

FIGURE 5. The number of Burrowing Owl pairs detected in the Bakersfield area during IBP's 1991-1993 survey (indicated in lower right corner of each block) and 2006-2007 survey (indicated in upper right corner of survey block). The large shaded area represents metropolitan Bakersfield; light gray shading indicates urban land cover as of 1992; dark gray shading indicates areas that were not mapped as urban in 1992, but were converted to urban use between 1992 and 2001 (Multi-resolution Land Characteristics Consortium 2001). Note the concentrated losses of Burrowing Owls in blocks on the western edge of Bakersfield, where substantial urban land conversion occurred between 1992 and 2001.

CENTRAL-WESTERN INTERIOR

We surveyed 30 randomly-selected blocks and 14 historic breeding blocks in this region (Fig. 8). Surveys of random blocks yielded just two Burrowing Owl pairs, both located on upland blocks of San Luis Obispo County. Pooling data from random and historic breeding blocks, we found 21 pairs in the region. Small clusters of owls were found in four areas: Bolsa Valley northwest of Hollister, San Benito County; low foothills of the Coast Range east of King City, Monterey County; northeast corner of San Luis Obispo County; and the Carrizo Plain, southeastern San Luis Obispo County (Fig. 8).

Since no Burrowing owls were detected on randomly-selected lowland blocks anywhere in this region, our random-sample based population estimate for the lowland subregion is zero pairs. However, we found 8 pairs on lowland historic breeding blocks, so our "best estimate" for the lowland subregion is the actual number of pairs we found: eight. On the 13 randomly-selected upland blocks we surveyed, we found two pairs, yielding a random-sample based estimate of 76 ± 51 pairs throughout the upland subregion. This estimate was greater than the total number of pairs we found in the upland subregion (two pairs on randomly-selected blocks plus 11 pairs on historic breeding blocks), so it serves as our best estimate for owl pairs in the upland subregion. Summing our count on the lowland blocks and our estimate in the upland subregion, our estimate for the Central-western Interior region is 84 pairs, a 121% increase from the estimate of 38 pairs during the 1991-1993 survey (Table 4).

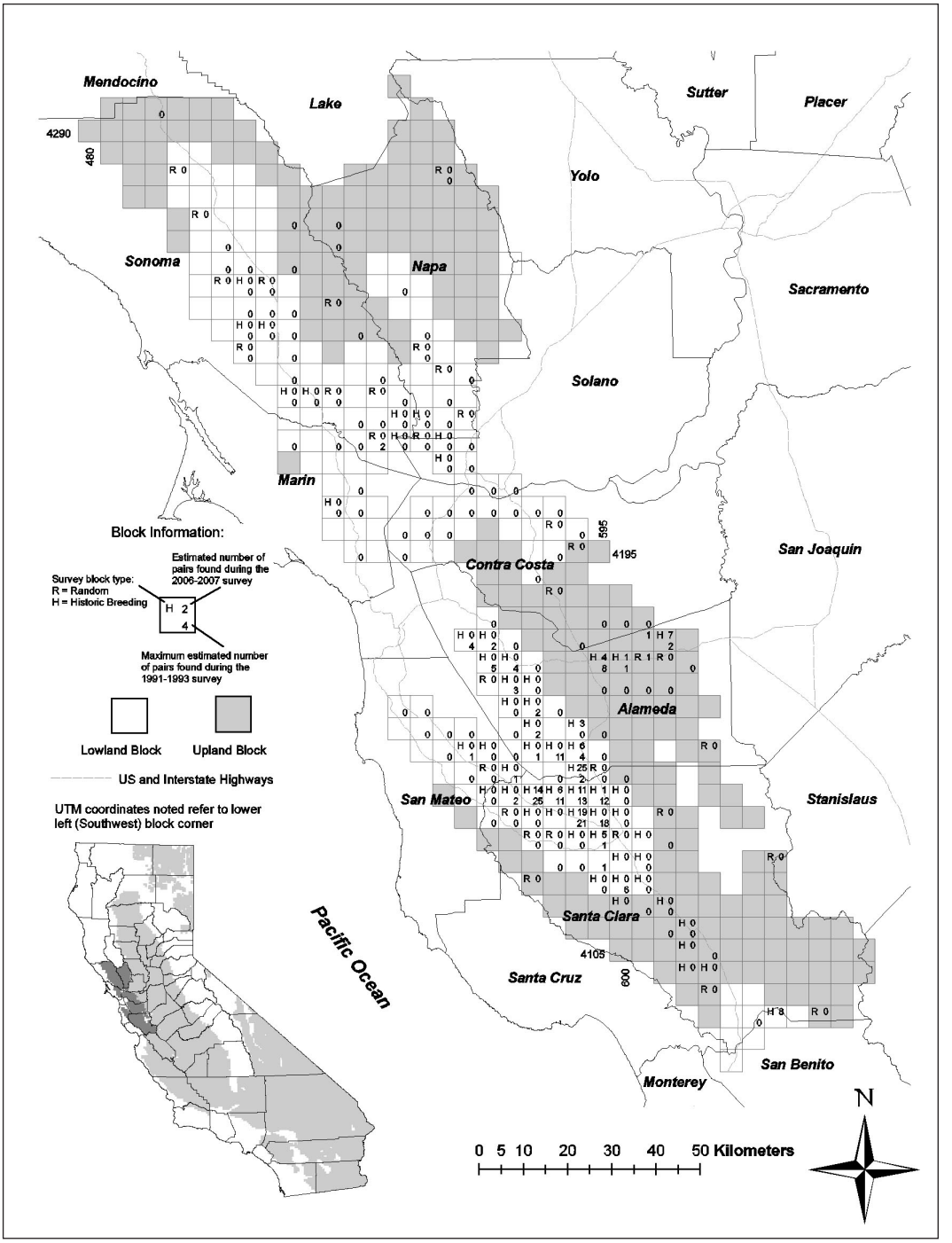

FIGURE 6. Results from the San Francisco Bay Area Interior region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the San Francisco Bay Area Interior region are shown in the inset.

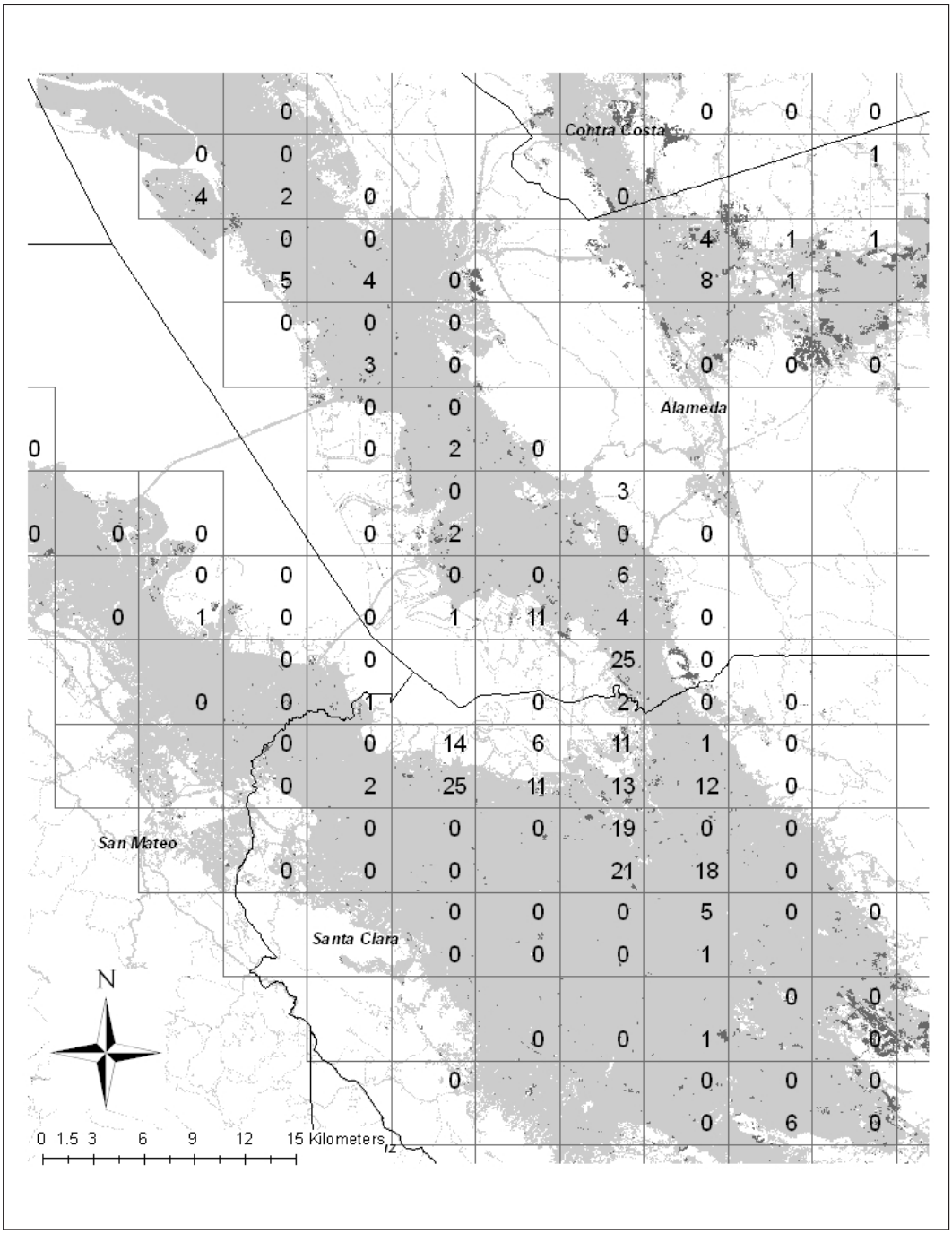

FIGURE 7. The number of Burrowing Owl pairs detected on survey blocks in the southern and eastern San Francisco Bay Area during IBP's 1991-1993 survey (indicated in lower right corner of each block) and 2006-2007 survey (indicated in upper right corner of survey block). Light gray shading indicates urban land cover as of 1992; dark gray shading indicates areas that were not mapped as urban in 1992, but were converted to urban use between 1992 and 2001 (Multi-resolution Land Characteristics Consortium 2001).

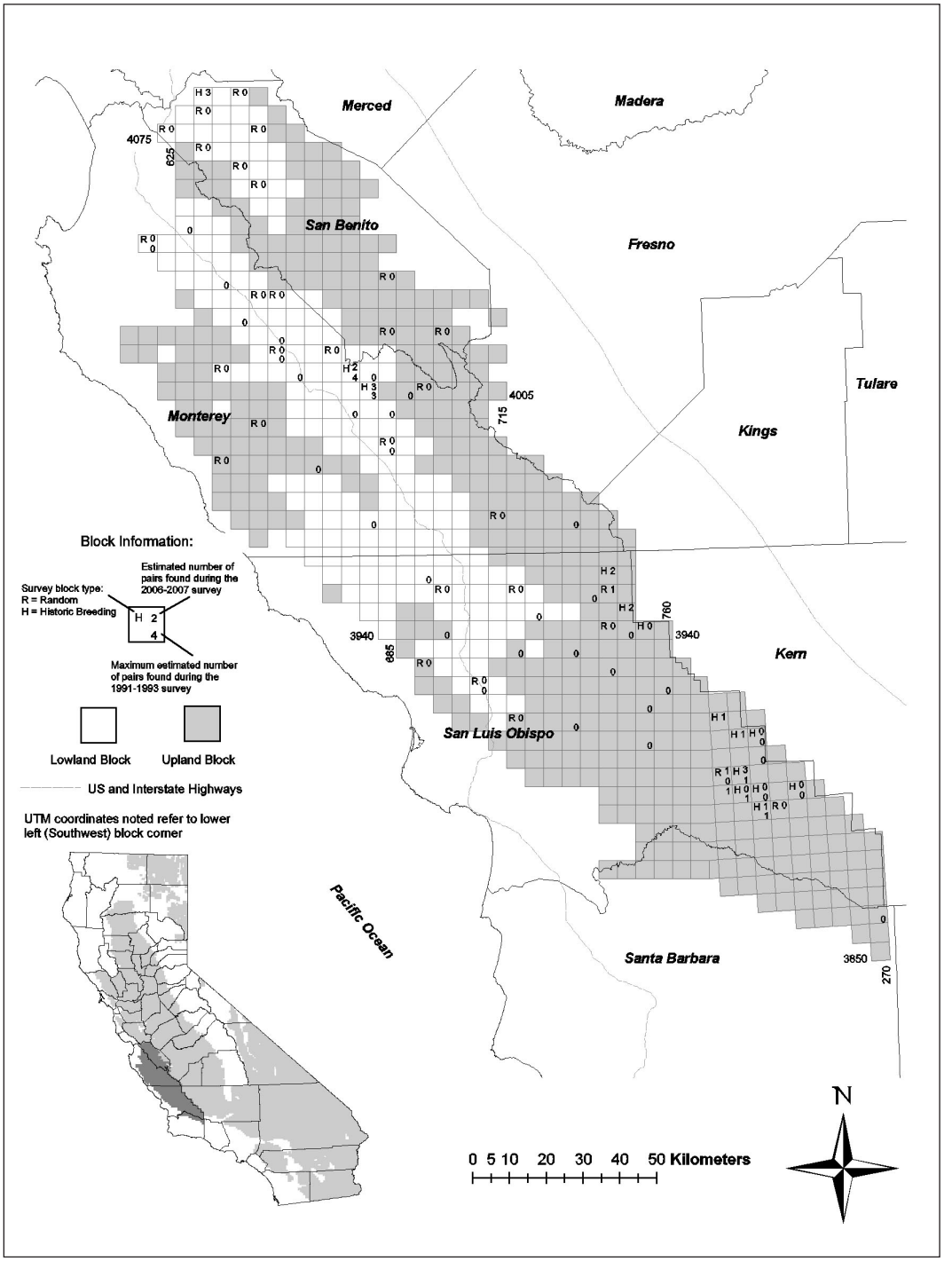

FIGURE 8. Results from the Central-western Interior region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Central-western Interior region are shown in the inset

CENTRAL-WESTERN COAST

This is one of the three coastal regions we did not survey during 2006-2007. In the 1991-1993 survey, eight pairs of Burrowing Owls were detected in the region; seven pairs were near Salinas, Monterey County, and a single pair was in northern Santa Barbara County (DeSante et al. 2007). The Salinas owls were distributed between two areas; five pairs were at the Salinas Airport and two pairs were near the town of Boronda. Visits to both of those sites by local birders in the last decade have yielded no detections, and foraging habitat adjacent to the airport colony has been developed (D. Roberson, *pers. comm*.). The single pair from northern Santa Barbara County was present in 1992, but could not be relocated when the same survey block was revisited in 1993 (DeSante et al. 2007). Consequently Burrowing Owls are likely extirpated from the region (Table 4).

SOUTHWESTERN COAST

Because the few breeding owls present in this region are already well monitored, we did not survey the region. Kidd et al. (2007) determined that Burrowing Owl populations in western Santa Barbara, Ventura, and Los Angeles counties had been extirpated; however, they documented three breeding pairs in Orange County as recently as 2005. In a thorough assessment of the species' status in San Diego County, Lincer and Bloom (2007) determined there were between 41 and 46 pairs present; all but two were within our region boundaries, allowing for a count of between 39 and 44 pairs. The lower count of 39 plus the three pairs from Orange County yields an estimate of 42 pairs for the Southwestern Coast region (Table 4). The 1991-1993 "best estimate" for this region was 36 pairs, although only eight pairs were actually detected (DeSante et al. 2007). The apparent increase could be from the more thorough coverage provided by Lincer and Bloom (2007) or a slight but real increase in the region's owl population.

SOUTHWESTERN INTERIOR

We surveyed 11 randomly-selected blocks and 57 historic breeding blocks in this interior region (Fig. 9). The relatively large proportion of historic breeding blocks reflects the excellent pre-survey information we received from a UC Riverside graduate student studying the local Burrowing Owl population (Ginny Short, *pers. comm*.). Our surveys of random blocks yielded only a single pair, located in a lowland block at Ontario International Airport, San Bernardino County. However, we found 149 pairs utilizing diverse habitats on historic breeding blocks, yielding a total of 150 pairs of owls detected in the region.

The one pair of owls found on the three randomly-selected lowland blocks yielded a random-sample based estimate of 17 ±17 pairs throughout the lowland subregion. Since this estimate was lower than the total number of pairs found in the lowland subregion (pooling data detections from random and historic breeding blocks) our "best estimate" for the number of owl pairs in the lowland subregion is the actual number of pairs counted: 37. Since no Burrowing Owls were detected on any of the eight randomly-selected upland blocks, our random-sample based estimate for the upland subregion is zero pairs. However, we found 113 pairs on upland historic breeding blocks, so our best estimate for the upland subregion is the actual number of pairs found: 113. Summing our counts from lowland and upland blocks, our estimate for the Southwestern Interior region is 150 pairs, 33.9% fewer than were estimated to be present during the 1991-1993 survey (Table 4). We note, however, that the 1990s estimate was extrapolated from surveys of random blocks while our estimate is our actual count of all owls on random and historic breeding blocks, and was based on more extensive pre-survey information. Thus, comparing these "best estimates" may be somewhat problematic.

COACHELLA VALLEY

We surveyed eight randomly-selected blocks and 12 historic breeding blocks in this region (Fig. 10). Surveys of random blocks yielded just one pair of Burrowing Owls, while surveys of historic breeding blocks yielded 48 pairs, for a total of 49 pairs detected in the region. The highest densities of detections were clustered at the northern end of the region around the town of Desert Hot Springs and south to Interstate 10. Smaller numbers of owls (1-4 pairs per block) were detected along the Interstate 10 corridor as far south as the town of Mecca. A single pair was located on a randomly-selected block along

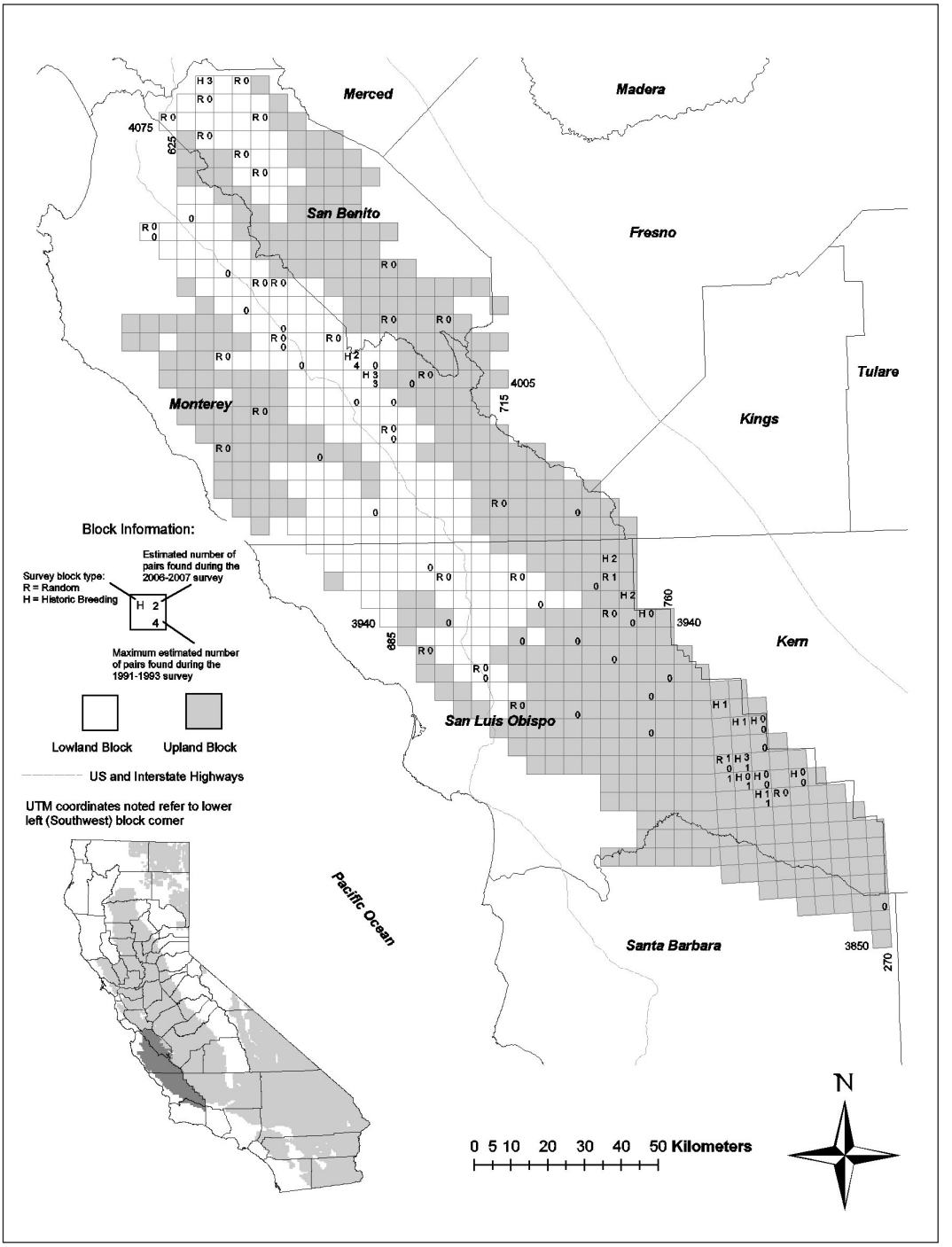

FIGURE 9. Results from the Southwestern Interior region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Southwestern Interior region are shown in the inset.

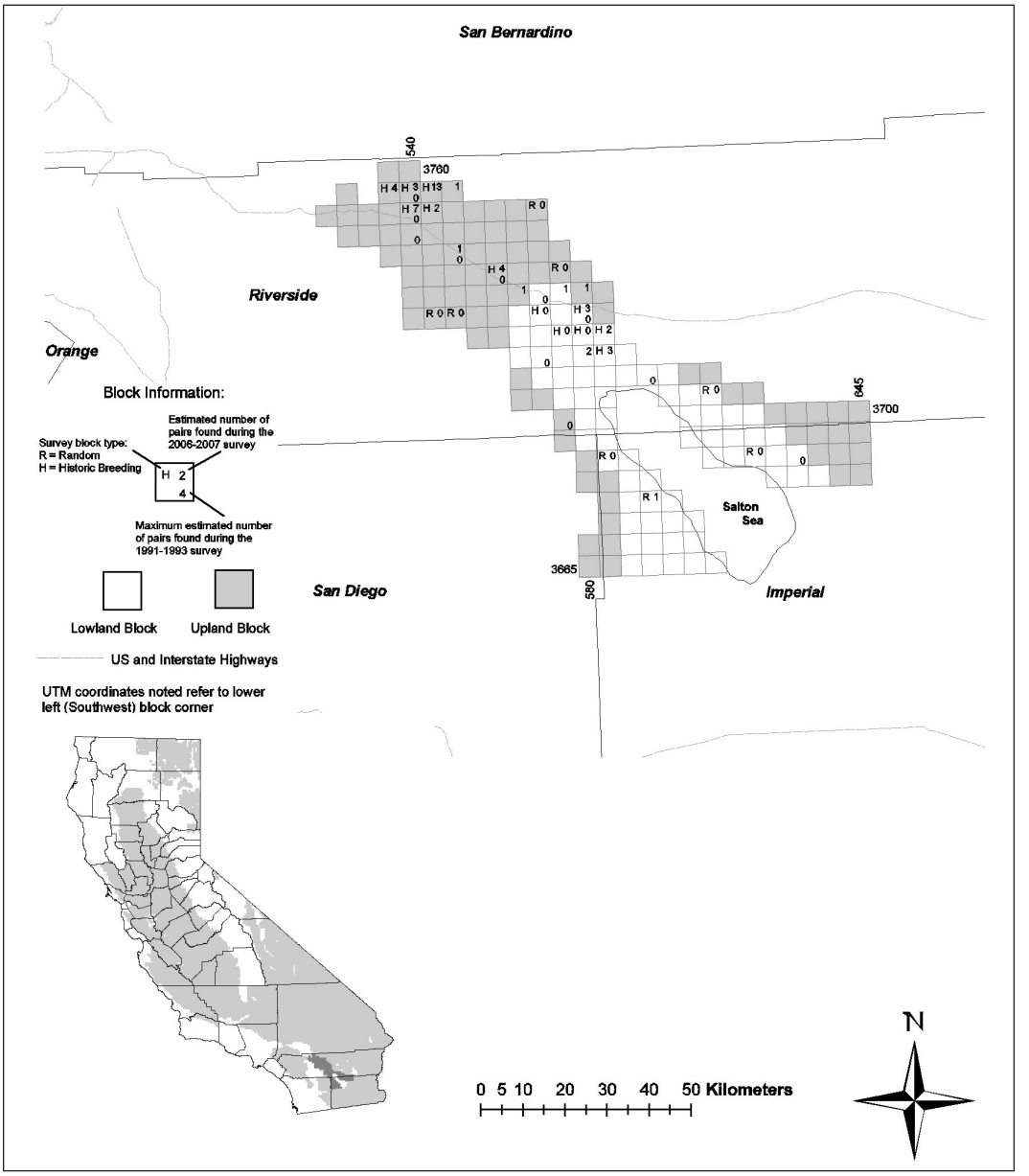

FIGURE 10. Results from the Coachella Valley region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Coachella Valley region are shown in the inset.

the west side of the Salton Sea, at the southern end of Salton City.

In the four randomly-selected lowland blocks surveyed, we found one pair of owls, yielding a random-sample based estimate of 16 ± 16 pairs throughout the lowland subregion. This estimate was slightly greater than the total number of pairs found in the lowland subregion (one pair on randomly-selected blocks plus 11 pairs on historic breeding blocks), so it serves as

our "best estimate" for owl pairs in the lowland subregion. No Burrowing Owls were detected on the four randomly-selected upland blocks, so our random-sample based population estimate for the upland subregion is zero pairs. However, we found 37 pairs on upland historic breeding blocks, so our "best estimate" for the upland subregion is the actual number of pairs we found: 37. Summing our estimate from the lowland subregion and our count on the upland blocks surveyed, our estimate for the Coachella Valley region is 53 pairs, a remarkable change from the 1991-1993 estimate of zero pairs (Table 4). Four historic breeding blocks (two upland blocks at the northern end of the region plus an additional upland and lowland block further south), in which we found multiple pairs, were also surveyed in the early 1990s (then also selected as random blocks), when no owls were detected. These results suggest the blocks may have been colonized since the 1991-1993 survey.

IMPERIAL VALLEY

We surveyed seven randomly-selected blocks and eight historic breeding blocks in this region (Fig. 11). Surveys of random blocks yielded 271 Burrowing Owl pairs, and surveys of historic breeding blocks yielded 250 pairs, for a total of 521 pairs detected.

In the five randomly-selected lowland blocks surveyed, we found 254 pairs, yielding a random-sample based estimate of 5,701 ± 2,244 pairs throughout the lowland subregion. This estimate was greater than the total number of pairs found in the lowland subregion (254 pairs on randomly-selected blocks plus 245 pairs on historic breeding blocks), so it serves as our "best estimate" for pairs in the lowland subregion. In the two randomly-selected upland blocks surveyed, we found 17 pairs of owls, yielding a random-sample based estimate of 707 ± 140 pairs throughout the upland subregion. This estimate was greater than the number of pairs we found in the upland subregion (17 pairs in randomly-selected blocks plus five pairs in historic breeding blocks), so it serves as our "best estimate" in the upland subregion. Summing our estimates for the lowland and upland subregions, our estimate for the Imperial Valley region is 6,408 ± 2,384 pairs, 2.5% fewer than the 6,571 pairs estimated during the 1991-1993 survey (Table 4), a statistically insignificant decline ($F_{1,12} = 0.3163$, $P = 0.584$).

MODOC PLATEAU/GREAT BASIN

We surveyed 13 randomly-selected blocks, and two historic breeding blocks in this region (Fig. 12). All blocks surveyed were classified as upland blocks, because the entire bioregion lies well above the upper bound of the lower elevation zones for all of our other survey regions.

We detected no Burrowing Owls on random blocks or historic breeding blocks, so our "best estimate" for the number of pairs in the region is zero pairs. Subsequent to our survey, breeding has been observed in Sierra Valley as recently as 2009 (Richard Carlson, *pers. comm.*), although information is lacking to determine whether this breeding location was active during 2006-2007 when we conducted our field work.

NORTHERN MOJAVE DESERT/EASTERN SIERRA NEVADA

We surveyed 36 randomly-selected blocks and two historic breeding blocks in this region; none of them yielded Burrowing Owl detections. However, one pair was detected incidentally on an otherwise unsurveyed block (see Wilkerson and Siegel, *in press*, for additional details).

WESTERN MOJAVE DESERT

We surveyed 48 randomly-selected blocks and 19 historic breeding blocks in this region. Our "best estimate", based on 25 pairs of owls detected on 42 pairs of owls detected on the random blocks, is 560 ± 268 pairs (see Wilkerson and Siegel, *in press*, for additional details).

EASTERN MOJAVE DESERT

We surveyed 43 randomly-selected blocks and two historic breeding blocks in the Eastern Mojave Desert region. Our "best estimate" for the region, based on one pair of owls detected on the randomly-selected blocks, is 32 ± 32 pairs (see Wilkerson and Siegel, *in press*, for additional details).

SONORAN DESERT

We surveyed 31 randomly-selected blocks, and 16 historic breeding blocks in the Sonoran Desert region. Our "best estimate" for the region, based on 179 pairs of owls detected

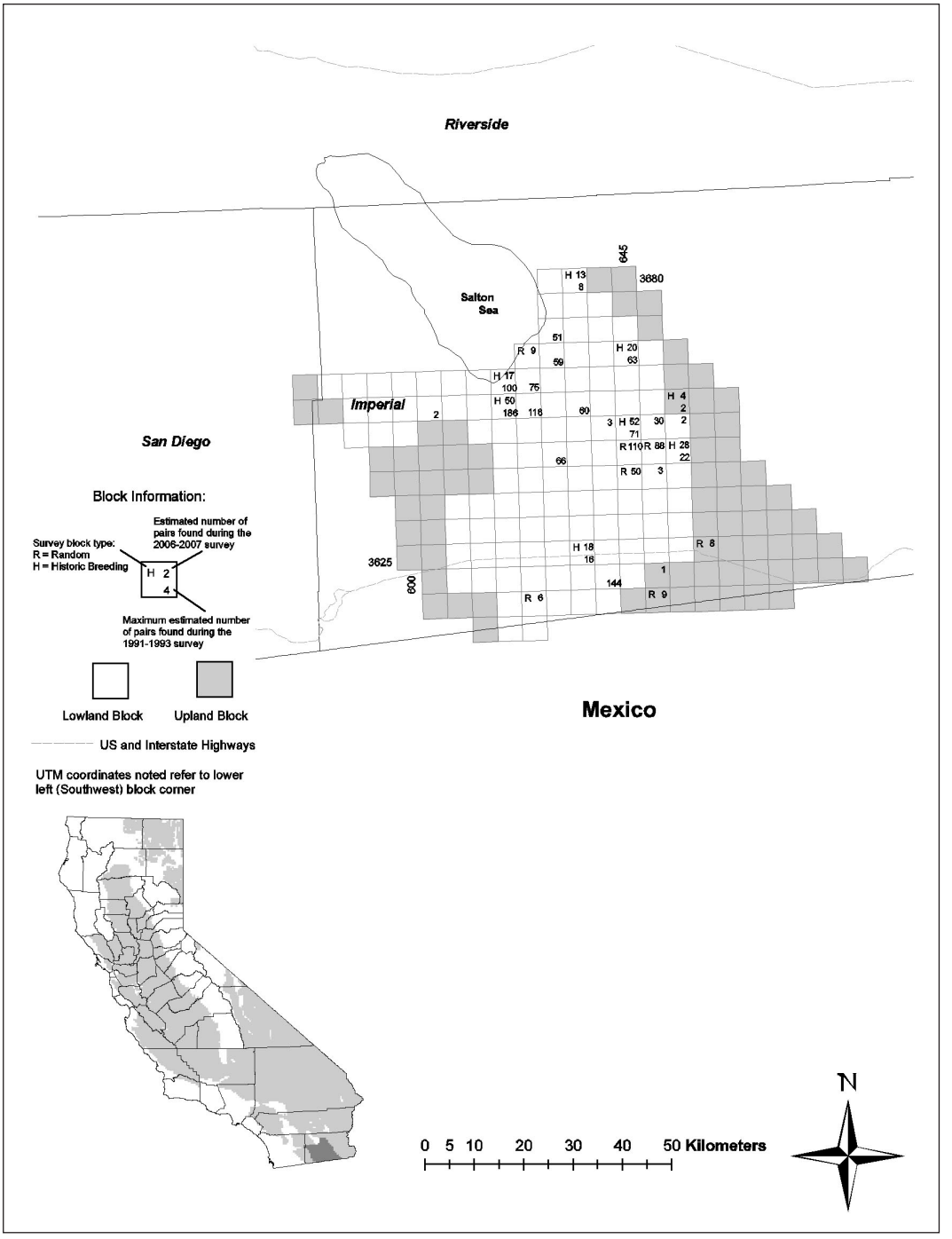

FIGURE 11. Results from the Imperial Valley region, including numbers of Burrowing Owl pairs detected during 1991-1993 and 2006-2007. Shown are all 5-km x 5-km lowland blocks (white) and upland blocks (gray) assigned to the region. The entire 2006-2007 survey area and the location of the Imperial Valley region are shown in the inset.

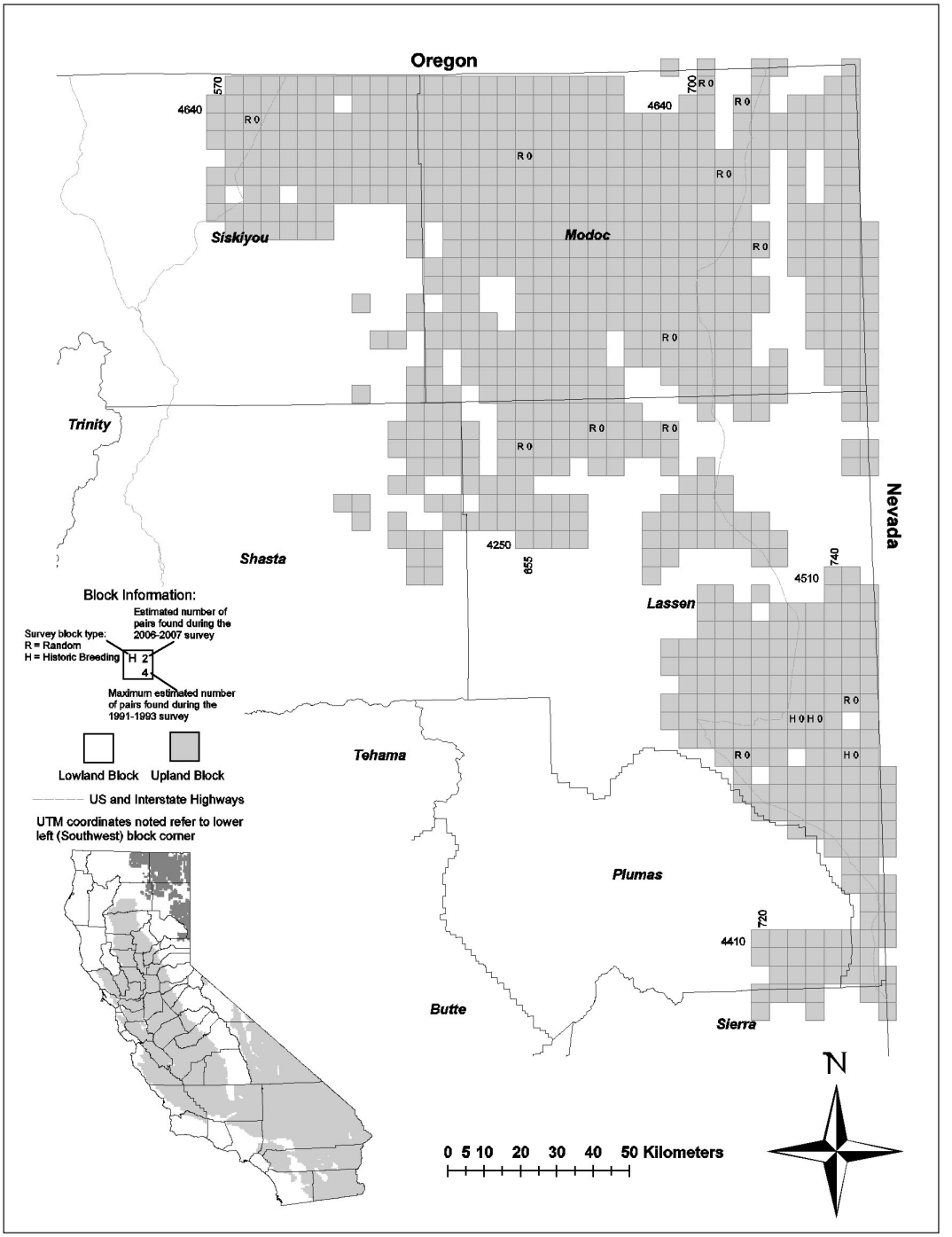

FIGURE 12. Results from the Modoc Plateau/Great Basin region of the 2006-2007 California Burrowing Owl survey. Shown are all 5-km x 5-km assigned to the region; in the case of this region, all blocks were classified as upland. The entire 2006-2007 survey area and the location of the Modoc Plateau/Great Basin region are shown in the inset.

exclusively within the Palo Verde Valley, and no owls detected elsewhere in the region, is our actual pair count in the Palo Verde Valley: 179 pairs (see Wilkerson and Siegel, *in press*, for additional details).

AGGREGATED STATEWIDE RESULTS

Aggregating results across all 2006-2007 survey regions yields a "best estimate" of 9,298 pairs of Burrowing Owls (Table 4). The population is highly concentrated in the Imperial Valley (68.9% of the California population) and to a lesser extent, the Southern Central Valley (12.0% of the statewide population) (Fig. 13). DeSante et al. (2007) reported very similar proportions of the estimated statewide population in 1991-1993 in these two regions.

Omitting the "new" survey regions (Modoc Plateau/Great Basin , Northern Mojave/Eastern Sierra Nevada, Western Mojave, Eastern Mojave, and Sonoran Desert), the aggregated "best estimate" for all regions that were previously surveyed in 1991-1993 is 8,526 pairs, 8% lower than the corresponding estimate generated from 1991-1993 (Table 4). Much of the apparent decline appears to be concentrated in two regions: the Northern Central Valley (231 pairs in 1991-1993 to 12 pairs in 2006-2007), and the Southern Central Valley (1,396 pairs in 1991-1993 to 1,113 pairs in 2006-2007). Other regions with reduced "best estimates" between 1991-1993 and 2006-2007 include the Middle Central Valley (-49 pairs), San Francisco Bay Interior (-46 pairs), Southwestern Interior (-77 pairs), and the Imperial Valley (-163 pairs, but the relatively high absolute numbers make this unlikely to be a meaningful change). In contrast to the overall pattern of declines, our 2006-2007 "best estimates" were higher than the corresponding 1991-1993 estimates for three regions: Central-western Interior (+46 pairs), Southwestern Coast (+6 pairs), and Coachella Valley (+53 pairs).

Because the statewide "best estimate" of the number of pairs is an aggregate of regional extrapolated population estimates and regional minimum counts there is no way to test the statistical significance of the apparent decline between 1991-1993 and 2006-2007. However, we can test for statistically significant change in our population estimates extrapolated only from surveys of randomly-selected blocks. DeSante et al. (2007) provided an extrapolated estimate of 9,127 ± 1,243 pairs for their entire study area; our 2006-2007 estimate extrapolated from randomly-selected blocks across the same survey regions is 8,128 ± 2,391 pairs (Table 4), a non-significant ($F_{1,710} = 0.0533$, $P = 0.817$) reduction of 10.9%.

Including the "new" survey regions, our 2006-2007 estimate extrapolated from randomly-selected blocks is 9,187 ± 2,346 pairs (Table 4). Our "best estimate" for the same comprehensive area is a very similar 9,298 pairs (Table 4).

LAND OWNERSHIP AND HABITATS.

Similar to the findings reported by DeSante et al. (2007), we found that the vast majority of California's breeding Burrowing Owls occur on private lands (Table 5). Small numbers were also found on lands managed by four federal agencies, California state government, and local municipalities (Table 5).

The Burrowing Owls detected during our survey occupied a wide range of habitats, including natural grasslands, agricultural lands, and other human-modified areas (Table 6). Nearly one third of breeding sites were located on the banks of irrigation canals or other concrete or earthen water conveyance structures (Table 6).

DeSante et al. (2007) reported a strong association between Burrowing Owl breeding sites and the presence of ground squirrels. Our results corroborated this finding, but also revealed that association to be far weaker for owls nesting along irrigation canals and other water conveyance structures (Table 6). This weaker association presumably stems from owls not having to depend on ground squirrels for burrow excavation along canal banks, where earthen banks may be particularly easy to excavate, and concrete-lined banks often provide attractive nesting spaces between the concrete lining and the underlying soil.

OWL PERSISTENCE ON SURVEY BLOCKS OCCUPIED DURING THE 1991-1993 SURVEY

Considering blocks surveyed during both 1991-1993 and 2006-2007, in which owls were detected during the first (1991-1993) survey ($N = 149$), we found that abundance significantly declined (mean difference = -2.68 ± 0.50; $t = -5.37$; df = 148; $P < 0.0001$). The probability of detecting

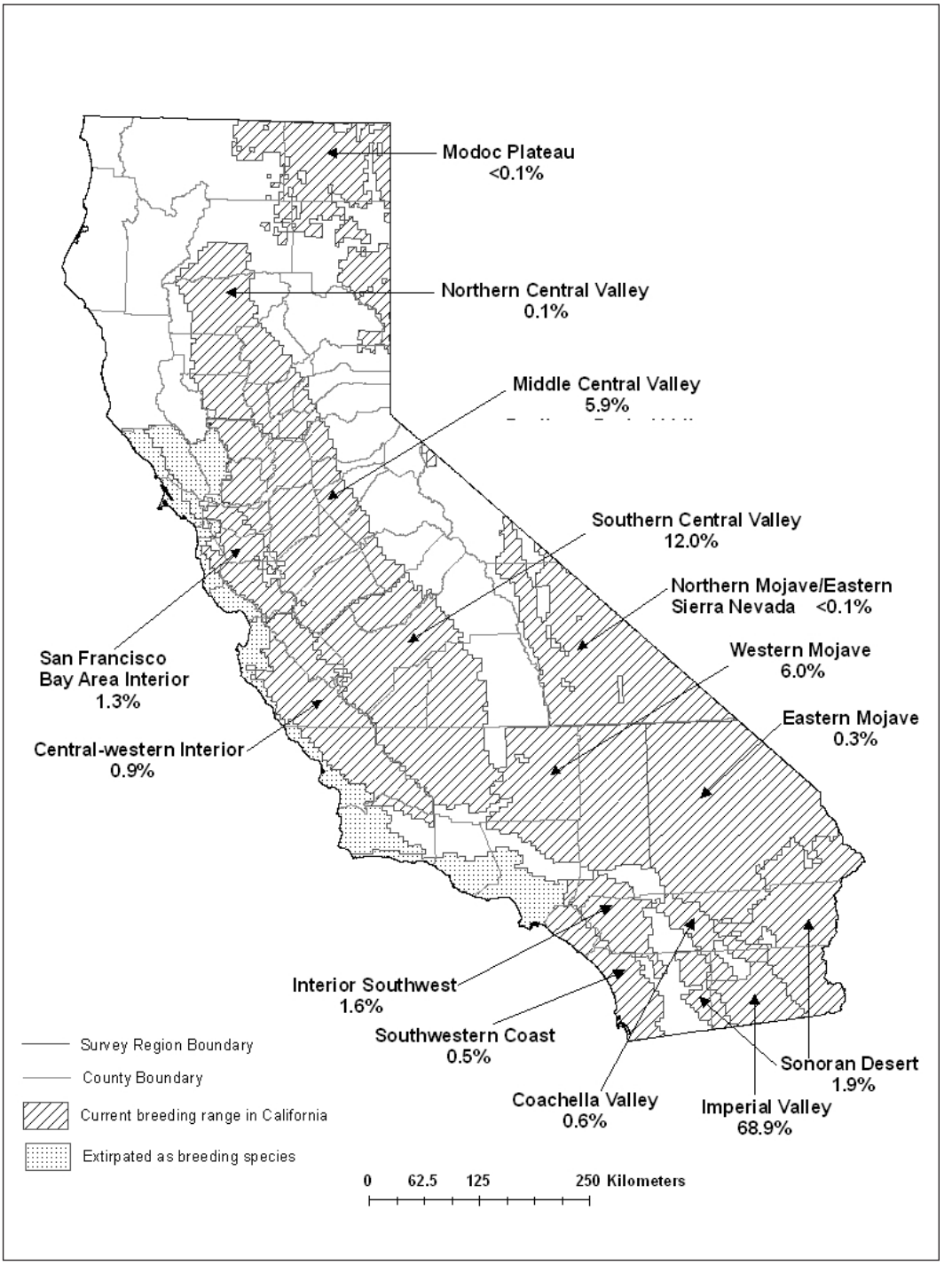

FIGURE 13. Current and former breeding range of Burrowing Owl in California, and percent of the 2006-2007 statewide breeding population estimated to occur in each region based on "best' estimates" (see Methods for explanation of "best" estimates) during the 2006-2007 survey.

TABLE 5. Number and percent of owl pairs detected during the 2006 and 2007 statewide Burrowing Owl survey, classified by land ownership or jurisdiction.

Land ownership or jurisdiction	Number of Burrowing Owl pairs detected	
	Randomly-selected blocks only	Randomly-selected blocks and historic breeding blocks
Private	415 (96.7%)	1,592 (90.6%)
Federal		
Bureau of Land Management	2 (0.5%)	18 (1.0%)
Department of Defense	12 (2.7%)	50 (2.8%)
NASA	0	11 (0.6%)
National Wildlife Refuge System	0	38 (2.2%)
Local government	0	26 (1.5%)
State government	0	22 (1.3%)
Tribal	0	1 (0.1%)
Total	429	1,758

TABLE 6. Primary habitats indicated by field observers at sites where Burrowing Owl pairs were found, and prevalence of ground squirrels at those sites.

Primary habitat	No. of breeding sites[a]	No. of sites where ground squirrel presence was assessed	Percentage of assessed sites with ground squirrels present
Irrigation canal[b]	383	285	19
Natural grassland	211	211	92
Idle or fallow field	121	103	76
Field crop	114	10	60
Pasture	100	100	87
Brushland	75	75	67
Airport	45	45	91
Golf course	30	30	100
Levee	27	26	92
Railroad	26	26	85
Grain or hayfield	25	21	57
Row crop	14	6	43
Other	116	107	48
Total	1,287	1,045	64

[a]In many cases breeding sites encompassed multiple Burrowing Owl pairs.
[b]Here the term "irrigation canal" is used broadly to indicate any man-made concrete or earthen water conveyance structure.

owls on those blocks during the 2006-2007 survey increased as a function of the number of owls detected during the 1991-1993 survey (Fig. 14; $\chi^2_1 = 12.41$; $P = 0.0004$). For example, the predicted probability of detecting owls during the 2006-2007 survey in blocks where just one pair was detected during the 1991-1993 survey was about 0.36, compared to 0.93 in blocks where 25 pairs of owls were detected during the 1991-1993 survey.

DISCUSSION

Our survey method likely contains some systematic sources of error. As DeSante et al. (2007) pointed out, the inability of observers to

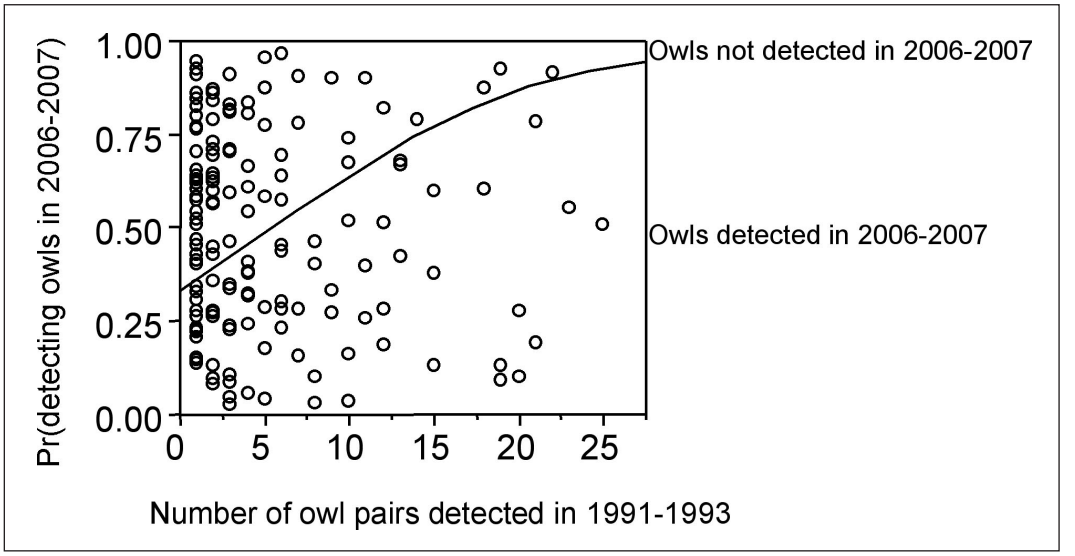

FIGURE 14. Probability of detecting owls during the 2006-2007 survey in blocks where owls were detected in 1991-1993 as a function of the number of owl pairs detected on the block in 1991-1993. The predicted probability of detection in 2006-2007 is shown by the curve. Data points below the curve are blocks on which owls were detected during both surveys; data points above the curve represent blocks where owls were detected in 1991-1993 but not detected in 2006-2007. Data points are plotted at their 1991-1993 owl pair (x-axis) values and randomly jittered in the probability (y-axis) space (below or above the curve, depending on whether owls were present in 2006-2007) to show the distribution of the data.

reliably detect all owls in sampled areas (Conway and Simon 2003, Conway et al. 2008), particularly in areas with limited or no road access may tend to bias our estimates low. Additionally, observers generally assumed that whenever they detected a single adult Burrowing Owl, it represented a breeding pair. To the extent that unmated adult birds may have been detected, this could result in an upward bias in our estimate of breeding pairs. Another potentially confounding factor was that surveyors were unable to gain access to some military installations and private landholdings; if such areas were more or less likely to be occupied by owls than other areas, bias in one direction or the other could have been introduced into our estimates. Finally, our survey methodology incorporated no means for assessing detection probability, which in some environments (such as desert areas with very low road density) may have been quite low. Perhaps of even greater concern than detection probability being low is that it could have varied substantially across survey blocks or survey regions with different physiographic characteristics.

Nevertheless, we believe the sheer volume of data collected counterbalances some of the methodological limitations described above, and ensures that the broader patterns in distribution and abundance are meaningful. Additionally, because our methods adhered to those established by DeSante et al. (2007), any biases affecting our results likely affected the 1991-1993 study, too, so that comparisons between the two surveys are appropriate. Finally, our survey documented the exact locations of 1,758 Burrowing Owl pairs (18.9% of the estimated total) across California, information that should be of great use for ongoing and future conservation efforts.

The generally large variances associated with our regional and statewide population estimates extrapolated from randomly-selected blocks indicate that our statistical power to detect changes in abundance was rather weak. Indeed, the Northern Central Valley was the only region for which our 2006-2007 population estimate differed significantly from the 1991-1993 estimate of DeSante et al. (2007). Moreover, many of

our regional "best estimates" were not obtained by extrapolating data from the randomly-selected blocks, but rather by simply counting all of the owl pairs that could be found in either randomly-selected or historical breeding blocks. We had no means for assessing statistical significance of such estimates from the corresponding 1991-1993 "best estimates", many of which were generated in the same manner. Nevertheless, inspection of our results, and qualitative comparisons with results from the 1991-1993 survey, still yield some important conclusions.

The major patterns in Burrowing Owl distribution and abundance across California described by DeSante et al. (2007) have not changed dramatically since 1991-1993, when the species was already extirpated or nearly extirpated from the San Francisco Bay Area Coast, Central-western Coast, and Southwestern Coast regions. The Imperial Valley still accounts for slightly more than two-thirds of the estimated statewide population, and the Southern Central Valley remains the second largest Burrowing Owl population center. Populations in other regions of the state that were surveyed in 1991-1933 all remain much smaller than those in the two most heavily populated regions.

While not statistically significant, we observed apparent declines in two urban areas: San Francisco Bay Area Interior Region and the Bakersfield area in the Southern Central Valley region. The San Francisco Bay Area Interior region's breeding owl population is both small and well-known by local birders and researchers, making it very likely that the "best estimates" from both the 1991-1993 and 2006-2007 surveys reflect very nearly all the owl pairs actually present. Consequently, the apparent loss of 27.9% of the population, from 165 to 119 pairs since the early 1990s survey, is somewhat alarming. This loss includes the last known pairs of owls in both Sonoma and San Mateo counties, and suggests that Burrowing Owls have now been extirpated as a breeding species in the entire San Francisco Bay Area, except for Alameda and Santa Clara counties, where populations have also declined. It should be noted that Burrowing Owl populations can fluctuate annually, so our lower count of owls in the region does not necessarily indicate a deterministic decline. However, the increasingly restricted distribution of the species throughout the region would seem to indicate that such a trend is real.

In the greater Bakersfield area, heavy losses (nine blocks lost a total of 96 pairs) appear to be associated with recent land conversion from agriculture to urban, though a finer resolution spatial assessment would be helpful to determine whether such land conversion really has driven the losses. In any case, it seems that like the San Francisco Bay Area, the greater Bakersfield area is in danger of losing most if not all of its once substantial Burrowing Owl population. This is particularly unfortunate because the species exhibits a remarkable degree of tolerance for human alteration of natural habitats (Klute et al. 2003, Chipman et al. 2008), often nesting within landfills, golf courses, airports, and vacant lots within urban areas (Haug et al. 1993, Trulio 1997). This tolerance of humans and their activities would seem to provide ample opportunity for successful conservation efforts, even in the context of urban areas with growing human populations. One result, showing that the likelihood of Burrowing Owls persisting through 2006-2007 on survey blocks where they were present in 1991-1993 was strongly and positively related to the number of owls that were present on the blocks in 1991-1993, underscores the precariousness of dwindling urban-area populations, and the need for rapid action to prevent local extirpation.

In contrast to areas where we noted declines, we also noted areas where Burrowing Owls may have increased since the 1991-1993 survey: the Central-Western Interior region and the Coachella Valley. However, we surveyed a much greater number of upland blocks in contrast to the earlier survey in the Central-Western Interior region, so the apparent increase could be an artifact due to increased surveys effort. In contrast, the apparent increase (from zero to 53 owl pairs) in the Coachella Valley seems more likely to indicate a real increase in owl presence, especially because we found multiple Burrowing Owl pairs on four blocks in the region that were also surveyed in the early 1990s, but yielded no detections at that time. Interestingly, none of the pairs we found in Coachella Valley appeared to be associated with agriculture or water conveyance structures;

rather they occupied a variety of relatively arid habitats including brushland, desert scrub, and natural grasslands, and appear to be clustered on the outskirts of urban development.

Large confidence intervals make comparing our statewide population estimate with that of DeSante et al. (2007) during 1991-1993 difficult, especially since the difference in the estimates is relatively small. Three quarters of owl pairs in our aggregated population estimate reside in the densely occupied Imperial Valley, where the standard error associated with our regional estimate is well over 2,000 pairs. Thus, the lack of precision in this single regional estimate could easily mask a real statewide decline, or for that matter, potentially even obscure a statewide increase. Future survey efforts could perhaps minimize the problem of low statistical power by focusing monitoring efforts on smaller areas selected for high owl population density or other factors, and sustaining those efforts for multiple successive breeding seasons.

Our survey of the "new" survey regions covering the Modoc Plateau/Great Basin, Mojave Desert, and Sonoran Deserts represents the first systematic survey of Burrowing Owls across vast portions of California. We found Burrowing Owls to be distributed heterogeneously among these regions, with few or no owls in the Modoc Plateau/Great Basin, Northern Mojave/Eastern Sierra Nevada, Eastern Mojave, or Sonoran Desert regions (excluding the Palo Verde Valley). However, we found much larger aggregations of burrowing Owls in the Western Mojave region, and in one small area of the Sonoran Desert—the Palo Verde Valley.

CONSERVATION IMPLICATIONS

A comprehensive conservation strategy for Burrowing Owl in California is under development by California Department of Fish and Game and its partners (Burkett and Johnson, 2008). Here we provide a few conservation-related conclusions and recommendations that stem directly from our results:

1) Despite the apparent robustness of the population in the Imperial Valley, smaller populations elsewhere in the state, particularly in and near urban areas, appear to have continued to decline since the 1991-1993 survey.

2) The vast majority of the state's breeding Burrowing Owls continue to nest on private lands; any meaningful conservation efforts must therefore engage private stakeholders.

3) Across much of California, Burrowing Owl nesting remains closely associated with the presence of ground squirrels, another factor that must be considered in developing successful conservation measures.

4) In a few key areas, particularly the Imperial Valley and the Palo Verde Valley, Burrowing Owls are not closely associated with ground squirrels, and instead rely heavily on the banks of concrete and earthen water conveyance structures for nesting sites. Comprehensive conservation planning for Burrowing Owl in California must take into consideration the importance of these artificial structures.

5) Although Burrowing Owl detections were scarce across most of the land area of the newly surveyed Modoc Plateau/Great Basin and southern California desert regions, substantial populations persist in the Sonoran Desert (Palo Verde Valley) and the western Mojave Desert regions (particularly in and around the Antelope, Apple, and Lucerne valleys). We estimate the western Mojave Desert region to contain ~6% of California's breeding Burrowing Owls, superseded in numerical importance to the statewide population only by the Imperial Valley and the Southern Central Valley regions. Successful conservation planning for this species must address the particular needs of these substantial desert populations (Wilkerson and Siegel, *in press*).

6) A statewide conservation strategy will likely need to incorporate a statewide monitoring program to assess the effectiveness of conservation measures. Our study demonstrates the potential value of citizen-science participation in single-species studies, particularly of raptors or other highly charismatic species like Burrowing Owls that are relatively easy to find and identify. While many of our volunteer observers were highly skilled birders, and in some cases, even wildlife professionals, others had little or no birding experience. With a fairly modest investment of time and money for recruiting, training, and supporting volunteer surveyors, we were able to extend our survey across a vast area. Engaging citizen-scientists in monitoring could reduce the cost and extend the scope of any owl monitoring project, and may also yield less tangible benefits — participants in

citizen science monitoring programs can reap an increased awareness and appreciation of study organisms and their habitats, which may then translate into tangible actions on their behalf (Evans et al. 2005).

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LITERATURE CITED

BAIRD, S. F. 1870. Ornithology. Volume I. Land birds. Geological Survey of California. Edited by S. F. Baird from the manuscript and notes of J. G. Cooper.

BARCLAY, J. H. 2007. Burrowing Owl management at Mineta San Jose International Airport, p. 146-154. *In* J. H. Barclay, K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts [Eds.], Proceedings of the California Burrowing Owl Symposium, November 2003. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

BARCLAY , J. H., AND L. HARMAN. 2007. 2007 nesting Burrowing Owl census: Souza and Vasco Caves parcels. Albion Environmental, Inc., Santa Cruz, CA.

BURKETT, E. E., AND B. S. JOHNSON. 2007. Development of a conservation strategy for Burrowing Owls in California, p. 165-168. *In* J. H. Barclay, K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts [Eds.], Proceedings of the California Burrowing Owl Symposium, November 2003. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

CALIFORNIA DEPARTMENT OF FISH AND GAME. 2006. California Natural Diversity Database. Updated 2006. California Department of Fish and Game, Biogeographic Data Branch, Sacramento.

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE

PROTECTION. 2002. Multi-source Land Cover Data (v02_2). Forest and Range Assessment Program. http://frap.fire.ca.gov/data/frapgisdata/download.asp?rec=fveg02_2

CALIFORNIA GAP ANALYSIS PROJECT. 1998. Gap analysis of mainland California: an interactive atlas of terrestrial biodiversity and land management. University of California, Santa Barbara.

CHIPMAN, E. D., N. E. MCINTYRE, R. E. STRAUSS, M. C. WALLACE, J. D. RAY, AND C. W. BOAL. 2008. Effects of human land use on western burrowing owl foraging and activity budgets. Journal of Raptor Research 42:87-98.

CONWAY, C. J., AND J. SIMON. 2003. Comparison of detection probability associated with Burrowing Owl survey methods. Journal of Wildlife Management 67:501-511.

CONWAY, C. J., V. GARCIA, M. D. SMITH, AND K. HUGHES. 2008. Factors affecting detection of Burrowing Owl nests during standardized surveys. Journal of Wildlife Management 72:688-696.

CULL, R. L., AND F. HALL. 2007. Status of Burrowing Owls in northeastern California, p. 42-51. In J. H. Barclay, K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts [Eds.], Proceedings of the California Burrowing Owl Symposium, November 2003. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

CUOLOMBE, H. N. 1971. Behavior and population ecology of the burrowing owl, *Speotyto canicularia*, in the Imperial Valley of California. Condor 73:162-176.

DAWSON, W. L. 1923. The birds of California. Volume Two. South Moulton Company, San Diego.

DESANTE, D. F., E. D. RUHLEN, AND D. K. ROSENBERG. 2004. Density and abundance of Burrowing Owls in the agricultural matrix of the Imperial Valley, California. Studies in Avian Biology 27:116-119.

DESANTE, D. F., E. D. RUHLEN, AND R. SCALF. 2007. The distribution and relative abundance of Burrowing Owls in California during 1991-1993: evidence for a declining population and thoughts on its conservation, p. 1-41. *In* J. H. Barclay, K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts [Eds.], Proceedings of the California Burrowing Owl Symposium, November 2003. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

EVANS, C., E. ABRAMS, R. REITSMA, K. ROUX, L. SALMONSEN, AND P. P. MARRA. 2005. The Neighborhood Nestwatch Program: participant outcomes of a citizen-science ecological research project. Conservation Biology 19:589-594.

GERVAIS, J. A. 2002. Evaluating space use and pesticide exposure risk for burrowing owls in an agricultural environment. Ph.D. dissertation, Oregon State University, Corvallis.

GERVAIS, J. A., AND R. G. ANTHONY. 2003. Chronic organochlorine contaminants, environmental variability, and the demographics of a burrowing owl population. Ecological Applications 13:1250-1262.

GERVAIS, J. A., D. K. ROSENBERG, AND L. A. COMRACK. 2008. Burrowing Owl (*Athene canicularia*). *In* W. D. Shuford and T. Gardali [Eds.], California Bird Species of Special Concern: a ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

GRINNELL, J. 1915. A distributional list of the birds of California. Pacific Coast Avifauna Number 11. Cooper Ornithological Club.

GRINNELL, J., AND A. H. MILLER. 1944. The distribution of the birds of California. Pacific Coast Avifauna, no. 27. Cooper Ornithological Club, Berkeley, CA.

HAUG, E. A., B. A. MILLSAP, AND M. S. MARTELL. 1993. Burrowing Owl (*Athene cunicularia*). *In* A. Poole [Ed.], The Birds of North America Online. Cornell Lab of Ornithology, Ithaca. Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/061

HICKMAN, J. C. [Eds.]. 1993. The Jepson manual: higher plants of California. University of California Press, Berkeley and Los Angeles.

HOLROYD, G. L., R. RRODRÍGUEZ-ESTRELLA, AND S. R. SHEFFIELD. 2001. Conservation of the Burrowing Owl in western North America: issues, challenges, and recommendations. Journal of Raptor Research 35:399-407.

JAMES, P. C., AND G. A. FOX. 1987. Effects of some insecticides on productivity of Burrowing Owls. Blue Jay 45:65-71.

JAMES, P. C., AND T. J. ETHIER. 1989. Trends in the winter distribution and abundance of burrowing owls in North America. American Birds 43:1224-1225.

KEELER, C. A. 1891. Geographical distribution of land birds in California. IV. The Island Fauna. Volume I.

KIDD, J. W., P. H. BLOOM, C. W. BARROWS, AND C. T. COLLINS. 2007. Status of Burrowing Owls in southwestern California, p. 76-89. *In* J. H. Barclay, K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts [Eds.], Proceedings of the California Burrowing Owl Symposium, November 2003. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

KLUTE, D. S., L. W. AYERS, M. T. GREEN, W. H. HOWE, S. L. JONES, J. A. SHAFFER, S. R. SHEFFIELD, AND T. S.

ZIMMERMAN. 2003. Status assessment and conservation plan for the Western Burrowing Owl in the United States. U.S. Department of Interior, Fish and Wildlife Service, Biological Technical Publication FWS/BTP-R6001-2003, Washington, D.C.

LINCER, J. L. AND P. H. BLOOM. 2007. The status of the Burrowing Owl in San Diego County, California, p. 90-102. *In* J. H. Barclay, K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts [Eds.], Proceedings of the California Burrowing Owl Symposium, November 2003. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

MULTI-RESOLUTION LAND CHARACTERISTICS CONSORTIUM. 2001. National Land Cover Database (NLCD 2001). http://www.mrlc.gov/nlcd.php

REMSEN, J. V., JR. 1978. Bird species of special concern in California. Prepared for the California Department of Fish and Game.

RONAN, N. A. 2002. Habitat selection, reproductive success, and site fidelity of burrowing owls in a grassland ecosystem. M.S. thesis, Oregon State University, Corvallis.

ROSENBERG, D. K. AND K. L. HALEY. 2004. The ecology of burrowing owls in the agro-ecosystem of the Imperial Valley, California. Studies in Avian Biology 27:120-135.

SAUER, J. R., J. E. HINES, AND J. FALLON. 2008. The North American Breeding Bird Survey, Results and Analysis 1966 - 2007. Version 5.15.2008. USGS Patuxent Wildlife Research Center, Laurel, MD.

SHEFFIELD, S. R. 1997a. Current status, distribution, and conservation of the Burrowing Owl in Midwestern and western North America. p. 399-408. *In* J. R. Duncan, D. H. Johnson, and T. H. Nichols [Eds.], Biology and conservation of owls of the northern hemisphere: 2nd international symposium. USDA Gen. Tech. Rep. NC-190, St. Paul, Minnesota.

SHEFFIELD, S. R. 1997b. Owls as biomonitors of environmental health hazards, p. 383-398. *In* J. R. Duncan, D. H. Johnson, and T. H. Nicholls [Eds.], Biology and conservation of owls in the northern hemisphere: 2nd international symposium. USDA Gen. Tech. Rep. NC-190, St. Paul, Minnesota.

SHUFORD, W. D., AND T. GARDALI [Eds.]. 2008. California bird species of special concern: a ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

THOMSEN, L. 1971. Behavior and ecology of Burrowing Owls on the Oakland Municipal Airport. Condor 73:177-192.

TOWNSEND, S. E. AND C. LENIHAN. 2007. Burrowing Owl status in the Greater San Francisco Bay Area, p. 60-69. *In* J. H. Barclay, K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts [Eds.], Proceedings of the California Burrowing Owl Symposium, November 2003. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

TRULIO, L. A. 1997. Strategies for protecting western burrowing owls (*Speotyto cunicularia hypugaea*) from human activities, p. 461-465. *In* J. R. Duncan, D. H. Johnson, and T. H. Nicholls (eds.). Biology and conservation of owls in the northern hemisphere. USDA Forest Service General Technical Report NC-190. St. Paul, Minnesota.

TRULIO, L. A. AND D. A. CHROMCZAK. 2007. Burrowing Owl nesting success at urban and parkland sites in northern California, p. 115-122. In J. H. Barclay, K. W. Hunting, J. L. Lincer, J. Linthicum, and T. A. Roberts [Eds.], Proceedings of the California Burrowing Owl Symposium, November 2003. Bird Populations Monographs No. 1. The Institute for Bird Populations and Albion Environmental, Inc., Point Reyes Station, CA.

WEDGWOOD, J. A. 1978. The status of the burrowing owl in Canada. Committee on the Status of Endangered Wildlife in Canada. Can. Wildl. Serv., Ottawa, ON, Canada.

WELLICOME, T. I. AND G. L. HOLROYD. 2001. The second international burrowing owl symposium: background and context. Raptor Research Report 35:269-273.

WILKERSON, R. L., AND R. B. SIEGEL. *In review*. Burrowing Owl distribution and abundance in southeastern California. The Southwestern Naturalist.

ZAR, J. H. 1984. Biostatistical analysis. Prentice Hall, Englewood Cliffs, NJ.

ZARN, M. 1974. Burrowing Owl (*Speotyto cunicularia hypugaea*). Habitat management series for unique or endangered species, U.S. Bureau of Land Management. Tech. Note 242, Denver, CO.

Bird Populations 10:37-55

THE BIRDS OF NAMERI NATIONAL PARK-ASSAM, INDIA: AN ANNOTATED CHECKLIST[1]

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Abstract. Assam, comprising the eastern Himalayas, is one of the Mega bio-diversity hot spots of the world. It forms part of two bird areas, viz. eastern Himalaya and Assam plains, with many endemic species. Nameri National Park is a part of the North Bank Landscape (NBL) of Brahmaputra River bordering Assam and Arunachal Pradesh as established by the World Wildlife Fund; it also is a part of the Eastern Himalayan Bio-diversity Hotspot.

Detailed in this checklist are 374 avian species recorded in Nameri National Park. The list was compiled on the basis of fieldwork carried out in 1996-2003, as well as tabulation of records by other observers. This includes, as reported in the International Union for Conservation of Nature (IUCN) Red List: eight globally threatened species (White-winged Wood Duck (*Cairina scutulata*), Rufous-necked Hornbill (*Aceros nipalensis*), Pallas's Fish Eagle (*Haliaeetus leucoryphus*), White-rumped Vulture (*Gyps bengalensis*), Slender-billed Vulture (*Gyps tenuirostris*), Greater Spotted Eagle (*Aquila clanga*), Lesser Adjutant (*Leptoptilos dubius*) and Jerdon's Babbler (*Chrysomma altirostre*); and five near threatened species (White-cheeked Partridge (*Arborophila atrogularis*), Black-bellied Tern (*Sterna acuticauda*), White-tailed Eagle (*Haliaeetus albicilla*), Lesser Fish Eagle (*Ichthyophaga humilis*) and Red-headed Vulture (*Sarcogyps calvus*). Annotations highlight the present status of avian species in Nameri National Park.

Key words: Assam, avian hotspots, India, Nameri National Park.

LAS AVES DEL PARQUE NACIONAL NAMERI-ASSAM, INDIA: UNA LISTA ANOTADA

Resumen. Assam, que incluye el Himalaya oriental, es uno de los "hot spots" mega diversos del planeta. Forma parte de dos áreas avifaunísticas, el Himalaya este y las llanuras de Assam, con numerosos endemismos. El Parque Nacional Nameri es parte del North Bank Landscape (NBL) del Río Brahmaputra que bordea Assam y Arunachal Pradesh según lo establecido por el World Wildlife Fund; también forma parte del Hotspot de Biodiversidad del Himalaya Oriental.

Detalladas en esta lista se encuentran 374 especies de aves registradas en el Parque Nacional Nameri. La lista fue recopilada en base a trabajo de campo llevado a cabo en 1996-2003, así como mediante la tabulación de registros de otros observadores. Esto

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incluye, como se reporta en la Lista Roja de la UICN: ocho especies globalmente amenazadas (*Cairina scutulata, Aceros nipalensis, Haliaeetus leucoryphus, Gyps bengalensis, Gyps tenuirostris, Aquila clanga, Leptotilos dubius* y *Chrysomma altirostre*); y cinco especies casi amenazadas (*Arborophila atrogularis, Sterna acuticauda, Haliaeetus albicilla, Ichthyophaga humilis*, y *Sarcogyps calvus*). Las anotaciones resaltan el estado actual de las especies de aves del Parque Nacional Nameri.

Palabras clave: Assam, hotspots de aves, India, Parque Nacional Nameri.

INTRODUCTION

Nameri National Park (latitude 26º51′ to 27º04′ N, longitude 92º39′ to 92º59′ E) covers 200 km² of the eastern Himalayan foothills in Assam (Fig. 1). It is contiguous with Pakhui Wildlife Sanctuary in Arunachal Pradesh to the north. Together they exceed 1,000 km², ranging in altitude from 79 to >1,500m. The park extends east and south of the west bank of the Bor-Dikorai River from the interstate boundary at Sijussa to the left bank of Jia-Bhorelli River along the north of Sikam Basti, up to the south bank of Balipara Reserve Forest. The area is criss-crossed by the Jia-Bhorelli River and its tributaries namely Diji, Dinai, Doigurung, Nameri, Dikorai, Khari.

The terrain is undulating, with lower areas at 80–100 m along the Jia-Bhorelli and its tributaries, and higher areas at 200–225m in the central and northern parts of the park. Soils are composed of sand or sandy loam alluvial deposits. Numerous small rivers and perennial streams originating in Arunachal Pradesh run through the park and feed into the Jia-Bhorelli River. Many rivers shift their course during the rainy season and form dry riverbeds during winter.

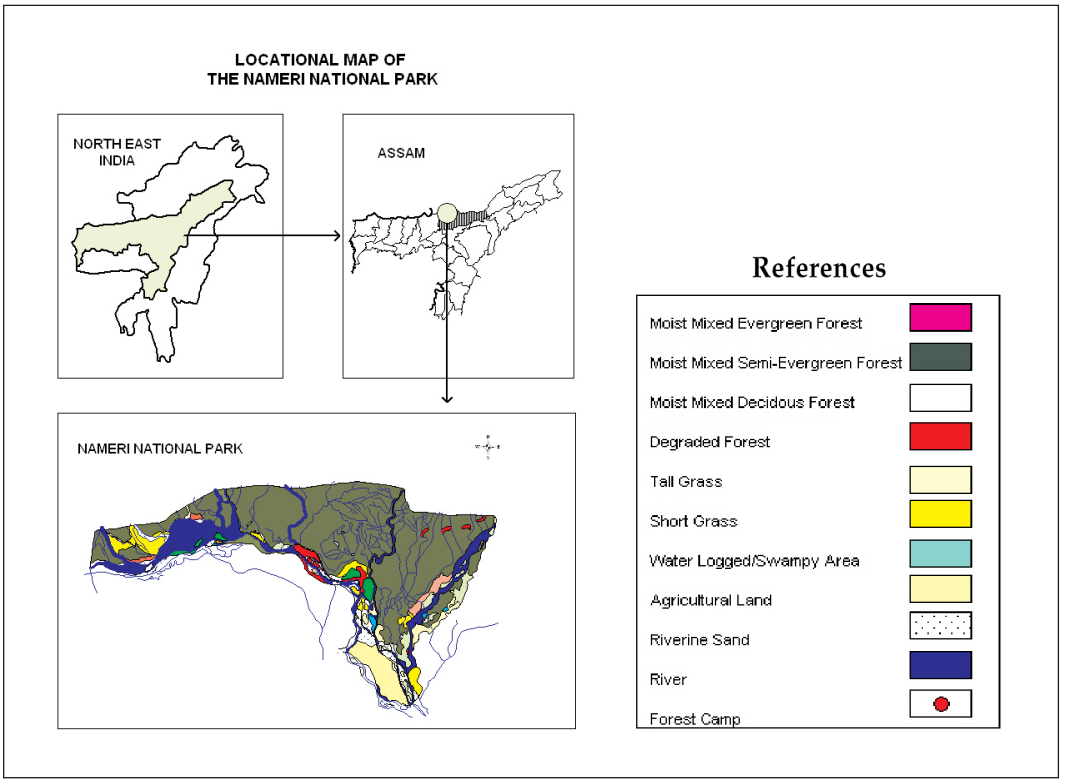


FIGURE 1. Location of Nameri National Park and distribution of habitats.

The subtropical monsoon climate of the region is characterised by heavy rainfall with an annual average of 3,500mm. The predominance of the southwest monsoon causes precipitation to be highly seasonal (Barthakur 1986). Most of the rain falls between May and September, which forms the summer (hot) season. Winters (October to April) are usually cool and dry, although rains are not uncommon. The average temperature varies from a low of 5ºC in winter to a high of 37ºC in summer. The relative humidity is high, and varies between 65 and >90%. Forest and woodland cover the majority of the park (94%, i.e.188 km^2). Grasslands are found along the banks of the Jia-Bhorelli River and its tributaries and cover an area of 10 km^2 (5%). The remaining 2 km^2 (1%) is formed by various river beds. Nameri is covered by tropical evergreen, semi-evergreen and moist deciduous forest with cane and bamboo brakes and narrow strips of open grassland along rivers. Grasslands comprise >10% of the total area of the park while the semi-evergreen and moist deciduous species dominate the area. The vegetation of the park is a mosaic of four major forest types (Champion and Seth 1968): (1) eastern alluvial secondary semi-evergreen forest, (2) low alluvial savannah woodland, (3) eastern dillenia swamp forest, and (4) wet bamboo forest (usually found along streams or on badly drained hollows), with areas of cane brakes formed by *Calamus tenuis*. Orchids include *Dendrobium*, *Cymbidium*, and Ladies Sleeper, along with tree ferns and lianas; creepers are some of the specialties of this forest.

Parts of the area were designated as Nauduar Reserve Forest in 1876 and Nameri Wildlife Sanctuary in 1985. The present Nameri National Park was formed in1988. Considerable commercial timber exploitation and intensive extraction of canebrakes has taken place, and habitat has been further degraded through livestock grazing. In recent years, cattle camps have been evicted to reduce grazing pressure, resulting in grassland regeneration in some areas. A belt of reserved forests contiguous to the park forms a buffer, but which is now being encroached upon for homesteads and cultivation. This has resulted in further fragmentation of the park, which in turn is becoming progressively insular.

RESULTS

Like most areas in North-East India, Nameri has been poorly surveyed for avian species. No published checklist of the birds of the park exists, although there is some literature relating to birds in the neighboring Pakhui Wildlife Sanctuary of Arunachal Pradesh (Datta et al. 1998; Singh 1991, 1994). Fieldwork has mostly done in Nameri during all seasons from 2005 to September 2009, although less intensively prior to 2004. Before then records were kept from ecotourism excursions in the park. Bird species from Nameri are recorded in Talukdar (1997), Talukdar and Das (1997), Dymond (1998), Hendriks (1998), and Barua and Sharma (1999); see also the IUCN Red List (Bird Life International 2004).

A total of 374 bird species have been recorded from Nameri (see Appendix, Table 1). These include nine globally threatened species (three Critically Endangered, four Endangered, seven Vulnerable and eight Near-Threatened), many of which are dependent on forest. The park

TABLE 1. Major bird watching areas of Nameri National Park. Locations identified during field surveys in 2004-2009; A-Available, NA-Not Available.

Locality	Resident Birds	Migratory Birds	Grassland Birds	Hill birds in winter	Hill birds year round
Potasali (Watch tower)	A	A	A	A	NA
Kurua Beel	A	A	NA	A	A
Borghulli Beel	A	A	A	A	NA
Magurmari beel	A	A	NA	A	NA
Balipung area	A	A	A	A	NA
Along Jiabhoreli River	A	A	A	NA	NA
Near Bogijuli Nala	NA	A	A	A	A

provides little habitat for any globally threatened grassland species that occur elsewhere in Assam, apart from Jerdon's Babbler (*Chrysomma altirostre*), which was reported in January 2004 (Robson 2004). Rahmani et al. (1990) mentioned that the endangered Bengal Florican (*Houbaropsis bengalensis*) might be found in the area 'in due course' as the grasslands, although not extensive, were suitable in certain places and were being given protection. However, the species was not detected during the study.

OBSERVATIONS ON SELECTED SPECIES FOUND IN NAMERI NATIONAL PARK, INCLUDING IUCN STATUS.

The following species are of special status, deserving more extensive discussion than the remaining species presented in Table 2 (see Fig. 2).

WHITE-RUMPED VULTURE (*Gyps bengalensis*) — Critically Endangered. Between 1998 and 2000, this species was recorded seven times, usually involving 2–3 birds, mostly seen soaring. There were no subsequent records. When 10 wild elephants (*Elephas maximus*) died in the area due to poisoning during July–August 2001, no vultures were seen on the carcasses. Their absence is noteworthy and presumably related to the catastrophic decline of *Gyps* vultures in the Indian subcontinent owing to Diclofenac poisoning (Bird Life International 2004).

SLENDER-BILLED VULTURE (*Gyps tenuirostris*) — Critically Endangered. This species was rare, with most records referring to soaring birds. It was not observed during 1996, but small flocks of up to six birds were seen 4–5 times a year during 1997–2001, mainly between November and March. None has been seen since 2001, again presumably linked to the decline of *Gyps* vultures.

RED-HEADED VULTURE (*Sarcogyps calvus*) — Critically Endangered. Singles were seen soaring at Potasali on 16 April 2002 and feeding on a carcass along the Khari River on 10 July in the same year.

INDIAN VULTURE (*Gyps indicus*) — Critically Endangered. This species is classified as Critically Endangered because it has suffered an extremely rapid population decline as a result of feeding on carcasses of animals treated with the veterinary drug diclofenac. Between 2001 to 2002, this species was recorded five times, usually involving 2–3 birds, mostly seen soaring near the south buffer area of the park.

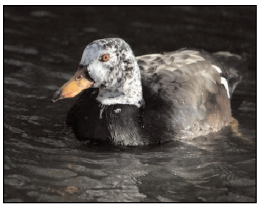
WHITE-WINGED WOOD DUCK (*Cairina scutulata*) — Endangered. This resident species inhabits pools and secluded marshes in dense forest. Although no population estimate has been made, sightings are fairly regular and breeding occurs: 11 ducklings were seen on 17 June 2003 with two adults. Nameri is one of the few areas where this species has been recorded in Assam outside its main stronghold in the Dibru-Saikhowa Biosphere Reserve, where a population of 200 individuals is estimated (out of a total Indian population of 300–350 individuals; Islam and Rahmani 2002).

SPOTTED GREENSHANK (*Tringa guttifer*) — Endangered. This species has a very small population that is declining. One bird was seen in Kurua Beel (Wetland) along with a group of Spot-billed Ducks (*Anas peocilorhyncha*) on 19th February 2003 early morning.

RUFOUS-NECKED HORNBILL (*Aceros nipalensis*) — Vulnerable. One bird was observed flying north along the Upper Dikrai River in primary forest on 18 December 2001. It was readily identified by its tail pattern (black with a white distal half) and its silent flight. The species has been recorded at higher altitudes in neighboring Arunachal Pradesh, but it appears to be extremely rare in Nameri National Park. The species has disappeared from much of its range, and currently survives at fewer than 20 locations in India (Islam and Rahmani 2002).

PALLAS'S FISH EAGLE (*Haliaeetus leucoryphus*) — Vulnerable. This species breeds along the banks of the Jia-Bhareli River. Two traditional nest sites are known: one at 13th Mile area and the other at the confluence of the Upper Dikrai and Jia-Bharelli rivers. Both sites were still in use up to at least 1997. Other than these two pairs, no other birds have been seen. There are probably <150 breeding pairs in Assam (Islam and Rahmani 2002).

GREATER SPOTTED EAGLE (*Aquila clanga*) — Vulnerable. Small numbers were seen (<10) in winter each year between November and February in open areas along the Jia-Bharelli River and its tributaries. This species has a small


White Winged Wood Duck


Rufous-necked Hornbill

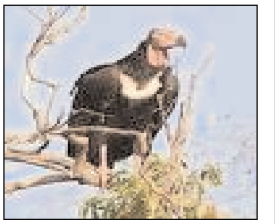

Black-bellied Tern


Pallas fish Eagle


Lesser Fish Eagle


White-rumped Vulture


Slender-billed Vulture


Red-headed Vulture


Greater Spotted Eagle


Lesser Adjutant


Sumba Buttonquail


Gray-headed Woodpecker


Great Hornbill


Yellow-legged Pigeon


Spotted Greenshank


Grey-headed Fish-eagle


Indian Vulture


Oriental Darter


Brown Fulvetta

FIGURE 2. Nameri National Park bird species of special status that are discussed in greater detail in the text.

population which appears to be declining owing to extensive habitat loss and persistent persecution.

LESSER ADJUTANT (*Leptoptilos javanicus*) — Vulnerable. Small numbers of this species are resident, mainly in marshes along the Jia-Bharelli River. Six nests were located on a 'Simul' (*Bombax ceiba*) tree near Bogijuli Nala in the eastern region of the park in 2000-2001. This stork has a small population which is rapidly declining, in particular as a result of hunting pressure.

SUMBA BUTTONQUAIL (*Turnix everetti*) — Vulnerable. This elusive grassland specialist qualifies as Vulnerable on the grounds that its small range (where it is known from few locations) and single population are likely to be declining as a result of habitat degradation. One individual was seen in the grassland near the confluence of Doigrung River on 13th March 2000.

YELLOW-LEGGED PIGEON (*Columba pallidiceps*) — Vulnerable. This species has undergone a considerable decline in numbers over the last century. A pair was seen in a Jamuk (*Syzygium fruticosum*) tree near the secondary forest in Owbari area. Now it has a small population, fragmented and likely to be in decline owing to forest loss.

GREY HEADED WOODPECKER (*Picus canus*) — Threatened. The Grey-headed Woodpecker, also known as the Grey-faced Woodpecker, is a resident in leaf forests and mixed forests. Three birds were seen on 24th June 1999 near the high forest bordering southern edge of Pakhui Wildlife Sanctuary of Arunachal Pradesh.

BLACK-BELLIED TERN (*Sterna acuticauda*) — Near-Threatened. This rare species was observed at Potasali on the Jia-Bhareli River (two on 5 February, two on 2 March 2000 and one on 7 November 2001) amidst groups of River Terns (*Sterna aurantia*). Breeding has not been observed in the area and the species' seasonal status is unclear.

LESSER FISH EAGLE (*Ichthyophaga humilis*) — Near-Threatened. This species is rare, and presumably resident. One was seen soaring over woodland along the Nameri River on 13 February 1998. Dymond (1998) recorded one at Potasali on 25–27 November in the same year.

GREAT HORNBILL (*Buceros bicornis*) — Near-Threatened. Although this species has a large range, it occurs at low densities and is patchily distributed. Three birds were observed flying south along the Dinai River in primary forest on 12 December 2001. Probably they were flying from Pakhui Wildlife Sanctuary towards high forest Bhelu (*Tetrameles nudiflora*) in the park. It is likely to be declining moderately rapidly throughout its range.

GREY-HEADED FISH EAGLE (*Ichthyophaga ichthyaetus*) — Near-Threatened. This species is thought to be undergoing a moderately rapid population reduction owing to habitat degradation, pollution and over-fishing. One was seen with Ruddy Kingfisher (*Halcyon coromanda*) along the bed of Jia-Bhorelli River near Potasali camp on 17th May 2002. Although widespread, it is now only locally common.

ORIENTAL DARTER (*Anhinga melanogaster*) — Near-Threatened. This species' population is declining rapidly owing to pollution, drainage, hunting and collection of eggs and nestlings. A pair was seen in the Borghuli wetland on 19th December 2000.

BROWN FULVETTA (*Alcippe brunneicauda*) — Near-Threatened. This species is found in subtropical or tropical moist low land forests. It is threatened by habitat destruction. One was seen in the dry grassland area near Nameri River on 13th March, 2003.

CONCLUSIONS

This is the second ornithological survey of Nameri National Park. Further work should focus on systematic surveys for White-winged Wood Duck in order to determine its population size in the park. Fragmentation of forests in this region has led to the park becoming increasingly insular, and landscape-level studies are needed to investigate the effect of habitat fragmentation on the park's avifauna.

REFERENCES

BARTHAKUR, M. 1986. Weather and climate of North-east India. North-Eastern Geographer 18: 31-32.

BARUA, M., AND P. SHARMA. 1999. Occurrence of the Hill Blue Flycatcher (*Cyornis banyumas*) in Nameri National Park, Assam. Newsletter for Birdwatchers 39: 61–62.

BIRD LIFE INTERNATIONAL. 2004. Threatened Birds of the World 2004. CD-ROM. Bird Life International, Cambridge, U.K.

CHAMPION, H.G., AND S.K. SETH. 1968. A revised Survey of the forest types of India. Government of India Publications, New Delhi.

DATTA, A., P.SINGH, R.M. ATHREYA, AND S. KARTHIKEYAN. 1998. Birds of Pakhui Wildlife Sanctuary in western Arunachal Pradesh, North East India. Newsletter for Birdwatchers 38: 39-43.

DYMOND, N. 1998. List of Birds seen in Nameri National Park: 25–27 November 1998. Unpublished Trip Report.

HENDRIKS, H. 1998. Birds seen in North-Eastern India. Unpublished Trip Report.

ISLAM, M.Z., AND A.R. RAHMANI. 2002. Threatened birds of India. Buceros 7: 1–2.

MYERS, N. 1988. Threatened biotas: 'hotspots' in tropical forests. Environmentalist 8: 18-20.

RAHMANI, A. R., G. NARAYAN, L. ROSALIND, AND R. SANKARAN. 1990. Status of Bengal Florican in India. Pp. 55–78 *in* Status and Ecology of the Lesser and Bengal Floricans, with reports on Jerdon's Courser and Mountain Quail: Final Report. Bombay Natural History Society, Mumbai.

PENHALLURICK, J. 2001. Birds seen in Assam during April 2001. Unpublished field notes.

ROBSON, C. 2004. From the field. Birding Asia 1: 78–87.

SINGH, P. 1991. Avian and mammalian evidences in Pakhui Wildlife Sanctuary in East Kameng District, Arunachal Pradesh. Arunachal Forest News 9: 1–10.

SINGH, P. 1994. Recent bird records from Arunachal Pradesh. Forktail 10: 65–104.

TALUKDAR, B.K. 1997. Record of largest Flock of Great Cormorant in Nameri Wildlife Sanctuary, Assam. Newsletter for Birdwatchers 37: 65.

TALUKDAR, B.K. AND R.K. DAS. 1997. Record of birds of prey in Nameri Wildlife Sanctuary, Assam. Newsletter for Birdwatchers 37: 50–51.

TABLE 2. Annotated checklist of birds recorded in Nameri National Park.

Species	Status[a]	Habitat[a]	Notes
WHITE-CHEEKED PARTRIDGE *Arborophila atrogularis*	NT	P, S	See text.
RED JUNGLEFOWL *Gallus gallus*		P, S, D	Common resident.
KALIJ PHEASANT *Lophura leucomelanos*		P, S	Common resident.
GREY PEACOCK PHEASANT *Polyplectron bicalcaratum*		P	Resident; small numbers in well-wooded areas.
FULVOUS WHISTLING DUCK *Dendrocygna bicolor*		W, R	Occasional; breeding migrant (May - Jul).
LESSER WHISTLING DUCK *Dendrocygna javanica*		W, R	Common resident; an influx of birds during the breeding season (May - Jul).
BAR-HEADED GOOSE *Anser indicus*		A	Passage migrant; 39 seen flying north along the Jia-Bhorelli River, 7 Mar 2004.
RUDDY SHELDUCK *Tadorna ferruginea*		W, R	Common winter visitor; large numbers along the Jia-Bharelli River and tributaries, smaller numbers seen in pools and marshes.
COMMON SHELDUCK *Tadorna tadorna*		W	Occasional winter visitor; along the Jia-Bharelli River
WHITE-WINGED DUCK *Cairina scutulata*		E, N, W	See text.
GADWALL *Anas strepera*		W, R	Common winter visitor.
MALLARD *Anas platyrynchos*		W	Common winter visitor.
SPOT-BILLED DUCK *Anas poecilorhyncha*		W	Common winter visitor.
NORTHERN PINTAIL *Anas acuta*		W	Uncommon winter visitor; in stagnant pools along abandoned course of Jia-Bharelli River.
COMMON TEAL *Anas crecca*		W, R	Common winter visitor; large numbers throughout the area.
COMMON MERGANSER *Mergus merganser*		R	Winter visitor; common along Jia-Bharelli River and tributaries.
YELLOW-LEGGED BUTTONQUAIL *Turnix tanki*		G	Uncommon resident.
SPECKLED PICULET *Picumnus innominatus*		P, S	Uncommon winter visitor; seen in mixed species feeding flocks.
GREY-CAPPED PYGMY WOODPECKER *Dendrocopos canicapillus*		S, D	Fairly common resident; seen singly or in pairs in degraded open forest.
FULVOUS-BREASTED WOODPECKER *Dendrocopos macei*		S, D	Common resident; seen singly or in pairs.
RUFOUS WOODPECKER *Celeus brachyurus*		P, S	Common resident.
LESSER YELLOWNAPE *Picus chlorolophus*		P, S	Common resident.
GREATER YELLOWNAPE *Picus flavinucha*		P, S	Common resident.
GREY-HEADED WOODPECKER *Picus canus*		S	Common resident; seen singly or in pairs, sometimes associated with Greater and Lesser Necklaced Laughing thrushes.
HIMALAYAN FLAMEBACK *Dinopium shorii*		S	Uncommon resident.
COMMON FLAMEBACK *Dinopium javanense*		S	Rare; seasonal status unclear; one observed well at Potasali, 3 Dec 2003.
BLACK-RUMPED FLAMEBACK *Dinopium benghalense*		P, S, D	Common resident.
GREATER FLAMEBACK *Chrysocolaptes lucidus*		P, S, D	Common resident.
GREAT SLATY WOODPECKER *Mulleripicus pulverulentus*		P	Rare; seasonal status unclear. flock of 8 seen at Potasali, 2 Dec 2003, and five seen 3 Dec 1996.
GREAT BARBET *Megalaima virens*		P	Uncommon; subject to altitudinal movements.; more common in higher areas towards Bhalukpong and Khari.
LINEATED BARBET *Megalaima lineate*		P, S, D	Common and widespread resident.
BLUE-THROATED BARBET *Megalaima asiatica*		P, S, D	Common and widespread resident.

TABLE 2. Continued.

Species	Status[a]	Habitat[a]	Notes
BLUE-EARED BARBET *Megalaima australis*		P, S	Uncommon resident.
COPPERSMITH BARBET *Megalaima haemacephala*		S, D	Rare resident.
ORIENTAL PIED HORNBILL *Anthracoceros albirostris*		P, S	Common resident.
GREAT HORNBILL *Buceros bicornis*		P, S	Common resident; found throughout the park.
RUFOUS-NECKED HORNBILL *Aceros nipalensis*	VU	P	See text.
WREATHED HORNBILL *Aceros undulates*		P, S	Common resident; breeds Mar - Apr; nests usually in Tetrameles nudiflora trees
COMMON HOOPOE *Upupa epops*		S, G, D	Common resident, partial migrant; numbers increase during winter (Oct - Apr).
RED-HEADED TROGON *Harpactes erythrocephalus*		P	Uncommon resident.
INDIAN ROLLER *Coracias benghalensis*		S, G, D	Common resident.
DOLLARBIRD *Eurystomus orientalis*		S	Common resident.
COMMON KINGFISHER *Alcedo atthis*		W, R	Common resident.
BLUE-EARED KINGFISHER *Alcedo meninting*		W, R	Uncommon resident; restricted to secluded pools and tributaries, often near forest.
ORIENTAL DWARF KINGFISHER *Ceyx erithacus*		R	Probable rare resident, seasonal status unknown; one seen along Bogijuli River, 10 Jul 2003.
RUDDY KINGFISHER *Halcyon coromanda*		S, W	See text.
WHITE-THROATED KINGFISHER *Halcyon smyrnensis*		S, W, R	Common and widespread resident.
CRESTED KINGFISHER *Megaceryle lugubris*		R	Common resident; restricted to the fast-flowing waters of Jia-Bharelli River and tributaries.
PIED KINGFISHER *Ceryle rudis*		W, R	Common resident; along Jia-Bharelli River and tributaries, also in water bodies and pools.
BLUE-BEARDED BEE-EATER *Nyctyornis athertoni*		P, S, D	Common resident. Nest (hole in a vertical face in dense forest) found atSeijusa, 23 May 2001.
GREEN BEE-EATER *Merops orientalis*		S, G, D	Common resident.
BLUE-TAILED BEE-EATER *Merops philippinus*		G, D	Rare resident.
CHESTNUT-HEADED BEE-EATER *Merops leschenaulti*		S, D	Common resident.
PIED CUCKOO *Clamator jacobinus*		S, D	Summer visitor; one seen Bhalukpong, 15 Sept 2004.
COMMON HAWK CUCKOO *Hierococcyx varius*		S	Rare; one at Potasali, 1 Mar 2007.
INDIAN CUCKOO *Cuculus micropterus*		S, D	Common summer migrant.
BANDED BAY CUCKOO *Cacomantis sonneratii*		S, D	Uncommon resident.
PLAINTIVE CUCKOO *Cacomantis merulinus*		S, D	Seasonal status unclear; uncommon but frequently seen or heard Apr - Aug.
ASIAN EMERALD CUCKOO *Chrysococcyx maculates*		P	Rare summer migrant; one seen in woodland near Potasali, 10 Jul 2004.
ASIAN KOEL *Eudynamys scolopacea*		S, D	Probable resident, commonly seen in summer (Apr–Jul), but no winter sightings.
GREEN-BILLED MALKOHA *Phaenicophaeus tristis*		S	Common resident.
GREATER COUCAL *Centropus sinensis*		S, G	Common resident; more numerous than Centropus bengalensis.
LESSER COUCAL *Centropus bengalensis*		S, G	Common resident.
VERNAL HANGING PARROT *Loriculus vernalis*		P, S	Common resident; seen in flocks of 20+ birds.
ALEXANDRINE PARAKEET *Psittacula eupatria*		S, D	Common resident.
ROSE-RINGED PARAKEET *Psittacula krameri*		S, D	Common resident.

TABLE 2. Continued.

Species	Status[a]	Habitat[a]	Notes
BLOSSOM-HEADED PARAKEET *Psittacula roseata*		S, D	Uncommon resident.
RED-BREASTED PARAKEET *Psittacula alexandri*		S, D	Common resident.
HIMALAYAN SWIFTLET *Collocalia brevirostris*		A	Common winter visitor.
ASIAN PALM SWIFT *Cypsiurus balasiensis*		A	Common resident.
SILVER-BACKED NEEDLETAIL *Hirundapus cochinchinensis*		A	Rare migrant; four seen at Seijusa, 5 Feb 1997.
HOUSE SWIFT *Apus affinis*		A	Rare.
ORIENTAL SCOPS OWL *Otus sunia*		S	Fairly common resident.
COLLARED SCOPS OWL *Otus bakkamoena*		S, D	Fairly common resident.
SPOT-BELLIED EAGLE OWL *Bubo nipalensis*		P, S	Uncommon resident.
BROWN FISH OWL *Ketupa zeylonensis*		S	Uncommon resident.
COLLARED OWLET *Glaucidium brodiei*		P, S	Uncommon; seasonal status unclear.
ASIAN BARRED OWLET *Glaucidium cuculoides*		P, S, D	Common and widespread resident.
SPOTTED OWLET *Athene brama*		S, D	Common resident; found in the areas fringing the park.
BROWN HAWK OWL *Ninox scutulata*		S	Common resident.
GREY NIGHTJAR *Caprimulgus indicus*		S	Uncommon resident.
LARGE-TAILED NIGHTJAR *Caprimulgus macrurus*		S	Common resident.
SAVANNA NIGHTJAR *Caprimulgus affinis*		G	Uncommon resident; found in grasslands along Jia-Bharelli River and tributaries.
ORIENTAL TURTLE DOVE *Streptopelia orientalis*		S, G, D	Common and widespread resident.
SPOTTED DOVE *Streptopelia chinensis*		S, G, D	Common and widespread resident.
RED COLLARED DOVE *Streptopelia tranquebarica*		S, G, D	Common resident.
EURASIAN COLLARED DOVE *Streptopelia decaocto*		G, D	Uncommon resident; in somewhat open areas.
BARRED CUCKOO DOVE *Macropygia unchall*		P	Uncommon resident; only in well-wooded areas.
EMERALD DOVE *Chalcophaps indica*		P, S	Common resident.
ORANGE-BREASTED GREEN PIGEON *Treron bicincta*		P, S	Rare resident.
POMPADOUR GREEN PIGEON *Treron pompadora*		S, D	Rare resident; recorded 25–27 Nov 2004 (Dymond 1998) and 15 -17 Mar 1998 (Hendriks 1998).
THICK-BILLED GREEN PIGEON *Treron curvirostra*		S, D	Uncommon resident.
YELLOW-FOOTED GREEN PIGEON *Treron phoenicoptera*		S, D	Common and widespread resident.
PIN-TAILED GREEN PIGEON *Treron apicauda*		P, S	Uncommon resident; seen in large flocks in wooded areas.
WEDGE-TAILED GREEN PIGEON *Treron sphenura*		P, S	Rare, probable winter visitor; undergoes altitudinal movements.
GREEN IMPERIAL PIGEON *Ducula aenea*		P, S	Common resident.
MOUNTAIN IMPERIAL PIGEON *Ducula badia*		P	Uncommon; undergoes local movements in well-wooded areas.
BROWN CRAKE *Amaurornis akool*		W	Uncommon resident.
WHITE-BREASTED WATERHEN *Amaurornis phoenicurus*		W	Common resident.
PURPLE SWAMPHEN *Porphyrio porphyrio*		W	Rare resident.
COMMON MOORHEN *Gallinula chloropus*		W	Common resident; in stagnant pools and along the abandoned course of Jia-Bharelli River.

TABLE 2. Continued.

Species	Status[a]	Habitat[a]	Notes
EURASIANWOODCOCK *Scolopax rusticola*		S	Rare winter visitor; one at Potasali, 3 Dec 2006 and another 8 Apr 2001 (Penhallurick 2001).
PINTAIL SNIPE *Gallinago stenura*		W	Common winter visitor.
COMMON SNIPE *Gallinago gallinago*		W	Common winter visitor.
COMMON REDSHANK *Tringa tetanus*		R	Rare; presumed passage migrant; 4–5 seen along Jia-Bharelli River, 9 May 2005.
MARSH SANDPIPER *Tringa stagnatilis*		W, R	Uncommon winter visitor.
COMMON GREENSHANK *Tringa nebularia*		W, R	Common winter migrant; found in all major rivers and pools.
GREEN SANDPIPER *Tringa ochropus*		W, R	Common winter migrant; found in all major rivers and pools.
WOOD SANDPIPER *Tringa glareola*		W, R	Uncommon winter visitor.
COMMON SANDPIPER *Tringa hypoleucos*		W, R	Common winter visitor.
TEMMINCK'S STINT *Calidris temminckii*		W, R	Common winter migrant (Oct - May).
GREATER PAINTED-SNIPE *Rostratula benghalensis*		W	Rare; presumed resident.
BRONZE-WINGED JACANA *Metopidius indicus*		W	Rare resident.
EURASIAN THICK-KNEE *Burhinus oedicnemus*		G, W	Rare winter visitor.
GREAT THICK-KNEE *Esacus recurvirostris*		W, R	Resident; common along Jia-Bharelli River and tributaries; 16 seen together, Dec 2003.
IBISBILL *Ibidorhyncha struthersii*		R	See text.
LONG-BILLED PLOVER *Charadrius placidus*		R	See text.
LITTLE RINGED PLOVER *Charadrius dubius*		W, R	Common winter migrant.
KENTISH PLOVER *Charadrius alexandrinus*		W, R	Uncommon winter migrant; seen along Jia-Bharelli River and tributaries.
NORTHERN LAPWING *Vanellus vanellus*		D	Passage migrant; flock of <30 birds seen in an open field along park fringe, 20 Nov 2003.
RIVER LAPWING *Vanellus duvaucelii*		W, R	Common resident.
RED-WATTLED LAPWING *Vanellus indicus*		G, W,	Resident; common, but not as numerous as previous species.
ORIENTAL PRATINCOLE *Glareola maldivarum*		R	Rare winter visitor; two seen at Potasali, 15 Feb 2005.
SMALL PRATINCOLE *Glareola lacteal*		R	Common resident; nesting recorded on sandy islets of Jia-Bharelli River; flocks of several hundred birds seen in winter.
BROWN-HEADED GULL *Larus brunnicephalus*		R	Uncommon winter visitor; mainly along Jia-Bharelli River.
BLACK-HEADED GULL *Larus ridibundus*		R	Occasional winter visitor; mainly on Jia-Bharelli River.
RIVER TERN *Sterna aurantia*		W, R	Common resident.
LITTLE TERN *Sterna albifrons*		R	Rare; one record of single bird along Jia-Bharelli River at Potasali, 27 May 2004.
BLACK-BELLIED TERN *Sterna acuticauda*		NT R	See text.
OSPREY *Pandion haliaetus*		R	Regular winter visitor; seen along Jia-Bharelli River.
JERDON'S BAZA *Aviceda jerdoni*		P	Rare resident; singles at Khari, 7 Feb 2005 (and 30 Nov 2003: R. Naoroji in litt. 2004) and Potasali on16 Apr 2004.
BLACK BAZA *Aviceda leuphotes*		S	Breeding migrant; one seen 18 Apr 2002 in Sal (Shorea robusta) forest adjoining the park
ORIENTAL HONEY-BUZZARD *Pernis ptilorhyncus*		S, G, D	Common and widespread resident.
BLACK-SHOULDERED KITE *Elanus caeruleus*		G	Seasonal status unclear; presumed rare resident; one seen in grassland along Khari River, 30 Nov 2003.

TABLE 2. Continued.

Species	Status[a]	Habitat[a]	Notes
BLACK KITE *Milvus migrans*		G, D	Uncommon, seasonal status unclear (all sightings during winter); seen along park fringe and along Jia Bharelli River.
BRAHMINY KITE *Haliastur Indus*		R	Rare; one bird seen at Potasali, 30 Nov 2006.
PALLAS'S FISH EAGLE *Haliaeetus leucoryphus*	VU	R	See text.
WHITE-TAILED EAGLE *Haliaeetus albicilla*		NT R	See text.
LESSER FISH EAGLE *Ichthyophaga humilis*		NT R	See text.
WHITE-RUMPED VULTURE *Gyps bengalensis*		CR S, G, D, A	See text.
SLENDER-BILLED VULTURE *Gyps tenuirostris*		CR S, G, D, A	See text.
RED-HEADED VULTURE *Sarcogyps calvus*		NT S, G, D, A	See text.
SHORT-TOED SNAKE EAGLE *Circaetus gallicus*		S, G	Rare, seasonal status unclear; 0ne along Jia-Bhorelli River at 16th mile, 17 Jan 2003.
CRESTED SERPENT EAGLE *Spilornis cheela*		S, G, D	Common resident throughout area.
HEN HARRIER *Circus cyaneus*		G	Occasional winter visitor; in grasslands along the Jia-Bharelli River and tributaries; also one seen at Bor-Dikorai River at Seijusa, 4 Feb 2005, and one at Potasali, 15 Feb 2003.
PIED HARRIER *Circus melanoleucos*		G	Rare winter visitor; one along Bor-Dikrai River at Seijusa, 4 Feb 2006.
CRESTED GOSHAWK *Accipiter trivirgatus*		P, S	Status unclear, presumabed resident; singles at Khari, 5 - 6 Feb 2004.
SHIKRA *Accipiter badius*		P, S, D	Common resident; commonest hawk in the area.
EURASIAN SPARROWHAWK *Accipiter nisus*		S	Uncommon winter migrant.
NORTHERN GOSHAWK *Accipiter gentilis*		S	Occasional winter visitor.
BLACK EAGLE *Ictinaetus malayensis*		P, S	Uncommon winter visitor; seen at Potasali and Khari.
GREATER SPOTTED EAGLE *Aquila clanga*	VU	S, G	See text.
STEPPE EAGLE *Aquila nipalensis*		S, G	Occasional winter visitor; seen along Jia-Bharelli River.
RUFOUS-BELLIED EAGLE *Hieraaetus kienerii*		P, S	Uncommon but regular winter visitor; adults and juveniles seen Dec–Jan.
CHANGEABLE HAWK EAGLE *Spizaetus cirrhatus*		S, G	Rare; one seen at Potasali, 19 Dec 2003.
MOUNTAIN HAWK EAGLE *Spizaetus nipalensis*		S	Rare, seasonal status unclear; one seen 23 Mar 2004.
PIED FALCONET *Microhierax melanoleucos*		S, D	Uncommon resident, presumed breeder in the park and adjacent areas; singles at Potasali, 29 Dec 2004, 20 Jan 2006 and 2007;.
COMMON KESTREL *Falco tinnunculus*		S, G, D	Common winter migrant; in the park and fringe areas.
AMUR FALCON *Falco amurensis*		S, G, D	Passage migrant; flocks, usually <100 birds, seen early Nov, remaining in the area for about two weeks before moving south. In 2003, birds arrived later than usual (11 Nov, remaining to 18 Nov).
EURASIAN HOBBY *Falco subbuteo*		S	Occasional winter visitor; seen at Potasali, 12 Jan 2004, 10 May 2006.
ORIENTAL HOBBY *Falco severus*			Rare; two on 8 Apr 2001 (Penhallurick 2001).
PEREGRINE FALCON *Falco peregrinus*		S, W	Uncommon but regular winter visitor.
LITTLE CORMORANT *Phalacrocorax niger*		W, R	Common winter visitor; large flocks seen along Jia-Bharelli River.
INDIAN CORMORANT *Phalacrocorax fuscicollis*		R	Rare, seasonal status unclear.

TABLE 2. Continued.

Species	Status[a]	Habitat[a]	Notes
GREAT CORMORANT *Phalacrocorax carbo*		W, R	Common resident; influx of birds during winter indicates part of population migratory. A ring (probably Chinese) was recovered on a bird found along Upper Dikrai River by the Arunachal Pradesh Forest Department. Flocks of 400–500 birds seen regularly in winter along Jia-Bharelli River.
LITTLE EGRET *Egretta garzetta*		W, R	Common resident.
GREY HERON *Ardea cinerea*		R	Rare; seen along Jia-Bhareli River at Potasali, 17 May 2007.
INTERMEDIATE EGRET *Mesophoyx intermedia*		W, R	Common resident; found along Jia-Bharelli River and other water bodies.
CATTLE EGRET *Bubulcus ibis*		W, R	Common resident.
INDIAN POND HERON *Ardeola grayii*		W, R	Common resident.
LITTLE HERON *Butorides striatus*		W, R	Common resident; found throughout area in suitable habitat.
BLACK-CROWNED NIGHT HERON *Nycticorax nycticorax*		W	Rare; seen flying over Potasali, 5 May 2004.
MALAYAN NIGHT HERON *Gorsachius melanolophus*		S, W	Rare migrant; seen in pools and water bodies in dense woodland.
YELLOW BITTERN *Ixobrychus sinensis*		R	Rare; seen along Jia-Bharelli River, 28 Jul 2006.
CINNAMON BITTERN *Ixobrychus cinnamomeus*		W	Rare resident; found in pools and water bodies; sightings more frequent during summer (May - Aug).
ASIAN OPENBILL *Anastomus oscitans*		R	Rare; seen only in winter along Jia-Bharelli River and tributaries.
BLACK STORK *Ciconia nigra*		W, R	Common winter migrant; seen in small numbers (usually 4–5 birds) along Jia-Bharelli River and tributaries, in pools and marshes.
WOOLLY-NECKED STORK *Ciconia episcopus*		W, R	Resident; seen in small numbers throughout the park.
LESSER ADJUTANT *Leptoptilos javanicus*	VU	W, R	See text.
BLUE-NAPED PITTA *Pitta nipalensis*		P, S	Uncommon winter visitor.
HOODED PITTA *Pitta sordida*		P	Rare, presumably a breeding migrant. One juvenile observed in dense semi-evergreen forest at Daphalagarh, 18 Sept 2004.
SILVER-BREASTED BROADBILL *Serilophus lunatus*		P, S	Occasional winter visitor; seen in flocks of five to six birds.
LONG-TAILED BROADBILL *Psarisomus dalhousiae*		P, S	Common winter visitor; seen Oct - Apr.
ASIAN FAIRY BLUEBIRD *Irena puella*		P, S	Common winter visitor; seen Oct - Apr.
BLUE-WINGED LEAFBIRD *Chloropsis cochinchinensis*		P, S	Uncommon resident.
GOLDEN-FRONTED LEAFBIRD *Chloropsis aurifrons*		P, S, D	Common resident.
ORANGE-BELLIED LEAFBIRD *Chloropsis hardwickii*		P, S	Common winter visitor; seen Oct - Apr.
BROWN SHRIKE *Lanius cristatus*		S, G, D	Common winter migrant.
LONG-TAILED SHRIKE *Lanius schach*		G	Rare resident; restricted to grasslands, e.g. along Jia-Bharelli River.
GREY-BACKED SHRIKE *Lanius tephronotus*		S, G, D	Common and widespread winter visitor.
COMMON GREEN MAGPIE *Cissa chinensis*		P, S	Uncommon resident; seen among Laughing Thrushes Garrulax spp.
RUFOUS TREEPIE *Dendrocitta vagabunda*		S, D	Common resident.
GREY TREEPIE *Dendrocitta formosae*		S	Uncommon resident.
LARGE-BILLED CROW *Corvus macrorhynchos*		S, G, D	Common and widespread resident.

TABLE 2. Continued.

Species	Status[a]	Habitat[a]	Notes
ASHY WOODSWALLOW *Artamus fuscus*		S, A	Uncommon resident.
SLENDER-BILLED ORIOLE *Oriolus tenuirostris*		R	Two seen Potasali, 9 Apr 2001 (Penhallurick 2001).
BLACK-HOODED ORIOLE *Oriolus xanthornus*		S, D	Common and widespread resident.
MAROON ORIOLE *Oriolus traillii*		P, S	Common; seen in winter (Oct - Apr).
LARGE CUCKOOSHRIKE *Coracina macei*		S, D	Common resident.
BLACK-WINGED CUCKOOSHRIKE *Coracina melaschistos*		S	Common winter migrant; singles or pairs associate with mixed-species feeding flocks.
SMALL MINIVET *Pericrocotus cinnamomeus*		S	Rare winter visitor.
LONG-TAILED MINIVET *Pericrocotus ethologus*		S	Common winter visitor.
SHORT-BILLED MINIVET *Pericrocotus brevirostris*		S	Common winter visitor.
SCARLET MINIVET *Pericrocotus flammeus*		S	Common winter visitor.
BAR-WINGED FLYCATCHER-SHRIKE *Hemipus picatus*		P, S	Uncommon winter visitor.
YELLOW-BELLIED FANTAIL *Rhipidura hypoxantha*		P, S	Common regular winter visitor; singles seen Oct - Apr.
WHITE-THROATED FANTAIL *Rhipidura albicollis*		P, S	Common winter visitor; singles associate with mixed-species feeding flocks Oct - Apr.
BLACK DRONGO *Dicrurus macrocercus*		G, D	Common resident.
ASHY DRONGO *Dicrurus leucophaeus*		S, D	Common resident.
CROW-BILLED DRONGO *Dicrurus annectans*		P, S	Uncommon resident.
BRONZED DRONGO *Dicrurus aeneus*		P, S	Common resident; found throughout area.
LESSER RACKET-TAILED DRONGO *Dicrurus remifer*		P, S	Common resident.
SPANGLED DRONGO *Dicrurus hottentottus*		P, S, D	Common resident; found throughout area.
GREATER RACKET-TAILED DRONGO *Dicrurus paradiseus*		P, S	Common resident.
BLACK-NAPED MONARCH *Hypothymis azurea*		P, S	Common winter visitor (Oct - May).
ASIAN PARADISE-FLYCATCHER *Terpsiphone paradisi*		P, S	Uncommon summer visitor, e.g. female seen at Bogijuli, 23 May 2005; probably often overlooked.
COMMON IORA *Aegithina tiphia*		S	Common and widespread resident.
LARGE WOODSHRIKE *Tephrodornis gularis*		S	Common winter visitor.
COMMON WOODSHRIKE *Tephrodornis pondicerianus*		S	Uncommon. presumed resident, but seasonal status unclear.
BROWN DIPPER *Cinclus pallasii*		R	Uncommon winter visitor; found upper reaches of Jia-Bharelli River.
BLUE ROCK THRUSH *Monticola solitaries*		R	Common winter visitor; along Jia-Bharelli River and tributaries.
BLUE WHISTLING THRUSH *Myophonus caeruleus*		P, S, D	Common and widespread winter visitor.
ORANGE-HEADED THRUSH *Zoothera citrine*		P, S	Common winter migrant.
LONG-TAILED THRUSH *Zoothera dixoni*		P, S	Rare winter migrant.
SCALY THRUSH *Zoothera dauma*		S	Uncommon winter visitor.
DARK-SIDED THRUSH *Zoothera marginata*		P	Rare; one seen at Potasali, Dec 2006.
BLACK-BREASTED THRUSH *Turdus dissimilis*		P, S	Rare but regular winter visitor, inhabiting forest edges and clearings; also recorded by Hendriks (1998: a male on 16 Mar 1998 and a pair on 17 Mar 1998), and by Dymond (1998), 25–27 Nov 1998.

TABLE 2. Continued.

Species	Status[a]	Habitat[a]	Notes
EURASIAN BLACKBIRD *Turdus merula*		S	Rare; one seen at Seijusa in secondary forest, 1 Mar 2004.
DARK-THROATED THRUSH *Turdus ruficollis*		S, G	Rare; two birds, subspecies ruficollis, seen at Potasali, 14 Feb 2005.
WHITE-BROWED SHORTWING *Brachypteryx Montana*		P	Uncommon winter migrant.
ASIAN BROWN FLYCATCHER *Muscicapa dauurica*		S	Uncommon winter visitor; one at Potasali, 30 Nov 2006 and one at Khari 5-7 Feb 2007.
SLATY-BACKED FLYCATCHER *Ficedula hodgsonii*		S	Uncommon winter visitor; seen at Khari, 5–7 Feb 2004, and at Potasali, 20 February 2004.
RUFOUS-GORGETED FLYCATCHER *Ficedula strophiata*		P	Uncommon winter visitor.
RED-THROATED FLYCATCHER *Ficedula parva*		P, S, D	Common and widespread winter visitor.
SNOWY-BROWED FLYCATCHER *Ficedula hyperythra*		P, S	Common winter visitor.
LITTLE PIED FLYCATCHER *Ficedula westermanni*		P, S, D	Common winter visitor; usually seen singly.
SLATY-BLUE FLYCATCHER *Ficedula tricolor*		S, G	Uncommon winter visitor.
VERDITER FLYCATCHER *Eumyias thalassina*		S, D	Common winter visitor.
LARGE NILTAVA *Niltava grandis*		P, S	Common winter visitor.
SMALL NILTAVA *Niltava macgrigoriae*		P, S	Common resident.
RUFOUS-BELLIED NILTAVA *Niltava sundara*		P, S	Occasional winter visitor.
PALE-CHINNED FLYCATCHER *Cyornis poliogenys*		P, S	Common resident; one of area's commonest flycatchers.
PALE BLUE FLYCATCHER *Cyornis unicolor*		P	Uncommon but regular winter visitor.
HILL BLUE FLYCATCHER *Cyornis banyumas*		P	Rare winter visitor; one at Potasali, 16 Jan 1998 (Barua and Sharma 1999).
PYGMY BLUE FLYCATCHER *Muscicapella hodgsoni*		P, S	Uncommon but regular winter visitor.
GREY-HEADED CANARY FLYCATCHER *Culicicapa ceylonensis*		P, S, D	Common and widespread winter migrant; seen Sept - Apr.
SIBERIAN RUBYTHROAT *Luscinia calliope*		S	Common winter visitor.
RUFOUS-BREASTED BUSH ROBIN *Tarsiger hyperythrus*		P	Rare; three seen near Upper Dikorai, 2 Dec 2003.
ORIENTAL MAGPIE ROBIN *Copsychus saularis*		S, D	Common resident.
WHITE-RUMPED SHAMA *Copsychus malabaricus*		P, S	Common resident.
BLACK REDSTART *Phoenicurus ochruros*		S, G, R	Common winter visitor.
HODGSON'S REDSTART *Phoenicurus hodgsoni*		S, R	Rare but regular winter migrant; found in secondary growth along Jia-Bharelli River and tributaries.
DAURIAN REDSTART *Phoenicurus auroreus*		S, D	Regular winter visitor; seen singly or in pairs in secondary/degraded forest.
WHITE-CAPPED WATER REDSTART *Chaimarrornis leucocephalus*		R	Common winter visitor; found along Jia-Bharelli River and tributaries as well as in fast-flowing streams.
PLUMBEOUS WATER REDSTART *Rhyacornis fuliginosus*		R	Common winter migrant; found along fast-flowing streams and rivers.
WHITE-TAILED ROBIN *Myiomela leucura*		P, S	Uncommon winter visitor.
LITTLE FORKTAIL *Enicurus scouleri*		R	Rare winter visitor; seen on Nameri River and along Chotai Nala.
BLACK-BACKED FORKTAIL *Enicurus immaculatus*		R	Common winter visitor.
WHITE-CROWNED FORKTAIL *Enicurus leschenaulti*		R	Rare winter visitor; recorded from Seijusa.
SPOTTED FORKTAIL *Enicurus maculates*		P, R	Rare winter visitor; seen at Nameri and Upper Dikrai.
COMMON STONECHAT *Saxicola torquata*		S, G	Common resident, with a migrant winter population.

TABLE 2. Continued.

Species	Status[a]	Habitat[a]	Notes
GREY BUSHCHAT *Saxicola ferrea*		S, D	Common winter visitor; found singly or in pairs in secondary growth.
CHESTNUT-TAILED STARLING *Sturnus malabaricus*		S, D	Common and widespread resident.
ASIAN PIED STARLING *Sturnus contra*		S, G, D	Common resident.
COMMON MYNA *Acridotheres tristis*		S, G, D	Common resident.
BANK MYNA *Acridotheres ginginianus*		R	Resident; breeds on sand banks of Jia-Bharelli River.
JUNGLE MYNA *Acridotheres fuscus*		S, G, D	Common and widespread resident.
WHITE-VENTED MYNA *Acridotheres cinereus*		S, G, D	Resident; commonly seen Apr onwards during breeding; scarce in winter.
HILL MYNA *Gracula religiosa*		P, S, D	Common resident; found throughout area.
SPOT-WINGED STARLING *Saroglossa spiloptera*		S	Migrant; small numbers seen regularly in Jul, large flocks (>1,000 birds) are seen when Simul (Bombax ceiba) trees flower, Jan - Mar.
CHESTNUT-BELLIED NUTHATCH *Sitta castanea*		P, S	Common resident.
VELVET-FRONTED NUTHATCH *Sitta frontalis*		S	Common resident.
GREAT TIT *Parus major*		S, D	Common resident.
SULTAN TIT *Melanochlora sultanea*		P, S	Common winter visitor; flocks seen Oct - Apr.
SAND MARTIN *Riparia riparia*		A	Rare resident.
PLAIN MARTIN *Riparia paludicola*		A	Common resident; nests along Jia-Bharelli River and tributaries.
BARN SWALLOW *Hirundo rustica*		A	Common resident.
RED-RUMPED SWALLOW *Hirundo daurica*		A	Uncommon; seasonal status unclear.
ASIAN HOUSE MARTIN *Delichon dasypus*		A	Rare winter migrant; flock of 20 seen along Bor-Dikorai River (Seijusa), 5 Feb 2004.
BLACK-CRESTED BULBUL *Pycnonotus melanicterus*		S	Common resident.
RED-WHISKERED BULBUL *Pycnonotus jocosus*		S, G, D	Common, widespread resident.
RED-VENTED BULBUL *Pycnonotus cafer*		S, G, D	Common, widespread resident; ubiquitous.
WHITE-THROATED BULBUL *Alophoixus flaveolus*		P, S	Common resident.
ASHY BULBUL *Hemixos flavala*		P, S	Common winter visitor.
MOUNTAIN BULBUL *Hypsipetes mcclellandii*		P, S	Rare winter visitor.
BLACK BULBUL *Hypsipetes leucocephalus*		P, S	Common winter visitor; influx during Jan - Mar when Simul trees flower.
ZITTING CISTICOLA *Cisticola juncidis*		G	Resident; found in grasslands along Jia-Bharelli River.
PLAIN PRINIA *Prinia inornata*		G	Uncommon resident; found in grassland along Jia-Bharelli River and Elsewhere.
ORIENTALWHITE-EYE *Zosterops palpebrosus*		P, S, D	Common, widespread resident; seen in large flocks or associated with other species.
CHESTNUT-HEADED TESIA *Tesia castaneocoronata*		P, S	Common winter visitor.
SLATY-BELLIED TESIA *Tesia olivea*		P, S	Common winter visitor; recorded less frequently than the following species.
GREY-BELLIED TESIA *Tesia cyaniventer*		P, S	Common winter visitor.
BROWNISH-FLANKED BUSH WARBLER *Cettia fortipes*		S	Uncommon but regular winter visitor.
SPOTTED BUSH WARBLER *Bradypterus thoracicus*			Recorded 25–27 Nov 1998 (Dymond 1998).
RUSSET BUSH WARBLER *Bradypterus seebohmi*		S, G	At Potasali one on 3 Dec 1996, two on 23 Mar 1997; also recorded 25–27 Nov 1998 (Dymond 1998).

TABLE 2. Continued.

Species	Status[a]	Habitat[a]	Notes
BLYTH'S REED WARBLER *Acrocephalus dumetorum*		G	Uncommon winter migrant; found in grasslands along Jia Bharelli River and tributaries.
THICK-BILLED WARBLER *Acrocephalus aedon*		S, G	Winter migrant; seen regularly in secondary growth, degraded woodland.
MOUNTAIN TAILORBIRD *Orthotomus cuculatus*		P, S	Uncommon winter visitor.
COMMON TAILORBIRD *Orthotomus sutorius*		P, S, D	Common resident.
DUSKY WARBLER *Phylloscopus fuscatus*		S, G	Common winter migrant; found singly in grasslands and secondary growth.
SMOKY WARBLER *Phylloscopus fuligiventer*		G	Uncommon winter migrant; found in grasslands and secondary growth along margins of pools.
TICKELL'S LEAF WARBLER *Phylloscopus affinis*		S	Common winter migrant.
LEMON-RUMPED WARBLER *Phylloscopus chloronotus*		P	Occasional winter visitor.
YELLOW-BROWED WARBLER *Phylloscopus inornatus*		P, S	Common, widespread winter migrant.
GREENISH WARBLER *Phylloscopus trochiloides*		P, S, D	Common, widespread winter migrant, throughout area.
LARGE-BILLED LEAF WARBLER *Phylloscopus magnirostris*		P, S	Uncommon winter visitor; seen in small numbers, usually associated with mixed-species feeding flocks.
BLYTH'S LEAF WARBLER *Phylloscopus reguloides*		P, S	Common winter migrant; f;ocks of 10–15 associated with mixed-species feeding flocks and other Phylloscopus spp. warblers.
YELLOW-VENTED WARBLER *Phylloscopus cantator*		P, S	Common winter visitor; seen Nov - Apr in flocks (usually 5–10 birds), associated with mixed-species feeding flocks.
GOLDEN-SPECTACLED WARBLER *Seicercus burkii*		P, S	Common resident; seen singly or in flocks (ca. 5 birds), associated with mixed-species feeding flocks.
GREY-HOODED WARBLER *Seicercus xanthoschistos*		P	Rare; two seen at Nameri, 24 Feb 2004.
WHITE-SPECTACLED WARBLER *Seicercus affinis*		P, S	Common winter migrant.
GREY-CHEEKED WARBLER *Seicercus poliogenys*		P, S	Uncommon winter visitor.
CHESTNUT-CROWNED WARBLER *Seicercus castaniceps*		P, S	Common winter visitor. Singles seen in association with mixed flocks of Phylloscopus spp. warblers, etc.
STRIATED GRASSBIRD *Megalurus palustris*		G	Common resident; found in grasslands along Jia-Bharelli River as well as in other areas.
LESSER NECKLACED LAUGHINGTHRUSH *Garrulax monileger*		P, S	Common resident.
GREATER NECKLACED LAUGHINGTHRUSH *Garrulax pectoralis*		P, S	Common resident; both Lesser and Greater Necklaced Laughing thrushes associate with one another and with Common Green Magpie.
RUFOUS-NECKED LAUGHINGTHRUSH *Garrulax ruficollis*		S	Rare, presumed resident; flock seen at Nameri, 18 Mar 2003.
RED-FACED LIOCICHLA *Liocichla phoenicea*		P	Uncommon winter visitor; seen in well-wooded areas towards northern park boundary with Arunachal Pradesh.
ABBOTT'S BABBLER *Malacocincla abbotti*		P, S	Common resident.
SPOT-THROATED BABBLER *Pellorneum albiventre*		P	Rare.
PUFF-THROATED BABBLER *Pellorneum ruficeps*		P, S, D	Common resident.
WHITE-BROWED SCIMITAR BABBLER *Pomatorhinus schisticeps*		S	Common resident; recorded from northern park areas bordering Arunachal Pradesh.

TABLE 2. Continued.

Species	Status[a]	Habitat[a]	Notes
PYGMY WREN BABBLER *Pnoepyga pusilla*		P	Uncommon winter migrant; recorded from well-wooded, northern park areas bordering Arunachal Pradesh.
RUFOUS-FRONTED BABBLER *Stachyris rufifrons*		S	Uncommon winter visitor.
RUFOUS-CAPPED BABBLER *Stachyris ruficeps*		S	Common winter visitor.
GREY-THROATED BABBLER *Stachyris nigriceps*		P, S	Common winter visitor.
STRIPED TIT BABBLER *Macronous gularis*		P, S	Common, widespread resident in primary and secondary forest.
STRIATED BABBLER *Turdoides earlei*		G	Uncommon resident; restricted to grasslands along Jia-Bharelli River and tributaries.
JUNGLE BABBLER *Turdoides striatus*		S A	Status unclear; few seen in Oct 2003 and 10–15 seen 3 Dec 2006 at Potasali in a fringe area west of the river Jia-Bharelli. Presumably distribution in Assam strictly linked to that of Sal (Shorea robusta)forest.
JERDON'S BABBLER *Chrysomma altirostre*	VU	G	One bird recorded 25–30 Jan 2004 (Robson 2004).
SILVER-EARED MESIA *Leiothrix argentauris*		P	Common winter visitor.
BLACK-EARED SHRIKE BABBLER *Pteruthius melanotis*		P	Rare migrant; single record in winter 1998.
BLUE-WINGED MINLA *Minla cyanouroptera*		P	Uncommon, regular winter migrant; seen singly associated with mixed-species feeding flocks.
BROWN-CHEEKED FULVETTA *Alcippe poioicephala*		S	Uncommon, seasonal status unclear; five seen at Khari, 6 Feb 2006.
NEPAL FULVETTA *Alcippe nipalensis*		P, S	Common winter migrant; seen in flocks of 5–10 birds.
RUFOUS-BACKED SIBIA *Heterophasia annectans*		P	Rare; seen at Nameri, 17 Jan 2003.
LONG-TAILED SIBIA *Heterophasia picaoides*		P	Common winter migrant.
WHITE-BELLIED YUHINA *Yuhina zantholeuca*		P	Regular, uncommon winter visitor; seen associated with mixed-species feeding flocks.
RUFOUS-WINGED LARK *Mirafra assamica*		G	Common resident.
HUME'S SHORT-TOED LARK *Calandrella acutirostris*		G	Rare; one seen along Jia-Bharelli River at Potasali, 29 Nov2005. No recent published records.
SAND LARK *Calandrella raytal*		G	Uncommon resident; found along sandy islet tracts of Jia-Bharelli River.
ORIENTAL SKYLARK *Alauda gulgula*		G	Common winter visitor.
THICK-BILLED FLOWERPECKER *Dicaeum agile*		P, S	Uncommon resident.
YELLOW-VENTED FLOWERPECKER *Dicaeum chrysorrheum*		P, S	Uncommon resident.
YELLOW-BELLIED FLOWERPECKER *Dicaeum melanoxanthum*		P	See text.
PLAIN FLOWERPECKER *Dicaeum concolor*		P, S	Uncommon resident.
SCARLET-BACKED FLOWERPECKER *Dicaeum cruentatum*		P, S, D	Common resident.
RUBY-CHEEKED SUNBIRD *Anthreptes singalensis*		P, S	Common resident.
PURPLE SUNBIRD *Nectarinia asiatica*		D	Rare resident.
BLACK-THROATED SUNBIRD *Aethopyga saturata*		P, S	Common winter visitor.
CRIMSON SUNBIRD *Aethopyga siparaja*		P, S, D	Common resident.
LITTLE SPIDERHUNTER *Arachnothera longirostra*		P, S	Common resident.
STREAKED SPIDERHUNTER *Arachnothera magna*		P, S	Common; found throughout area in primary and secondary forest in Winter, Oct - Apr.
HOUSE SPARROW *Passer domesticus*		D	Common resident; in fringe areas.

TABLE 2. Continued.

Species	Status[a]	Habitat[a]	Notes
EURASIAN TREE SPARROW *Passer montanus*		D	Common resident; in fringe areas.
WHITE WAGTAIL *Motacilla alba*		G, W, R, D	Common winter migrant; seen Sept - Apr.
CITRINE WAGTAIL *Motacilla citreola*		W, R	Common winter migrant.
GREY WAGTAIL *Motacilla cinerea*		W, R	Uncommon winter migrant.
RICHARD'S PIPIT *Anthus richardi*		G	Rare.
PADDYFIELD PIPIT *Anthus rufulus*		G	Common resident.
TAWNY PIPIT *Anthus campestris*		G	Uncommon migrant.
OLIVE-BACKED PIPIT *Anthus hodgsoni*		S, G	Common winter migrant; flocks of 10–15 birds seen throughout area.
RED-THROATED PIPIT *Anthus cervinus*		G	Recorded 25–27 Nov 1998 (Dymond 1998), as first records for Assam.
ROSY PIPIT *Anthus roseatus*		G, W	Common winter visitor; in wet areas in and around water.
STREAKED WEAVER *Ploceus manyar*		D	Uncommon resident; in fringe areas.
BAYA WEAVER *Ploceus philippinus*		D	Uncommon resident; in fringe areas.
WHITE-RUMPED MUNIA *Lonchura striata*		S, G, D	Common resident.
SCALY-BREASTED MUNIA *Lonchura punctulata*		D	Rare resident.
BLACK-HEADED MUNIA *Lonchura Malacca*		D	Rare resident.

[a] KEY TO ABBREVIATIONS:
CR = Critically Endangered.
EN = Endangered.
VU = Vulnerable.
NT = Near Threatened.
P = Primary forest (relatively intact, with a closed canopy that has remained undisturbed and unmodified by human activity).
S = Secondary forest (with an open canopy regenerating naturally after human and/or natural disturbance).
G = Grasslands (various serial stages of riverine grasslands including short grass on sandy islets through to areas being colonised by trees).
W = Water bodies (stagnant pools, marshes etc.).
R = Rivers and streams.
D = Disturbed areas (cultivation, settlements etc. in the fringe areas of the park).
A = Aerial.

Bird Populations 10:56-64

ISSUES ARISING FROM CHANGES IN WATERBIRD POPULATION ESTIMATES IN COASTAL GHANA[1]

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Abstract. Reported in this paper are waterbird census data collected from four coastal wetlands in Ghana over a period of 16 mo, with extrapolations made to indicate possible changes in population trends and bird distribution in the study area. Results indicated that Ramsar sites continue to play invaluable roles in the support of waterbirds on the coast of Ghana despite the presence of waterbird species on a large number of smaller, unmanaged wetlands. On the other hand, results also indicate that waterbird populations and distributions in Ghana, as reported previously, have changed. The need for conservation action for the waterbird species in Ghana increased with respective dependency on unmanaged wetlands, with 56% of species possibly affected.
Key words: Ghana, population changes, Ramsar sites, wetland birds.

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INTRODUCTION

The coast of Ghana falls within the boundary of two major waterbird migration corridors: the East Atlantic and the Mediterranean flyways (Jan et al. 2004). The 550km coast has about one hundred wetlands, mainly associated with estuaries and lagoons and essentially non-tidal (Ryan 2005, Ntiamoa-Baidu 1991). The importance of coastal wetlands in Ghana as habitats for resident and migratory waterbirds has been noted previously (Ntiamoa-Baidu 1988, 1991; Ntiamoa-Baidu and Herpburn 1988; Ntiamoa-Baidu et al. 2000).

Preliminary surveys of the entire coast of

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Ghana by staff of the Ghana Game and Wildlife Department (aided by British ornithologists), in November 1985 and January 1986, indicated that 13 of ~100 wetlands held ~80% of Ghana coastal terns, 85% of waders and 95% of herons (Ntiamoa-Baidu 1991). Eight of these 13 wetlands, namely Keta Lagoon, Songor Lagoon complex, Sakumo Lagoon, Densu Delta, Muni Lagoon, Elmina Saltpans, Korle Lagoon and Esiama Beach, were considered to be of international importance to waterbirds. On the merit of their importance as waterbird habitats, the first five were designated as Ramsar sites in 1992 (Ntiamoa-Baidu and Herpburn 1988, Ntiamoa-Baidu 1991).

Despite the extent of knowledge on bird migration and wader populations worldwide, several gaps exist for West African areas, including lack of current data and the restriction of most studies to a few large sites such as Banc d' Arguin in Mauritania and the Keta Lagoon in Ghana (Piersma et al. 1990, Piersma and Ntiamoa-Baidu 1995, Ntiamoa-Baidu et al 1998, Zwart and Piersma 1990). Previous reports, i.e. Ntiamoa-Baidu (1988, 1991), Ntiamoa-Baidu and Herpburn (1988), and Ntiamoa-Baidu et al. (2000), are quickly becoming irrelevant, needing desperately to be updated with current data, particularly in the context of frequent reports of the loss of wetlands and their qualities. According to Attuquayefio and Gbogbo (2001), most non-Ramsar sites in coastal Ghana are publicly owned, unmanaged or unregulated resources. Gordon et al. (1998) reported a number of non-Ramsar wetlands such as Korle, Chemu, Teshie and Kpeshie, Fosu and Benya lagoons to be polluted and no longer supporting bird life. Indiscriminate fishing, hunting of waterbirds, sewage disposal, cutting of mangroves and farming have been identified as the major human activities contributing to this alteration of these non-Ramsar sites (Attuquayefio and Gbogbo 2001).

In contrast, Ramsar sites on the coast receive conservation attention including the implementation of civil works to minimise the impact of problems, the construction of trails and bird observation points, the presence of wardens to ensure general law enforcement and the prevention of bird hunting, restrictions on the use of drag nets for fishing and the institution of closed fishing seasons. Nevertheless, discrepancies also exist in the nature and quality of coastal Ramsar sites. Available records indicate that between 1992 and 2007, the total area of Densu Delta, for instance, was reduced from 58.9 km^2 to 46.2 km^2 by encroachment (Amankwah 1998, Wetland International 2007).

The evidence that physical and chemical properties of wetlands on the coast of Ghana continue to change indicate that changes in waterbird populations could occur and these need to be documented to enhance the management of wetland and waterbirds. Comprehensive waterbird studies in this area demand the commitment of huge financial and human resources that may not readily be available. Nevertheless, imprecise but useful population trends can be deduced if studies are carried out on a limited number of wetlands to be used as an index (Howe 1998). In that regard, the waterbird numbers of four coastal wetlands are reported and discussed in this paper.

METHODS

STUDY AREA

The study was carried out at four coastal wetlands in Ghana: Densu Delta and Sakumo, Mukwe and Laiwi lagoons. Densu Delta (5º31'N, 0º20'W), a Ramsar site, constitutes the lower reaches of Densu River's water course where it joins the Gulf of Guinea. It provides a significant sanctuary for resident and migratory waterbirds, having an estimated 57 species and 35,000 individual waterbirds (Grimble et al. 1998). The vegetation is dominated by *Avicennia africana, Sesuvium portulacastrum, Paspalum vaginatum, Sporobolus virginicus, Cyperus articulatus* and *Imperata cylindrica* (Oteng-Yeboah 1999). Sakumo Lagoon (5º37'N, 0º02'W), also a Ramsar site, had a cover of 13.6 km^2 in 1992 but which was reduced to 13.4 km^2 by 2007 (Amankwah 1998, Wetland International 2007). It is the third most important site for shorebirds along the coast of Ghana (Anku 2006). Its vegetation consists mainly of *Paspalum vaginatum, Sesuvium portulacastrum, Philoxerus vermicularis,* and *Typha australis* with scanty remains of Avicennia africana (Oteng-Yeboah 1999).

Mukwe Lagoon (5º36'N, 0º03W) has a total land area of 2.6 km^2. Its vegetation consists of

Avicennia africana interspersed with *Cyperus articulatus, Paspalum vaginatum* and *Azadirachta indica* (Attuquayefio and Gbogbo 2001). Laiwi Lagoon (5º42'N, 0º04'E) is 7.5 km² in extent and has *Avicennia africana, Sesuvium portulacastrum* and *Philoxerus vermicularis* as the main components of its vegetation. Mukwe and Laiwi lagoons are two of the many small non-Ramsar sites on the Ghana coast that are publicly owned. The only management at Mukwe and Laiwi lagoons is a customary regulation that forbids people from fishing on Fridays and Tuesdays, respectively.

SURVEY METHODS

The total area of each wetland was divided into sectors with the aid of natural and artificial features that serve as land marks. By walking along designated routes through each sector, the number of individuals of each waterbird species was recorded monthly between September 2008 to April 2009 and September 2009 to April 2010, which are non-breeding seasons. Counting was done in the third quarter of each month during low tide using the naked eye, binoculars (8 x 42mm) and a telescopes (zoom 20-60) mounted on tripods. To minimize the incidence of double counting, birds seen flying were not counted (Bibby et al. 2000). Data from the various sectors for each species were compiled after every counting session to obtain the total number of individuals on the various wetlands.

DATA ANALYSIS

Data were separated between Ramsar and non-Ramsar sites. The number of each waterbird species on the Ramsar and non-Ramsar sites was divided by the species total number and multiplied by 100 to obtain an estimate of Relative Abundance (RA).

Thus,

$$RA_R = \frac{N_R \times 100}{N_R + N_{NR}}, \text{ and}$$

$$RA_{RN} = \frac{N_{NR} \times 100}{N_R + N_{NR}},$$

where RA_R = relative abundance of species *i* on the Ramsar sites, N_R = total number of species *i* on the Ramsar sites, N_{NR} = total number of species *i* on the non-Ramsar sites and RA_{NR} = relative abundance of species *i* on the non-Ramsar sites. On the basis that the Ghana coast has ~100 wetlands of which five are managed as Ramsar sites, the number of waterbirds of each species that the five Ramsar sites might support was extrapolated from the number counted on the two Ramsar sites, given that

$$E_R = \frac{5\, N_R}{2}$$

where E_R = the extrapolated number of waterbirds of species *i* that the 5 Ramsar sites in coastal Ghana might support.

Similarly, the number of waterbirds of each species that the 95 non-Ramsar sites might support was extrapolated from the number of waterbirds on the two non-Ramsar sites surveyed, such that

$$E_{NR} = \frac{95\, N_{NR}}{2},$$

where E_{NR} = the extrapolated number of waterbirds of species *i* of the 95 non-Ramsar sites. The number of non-Ramsar sites needed to support the equivalence of E_R (W_{NR}) was calculated for each species of waterbird given that

$$W_{NR} = E_R \,/\, (N_{NR} \div 2).$$

The percentage bird representation on the Ramsar sites (E_{BR}), signifying the number of birds on the Ramsar sites as a fraction of the total number of birds on Ghana's coastal wetlands, was calculated for each species. Thus,

$$E_{BR} = \frac{E_R \times 100.}{E_R + E_{NR}}$$

On the basis of W_{NR} and E_{BR}, the waterbirds were put into 6 categories as follows:

Category 1. Species found solely on the Ramsar sites whose E_{BR} was 100% and W_{NR} was undetermined.

Category 2. Species for which the total number of non-Ramsar wetlands needed to support the bird equivalence E_R is greater than the numbers that exist on the coast. Thus calculated W_{NR} is >95.

Category 3. Species for which the total number of non-Ramsar wetlands needed to support the bird equivalence E_R was lying between 51% and 100% of the total number of non-Ramsar wetlands on the coast. Thus W_{NR} lies between 48 and 95.

Category 4. Species for which the total number of non-Ramsar wetlands needed to support the bird equivalence E_R lies between 21% and 50% of

the total number of non-Ramsar wetlands on the coast. Thus W_{NR} lies between 20 and 47.

Category 5. Species for which the total number of non-Ramsar small-scale wetlands needed to support the bird equivalence E_R lies between 1% and 20% of the total number of non-Ramsar wetlands existing on the coast. Thus W_{NR} lies between 1 and 19.

Category 6. Species found solely on the non-Ramsar sites whose EBR were 0% and their WNR is undetermined.

RESULTS

A total of 48 species of waterbirds were recorded over the 16-mo period of study (see Table 1). Excepting Wood Sandpiper, Black Heron, White-fronted Plover, Common Moorhen, Senegal Thick-knee and Greater Painted Snipe, which had an RA_{RN} >50%, all other species had R_{AR} >50% indicating general species preference for the Ramsar sites. However, as many as 36 species of waterbirds, representing 75% of the total number of species, had an E_{NR} greater than their E_R (Table 2). Subsequently these 36 species had an E_{BR} <50% leaving only 25% of the waterbird species to have E_{BR} of 50% or greater.

Analysis of the values for W_{NR} and E_{BR} further indicated that waterbird species, namely African Skimmer, African Spoonbill, Ruff, Bar-tailed Godwit and Little Bittern, constituting 10.4% of species, occurred solely on the Ramsar sites (Table 2). These five species fall under Category 1 of the set criteria. The numbers of individuals among Category 1 species (Table 1), as well as the numbers extrapolated for the five Ramsar sites (Table 2), were generally low.

In addition, waterbird species occurring within the range of Roseate and Royal terns fell within Category 2 (Table 2). These Category 2 species represented 12.5% of the total number of species; they needed 100 to 885 non-Ramsar small-scaled wetlands to hold the equivalent of bird numbers occurring on the five managed wetlands. Thus these species are well represented on the Ramsar sites, with prevalence ranging from 90.3% for Roseate Terns to 51.4% for Royal Terns.

Species within the range of Black-tailed Godwit and White-back Night Heron, representing 16.6% of species, fell within Category 3 (Table 2). These species need 48 to 95 non-Ramsar small-scale wetlands to support equivalent numbers estimated for the five Ramsar sites. Between 50.1% and 36% of their numbers occurred on the Ramsar sites. Similarly, bird species falling within Category 4 had between 16.3% and 32.7% of their population on the Ramsar sites. Category 4 species include those within the range of Collared Pratincole and Spotted Redshank (Table 2). They constituted 25% of the bird species and needed 20 to 47 non-Ramsar wetlands to support numbers equivalent to those on the five Ramsar sites.

The proportion of birds that fell within Category 5 constituted 31% of species. Category 5 comprises species within the range of Common Redshank and Senegal Thick-knee (Table 2). These species need between 1 and 19 non-Ramsar wetlands to support numbers equivalent to those of the five Ramsar sites. Between 0.7% and 16% of the total occurrence of species in Category 5 was estimated to be on Ramsar sites. Only one species, *Rostratulla benghalensis* (2.1% of species), fell within Category 6.

DISCUSSION

The selection of wetlands for consideration as Ramsar sites in Ghana was based mainly on the merits of the wetlands as waterbird habitats. The fact that 87.5% of the waterbird species recorded R_{AR} >50%, once again, highlighted the importance of Sakumo and Densu Delta Ramsar sites in the support of waterbirds. This, therefore, confirmed that Ramsar sites play invaluable roles in the support of waterbirds on the coast of Ghana. Most non-Ramsar sites on the Ghana coast are small relative to the Ramsar sites. The observation that only 12.5% of species have their RA_{NR} greater than their R_{AR}, therefore, supports the report of Peterjohn and Sauer (1997) that wetlands that are small play a minimal role in the support of waterbird species in this area.

On the other hand, given that coastal Ghana has a large number of small-sized but unmanaged wetlands that are non-Ramsar sites, comparison of the values of E_R and E_{NR} indicates that the dependency of waterbird species on the non-Ramsar sites is ecologically important. The E_{NR} values for 39 species were greater that their E_R, rendering ~81% of the species to score E_{BR}

TABLE 1. Data on waterbird counts on four coastal Wetlands in Ghana .

Species Name	Common Name	Maximum number recorded at any one time				Species Abundance (%)		Total number of birds
		Densu Delta	Sakumo Lagoon	Mukwe Lagoon	Laiwi Lagoon	Non-Ramsar site	Ramsar site	
Actitis hypoleucos	Common Sandpiper	57	15	116	45	74.9	25.1	1313
Actophilornis africanus	Jacana	10	80	46	0	37.4	62.6	321
Ardea cinerea	Grey Heron	306	157	2	65	7.7	2.3	2875
Ardea pururea	Purple Heron	2	5	1	0	4.5	95.5	44
Ardeola ralloides	Squacco Heron	76	24	9	0	12.8	87.2	374
Arenaria interpres	Ruddy Turnstone	42	30	23	40	34	66	409
Burhinus senegalensis	Senegal Thick-knee	0	8	6	5	88.6	11.4	70
Butorides straitus	Green-back Heron	12	2	8	5	47.1	52.9	102
Calidris alba	Sanderling	831	458	32	376	27	73	6863
Calidris ferruginea	Curlew Sandpiper	3294	1673	40	696	19.3	80.7	18447
Calidris minuta	Little Stint	890	247	14	200	14.6	85.4	8363
Charadrius hiaticula	Common Ringed Plover	1860	904	125	1071	24.7	75.3	23263
Charadrius marginatus	White-fronted Plover	3	5	0	31	76.2	23.8	126
Charadrius pecuarius	Kettliz's Plover	25	83	2	64	23.6	76.4	853
Clidonias niger	Black Tern	4959	172	0	280	5.6	94.4	17931
Dendrocygna viduata	White-faced Whistling Duck	9	425	0	16	0.7	99.3	2340
Egretta alba	Great White Egret	240	184	3	18	5.9	94.1	2182
Egretta ardesiaca	Black Heron	186	36	0	0	63.9	36.1	654
Egretta garzetta	Little Egret	1170	603	29	368	12.5	87.5	15696
Egretta gularis	Western Reef Heron	420	300	6	59	6.9	93.1	5716
Egretta intermedia	Yellow billed Egret	23	30	8	1	11.3	88.7	238
Gallinula chloropus	Common Moorhen	6	9	9	3	66.7	33.3	93
Glareola pratincola	Collared Pratincole	206	380	58	75	9.8	90.2	3411
Gorsachius leuconotus	White-back Night Heron	2	13	3	0	8.6	91.4	35
Himantopus himantopus	Black-winged Stilt	1230	1031	118	263	15.6	84.4	14614
Ixobrychus minutus	Little Bittern	2	1	0	0	0	100	8
Limosa lapponica	Bar-tailed Godwit	7	4	1	6	60	40	60
Limosa limosa	Black-tailed Godwit	0	187	0	31	5	95	622
Numenius arquata	Eurasian Curlew	55	2	0	8	19.1	80.9	131
Numenius phaeopus	Whimbrel	200	20	15	68	25	75	1302

TABLE 1. Continued .

Species Name	Common Name	Maximum number recorded at any one time				Species Abundance (%)		Total number of birds
		Densu Delta	Sakumo Lagoon	Mukwe Lagoon	Laiwi Lagoon	Non-Ramsar site	Ramsar site	
Phalacrocorax africanus	Long-tailed Cormorant	1562	56	5	36	1.2	98.8	7765
Philomachus pugnax	Ruff	0	71	0	0	0	100	455
Platalea alba	African Spoonbill	0	11	0	0	0	100	61
Pluvialis squatarola	Grey Plover	142	77	22	69	30	70	1830
Rostratulla benghalensis	Greater Painted Snipe	0	0	2	0	100	0	5
Rynchops flavirostris	African Skimmer	128	0	0	0	0	100	320
Sterna albifrons	Little Tern	714	614	0	92	6.3	93.7	3408
Sterna dougallii	Roseate Tern	1742	24	0	8	0.6	99.4	2314
Sterna hirundo	Common Tern	5869	696	0	1488	7	93	35653
Sterna maxima	Royal Tern	4076	350	0	219	4.7	95.3	11773
Sterna sandvicensis	Sandwich Tern	3783	323	0	81	0.9	99.1	22629
Tringa erythropus	Spotted Redshank	206	450	0	289	20	80	3466
Tringa glareola	Wood Sandpiper	29	44	210	1	81	19	1663
Tringa nebularia	Greenshank	715	718	45	796	27.2	72.8	13597
Tringa stagnatilis	Marsh sandpiper	206	64	15	18	17.4	82.6	442
Tringa tetanus	Common Redshank	10	13	3	3	21.2	78.8	146
Vanellus senegallus	Wattled Plover	35	54	10	8	18.6	81.4	355
Vanellus spinosus	Spur-winged Plover	58	138	20	71	17.4	82.6	1375

TABLE 2: Estimated waterbird numbers for Ghana's coastal wetlands based on counts on two Ramsar and two non-Ramsar sites.

Cat	Name	Extrapolated number of of waterbirds on the 5 Ramsar wetlands (E_R)	Extrapolated number on the 95 non-Ramsar wetlands (E_{NR})	Extrapolated number of non-Ramsar wetlands holding equivalent numbers of waterbirds extrapolated for the 5 Ramsar sites (W_{NR})	Percentage bird representation on the Ramar sites (E_{BR})
I	African Skimmer	575	0	-	100%
	African Spoonbill	152	0	-	100%
	Ruff	1137.5	0	-	100%
	Bar-tailed Godwit	25	0	-	100%
	Little Bittern	20	0	-	100%
2	Roseate Tern	5752.5	617.5	885	90.30%
	White-faced Whistling Duck	5810	760	726.3	88.40%
	Sandwich Tern	56087.5	9215.0	578	85.90%
	Long-tailed Cormorant	19180	4417.50	412	81.30%
	Purple Heron	105	95	105	52.50%
	Royal Tern	28035	26552.5	100	51.40%
3	Black-tailed Godwit	1477.5	1472.5	95	50.10%
	Black Tern	42325.00	47547.50	85	47.10%
	Great White Egret	5132.5	6127.5	80	45.60%
	Little Tern	7985	10165	75	43.9%
	Western Reef Heron	13305	18715	68	41.60%
	Common Tern	82877.5	118845.0	66	41.10%
	Grey Heron	6632.5	10545	60	36.60%
	White-back Night Heron	80	142.5	53	36%
4	Collared Pratincole	7692.5	15865	46	32.70%
	Yellow billed Egret	527.5	1282.5	39	29.10%
	Little Egret	34327.5	93337.50	40	26.90%
	Squacco Heron	815	2280	34	26.30%
	Little Stint	17860	57902.5	29	23.60%
	Black-winged Stilt	30827.50	108442.5	27	22.10%
	Spur-winged Plover	2840	11352.5	24	20%
	Marsh sandpiper	912.5	3657.5	24	20.00%
	Wattled Plover	722.5	3135	22	18.70%
	Eurasian Curlew	265	1187.5	21	18.20%
	Curlew Sandpiper	37222.50	169005	20	18%
	Spotted Redshank	6935	32870	20	17.4%
5	Common Redshank	287.5	1472.5	19	16.30%
	Kettliz's Plover	1630	9547.5	16	14.60%
	Common Ringed Plover	43775	273267.5	15	13.80%
	Whimbrel	2442.5	15437.5	15	13.70%
	Sanderling	12530	87922.5	14	12.50%
	Greenshank	24745	175702.5	13	12.30%
	Grey Plover	3205	26077.5	12	10.90%
	Ruddy Turnstone	675	6602.5	10	9.30%
	Jacana	502.5	5700	8	8.10%
	Green-back Heron	135	2280	5.6	5.60%
	Black Heron	590	19855	3	2.90%
	Common Moorhen	77.5	2945	2.5	2.50%
	Common Sandpiper	825	46692.5	2	1.70%
	White-fronted Plover	75	4560	2	1.60%
	Wood Sandpiper	790	63982.5	1	1.20%
	Senegal Thick-knee	20	2945	1	0.70%
6	Greater Painted Snipe	-	278	-	0%

values <80%. This indicates that the numbers and distribution of waterbirds in Ghana, as reported by Ntiamoa-Baidu (1991), might have changed.

Additional evidence for change is provided by the relativities between reported maximum number of species counted for the entire coast of Ghana ((Ntiamoa-Baidu et al. 2001) and those reported in this study. For instance, the maximum number of Common Sandpipers reported at any one time along the entire coast of Ghana (Ntiamoa-Baidu et al. 2001) was 385, while in this study the maximum count in Mukwe Lagoon was 116 (Table 1). Similarly, only 8 Spur-winged Plovers were reported as a maximum count in the survey of the entire coast of Ghana (Ntiamoa-Baidu et al. 2001), but the present study recorded a maximum 138 in Sakumo lagoon. It is important to know that the preliminary surveys of Ntiamoa-Baidu (1991) were based on snap-shot events and that there is a possibility, therefore, that they might not be a true reflection of real trends in the populations of waterbirds along the coast of Ghana.

One deficiency associated with this extrapolation is the fact that the Ramsar sites, as well as the non-Ramsar sites that were not involved in this study, might not be of the same sizes nor qualities as those used for this study. Although this might render the comparisons imprecise, they can be justified on the basis that existing inequalities in the size and characteristics of the Ramsar sites equally exist in the non-Ramsar sites. For instance, although Keta-Lagoon complex is the largest Ramsar site in Ghana, and was not involved in the study, there are also non-Ramsar sites such as Esiama Beach that are far larger than Laiwi and Mukwe lagoons and were also not involved in the study. Making useful deductions from these extrapolations is further strengthened by the fact that Sakumo Lagoon has been rated the third most important site for shorebirds on the coast of Ghana (Anku 2006), while peak waterbird counts at Densu Delta (35,000) were reported to be more than half the peak count of 55,000 at Keta Lagoon complex (Grimble et al. 1998).

The numbers of waterbird species that fall into the individual categories have conservation significance. The criteria used indicate that the attention a species deserves increases with the category number allocated. Although Category 1 indicates the rarity of species, the species involved receive little direct conservation attention because all are located on Ramsar sites, where they enjoy the benefits of management. Similarly, Category 2 birds, though represented on the non-Ramsar sites, can also be considered to require little direct conservation attention. The number of non-Ramsar sites needed to support the equivalent number of Category 2 species on the Ramsar sites is generally larger than exist on the coast. This means that the Category 2 species are well represented on the Ramsar sites and that their current populations would not be significantly affected with the nevertheless continuous destruction of unmanaged coastal wetlands on the coasts.

The need for conservation action begins to increase with Category 3 through to Category 6 but the later, fortunately, involves only one species. Of particular importance are the birds that fall into Categories 4 and 5, which collectively constitute 56% of species. Two-thirds or more of the total population of these species use unmanaged, non-Ramsar sites implying that only a third actually use the Ramsar sites. The total number of non-Ramsar wetlands needed to support the bird equivalence on the Ramsar sites for these two categories generally remains a small fraction of the total number of non-Ramsar sites on the coast. Thus the risk of wetland loss through pollution and resource misuse would be consequential for species in these two categories.

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LITERATURE CITED

AMANKWAH, C. C. 1998. Coastal Wetland Management Project, Wildlife Department. http:\\www.wetlands.org/RSIS/_COP9Directory/Directory/ris/1GH004en.pdf.

ANKU, K. S. 2006. Managing wetlands in Accra, Ghana. African Regional Workshop on Cities, Ecosystems and Biodiversity. Nairobi, 21 September 2006.

ATTUQUAYEFIO, D. K. AND F. GBOGBO. 2001. Prospects of Conserving the wetlands along Mukwe Lagoon at Nungua in the Greater Accra Region of Ghana. West African Journal of Applied Ecology 2:65 -75.

BIBBY, C. J., N. D. BURGESS, D. A. HILL AND S. H. MUSTOE. 2000. Bird Census Techniques. Academic Press London.302 pp.

GORDON, C., K. YANKSON, C. A. BINEY, J. W. TAMBULTO AMLALO K. AND D. KPELE. 1998. Report of the working group on wetland topology, Ghana Coastal Wetland Management Project, pp. 19-22.

GRIMBLE, R., W. ELLENBROEK, N. WILLOUGHBY, E. DANSO AND J. AMETEKPOR. 1998. Study of Development options for Ghana's wetlands (Vol.1) Report to Environmental Protection Agency and Natural Resource International, Chatham, Kent. 94 pp.

HOWE, M. A., P. H. GEISSLER AND B. A. HARRINGTON. 1989. Population trends of North American shorebirds based on the International waterbird survey. Biological Conservation 49:185-199.

JAN, K. J., B. ENS, T. PIERSMA AND L. ZWARTS. 2004. Shorebirds — an illustrated behavioural ecology. KNNV, Netherlands. 368 pp.

NTIAMOA–BAIDU, Y. AND I. R. HEPBURN. 1988. Wintering waders in Coastal Ghana. RSPB Conservation Review 2:85-88

NTIAMOA–BAIDU Y., T. PIERSMA, P. WIERSMA, M. POOT M., P. BATTLEY AND C. GORDON. 1998. Habitat selection, daily foraging routines and diet of waterbirds in Coastal lagoons in Ghana. Ibis 140:89-103.

NTIAMOA-BAIDU, Y. 1988. Terns in coastal Ghana, p. 37-43. *In* Proceedings of the 7th Pan African Ornithological Congress Nairobi Kenya.

NTIAMOA-BAIDU , Y. 1991. Seasonal changes in the importance of coastal wetlands in Ghana for wading birds. Biological Conservation 57:139-158.

NTIAMOA-BAIDU, Y., S. K. NYAME AND A. NUOH. 2000. Trends in the use of a small coastal lagoon by waterbirds: Muni Lagoon (Ghana). Biodiversity and Conservation 9:527-539.

OTENG-YEBOAH, A. A. 1999. Biodiversity studies in three coastal wetlands in Ghana West Africa. Journal of the Ghana Science Association 3:147-149.

PETERJOHN, B. G. AND J. R. SAUER. 1997. Population trends of black terns from the North American breeding survey. Colonial Waterbirds 20:566-573.

PIERSMA, T. AND Y. NTIAMOA-BAIDU. 1995. Waterbird ecology and the management of coastal wetlands in Ghana, Netherlands, NIOZ. 105 pp.

PIERSMA, T., M. KLASSEN, J. H. BRUGGEMANN, A. M. BLOMERT, A. GUAYE, Y. NTIAMOA-BAIDU AND N. E. VAN BREDERODE.1990. Seasonal timing of spring departure of waders from Banc d' Arguine, Mauritania. Ardea 78:123-134.

WETLAND INTERNATIONAL (2007). Ramsar Wetland Information Sheet; www.wetlands.org/RDB/RamsarDir/Ghana/GH003D02.htm

Bird Populations 10:65-76

BIRD MONITORING AT ZACKENBERG, NORTHEAST GREENLAND, 2007[1]

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Abstract. Bird populations were monitored during the breeding season of 2007 in the 15.8 km^2 designated bird census area at Zackenberg Research Station in central Northeast Greenland. The results are presented here and compared with the previous seasons 1995 to 2006.

The breeding bird census revealed relatively high numbers of Sanderling *Calidris alba* and Dunlin *Calidris alpina* territories, whereas territories of Ruddy Turnstone *Arenaria interpres* were found in average numbers. Red Knot *Calidris canutus* territories were a little above average in 2007. Long-tailed Skua *Stercorarius* longicaudus territories, with 15 pairs, were found in near-average numbers.

Corresponding to the early snow-melt, wader nest initiation in 2007 was fairly early, and median first egg dates were before 16 June in all four species. For Ruddy Turnstone, 2007 was the earliest year in terms of median first egg dates recorded so far. Wader nest success, however, was extremely low, and most nests were depredated. The mean clutch size was 3.9. Long-tailed Skua nests were initiated early as well; average clutch size was 1.64 eggs per nest and success was just below average. High numbers of Barnacle Goose *Branta leucopsis* broods were observed, but mean brood size was relatively low.

Key words: Monitoring, Arctic, waders, geese, Long-tailed Skua, Rock Ptarmigan, Snow Bunting, climate.

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INTRODUCTION

The monitoring programme, Zackenberg Basic, based at the Zackenberg Research Station in central Northeast Greenland (Figure 1), was initiated in 1995 in order to establish long-term data series on abiotic and biotic parameters in this high-arctic ecosystem in relation to climatic fluctuations and change. BioBasis is the biological part of Zackenberg Basic and monitors floral communities, invertebrate occurrence, and mammalian and avian breeding performance and population trends (Meltofte et al. 2008). Following the recommendations in the report from the International Evaluation Committee (Callaghan et al. 2006) and a workshop held at the National Environmental Research Institute, Aarhus University, in spring 2007, the BioBasis protocols were subjected to thorough revisions. Several changes were implemented and new monitoring initiatives were incorporated into the programme during the 2007 field season. Detailed information on the revised BioBasis methods and updated sampling protocols can be found in Meltofte et al. (2008).

This paper summarises the bird monitoring part of the BioBasis programme during 2007, the 13th consecutive season in the programme. The results presented here will also be available in the 13th ZERO Annual Report (Klitgaard and Rasch 2008). Similar reports from previous seasons are available for all previous field seasons (see www.zackenberg.dk/publications.htm#ZAR).

METHODS

Details on BioBasis methodology are available at the home page of NERI (http://biobasis.dmu.dk) and the current sampling protocol (Meltofte et al. 2008) as well as the database, is available online: http://zackenberg.dk/sw12805.asp.

In 2007, the breeding bird census area was reduced in size by excluding the area west of the river, Zackenbergelven (see Meltofte and Berg 2004, Meltofte et al. 2008). Birds in that area were followed but less intensively; the main effort is kept to the 15.8 km^2 census area, sections 2-5 (Fig. 1). Also, the estimation of wader fledging success and the transect routes Zackenberg – Store Sødal and Daneborg – Zackenberg were omitted from the monitoring programme in 2007 onwards (Hansen et al. 2008).

A complete initial census was performed between 12 and 21 June. This represents a normal start, but a little later ending than usual, but adverse weather prevented census work on several days. The completion of the survey took 45 person-hours, which is a little above average, considering that the census period lasted more than one day less than previous seasons. Most parts of the 15.8 km^2 census area were snow free. The entire census was performed in good weather conditions.

Large parts of the census area were covered regularly also during June, July and most of August, exceptions being a closed goose moulting area (Fig. 1) along the coast and the slopes of local mountain Aucellabjerg above 350 m a.s.l. The latter were covered on only six occasions by the census taker (J. Hansen), however J. Reneerkens and colleagues visited this area regularly during their stay.

The total effort in June and July 2007 was similar to recent years.

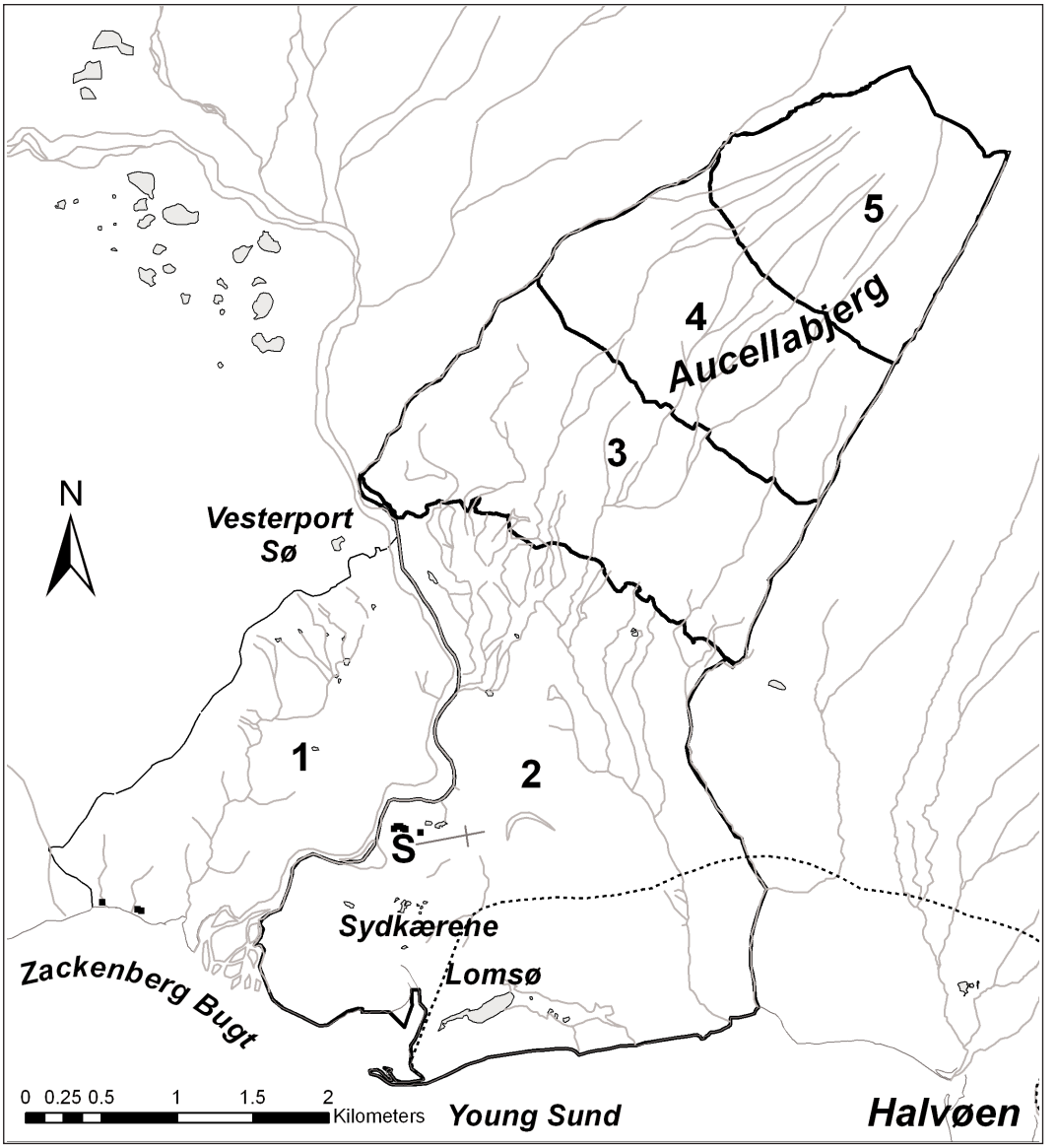

FIGURE 1. The study area in Zackenbergdalen, central Northeast Greenland, showing sections 1-5 of the bird census area. Also shown are place names mentioned in the text and the border of the closed goose molting area (broken line).

RESULTS AND DISCUSSION

BREEDING POPULATIONS

The results of the initial census, supplemented with records during the rest of the season (see Meltofte et al. 2008), are presented in Table 1 and 2, and are compared with the estimates of previous seasons.

The first pair of red-throated divers (*Gavia stellata*) to settle was a pair in Sydkærene, i.e. the fens south of the research station, on 6 June, five days after the first red-throated divers were observed (Table 4). All in all, three to four pairs attempted to breed within the census area in 2007, but no nests could be located. In adjacent areas, red-throated diver pairs were recorded in

TABLE 1. Estimated numbers of pairs/territories in four sectors of the 15.8 km² census area in Zackenbergdalen, 2007. Altitude shown in m a.s.l.

Species	<50 m a.s.l. 7.77 km²	50-150 m a.s.l. 3.33 km²	150-300m a.s.l. 2.51 km²	300-600 m a.s.l. 2.24 km²	Total
Red-throated Diver	3-4	0	0	0	3-4
King Eider	1-2	0	0	0	1-2
Long-tailed Duck	4-7	0	0	0	4-7
Rock Ptarmigan	0	0	0	2	2
Common Ringed Plover	15-17	2	6-7	3	26-29
Red Knot	3-6	12-15	11-12	1-2	27-35
Sanderling	26-32	3-4	12	21-22	62-70
Dunlin	74-93	12-14	1-2	2	89-111
Ruddy Turnstone	12-15	26-32	3	1	42-51
Red-necked Phalarope	1	0	0	0	0-1
Red Phalarope	0	0	0	0	0
Long-tailed Skua	9-11	5-7	2-5	1-2	17-25
Glaucous Gull	1	0	0	0	1
Arctic Redpoll	1-3	1	0	0	1-4
Snow Bunting	19	19-22	9	4-5	51-55

four lakes and ponds. In Vesterport Sø, which is a lake just outside the census area, a pair nested briefly. Most likely this nest suffered predation. Red-throated divers started to form smaller flocks on 21 July, culminating in the largest number of birds (five), on 18 August.

For the second year running, Sanderling (*Calidris alba*) territories were recorded at comparatively high numbers, comparable to the previous two peak years, 2003 and 2006 (Table 2). Since 2002, Dunlin (*Calidris alpine*) territories have appeared in high numbers and 2007 was no exception. Meltofte (2006a) suggests that the numbers were underestimated in early years, thus explaining the increase seen in numbers as a possible artefact of this underestimation. Highly varying numbers of common ringed plover (*Charadrius hiaticula*) territories have been found over the years, and in this season the numbers were near average. Ruddy turnstone (*Arenaria interpres*) territories were found in average numbers, following a two-year peak with above average numbers. In some years, e.g. 2006, large proportions of the population seemingly did not breed. In 2007, most but not all Ruddy Turnstone pairs bred. Red Knot (*Calidris canutus*) territory numbers were a little above average in 2007 (Tables 2 and 3).

As usual (cf. Meltofte and Høye 2007), Long-tailed Skua (*Stercorarius longicaudus*) territories, at 15 pairs, were found in near-average numbers (Table 2). A pair of Glaucous gulls (Larus hyperboreus) bred on an islet in the river, Zackenbergelven, as they have done since 2004. This year, no chicks were seen, and the fate of the nest is uncertain.

The number of Rock Ptarmigan territories (*Lagopus mutus*) was lower than in 2006, but the population is still higher than the low period of 2002-2005. At the opening of the station, a few ptarmigan remains were found at the active Arctic fox (*Alopex lagopus*) dens and other parts of the valley. They were found in much lower numbers than last year, however. During the census, two pairs were registered. One brood was found in the census area. The pair was first seen on 6 July with 10 pulli, and again on 11 July with 8 pulli, on the slopes of upper Aucellabjerg.

Fairly stable numbers of snow bunting (*Plectrophenax nivlais*) territories through the period 1996-2003, was followed by a rise in numbers that, so far, seem to have peaked in 2005. Numbers were lower in 2007, although still above average (Table 2).

Reproductive Phenology in Waders

Nest initiation in 2007 was fairly early for waders. Nearly 24% of egg laying in all wader nests was initiated before 10 June, just under 57% before 16 June, and medians of the first egg

TABLE 2. Estimated numbers of pairs/territories in the 15.8 km² census area in Zackenbergdalen, 1996-2007. Please note, that numbers for 1996-2006 are numbers of breeding pairs in the current bird census area. Numbers previously published included pairs breeding in the area west of river Zackenbergelven that is monitored extensively only from 2007 onward.

Regular breeders				
Species	No. of territories	Average min. and max. no. territories 1996-2006	No of nests found[a]	Comments
Red-throated Diver	3-4	2-2.5	0	
Common Eider	0	0.5-0.55	0	Flocks seen in June, females with chicks in August
King Eider	1-2	1.5-2.2	0	
Long-tailed Duck	4-7	5.5-6.9	0	Broods seen from 30 July
Rock Ptarmigan	2	2.6-3.6	2	
Common Ringed Plover	26-29	33.3-37.2	1	
Red Knot	27-35	24.9-32.5	2	
Sanderling	62-70	47.5-55.5	32	
Dunlin	89-111	70.3-79.3	12	
Ruddy Turnstone	42-51	43.1-48.2	7	
Red-necked Phalarope	0.1	0.9-1.8	0	
Long-tailed Skua	17-25	18.6-22	15	
Glaucous Gull	1	0.3	1	
Common Raven	2	-	0	Nests outside the census area.
Snow Bunting	51-55	39.5-44.6	0	Nests of passerines are only found oportunistically.
Irregular breeders				
Species	No. of territories	Average min. and max. no. territories 1996-2006	No of nests found[a]	Comments
Pink-footed Goose	0	0.2	0	Min. 1120 immatures migrated northwards over the area
Eurasian Golden Plover	0	0.1	0	1 individual, 1-9 June.
Red Phalarope	0	0.6-0.9	0	
Snowy Owl	0	0.1	0	
Northern Wheatear	0	-	0	
Arctic Redpoll	1-4	0.1-0.3	0	One additional observation in adjacent areas

[a] Within the census area

dates were before 16 June in all four species in which nests were found (Table 4). For Ruddy Turnstone, 2007 was the earliest year recorded in terms of median first egg dates. The melting of the snow was early in 2007 and nest initiation was near or earlier than the average of previous seasons (Table 5).

Reproductive Success in Waders

Overall wader nest success was extremely low in 2007. Only the 2005 season exhibited an equally low nest success; 36 of 60 nests were predated. Using the modified Mayfield method (Johnson 1979), 82% of the wader nests fell victim to predation. Dunlin suffered the lowest level of predation of the three main study species; 52.2% of the nest had full predation, a somewhat higher than average for 1996-2007. Sanderling and Ruddy Turnstone nests suffered extremely from predation, losing more nests than previously recorded at Zackenberg (Table 6). A single Sanderling nest was abandoned during laying

TABLE 3. Dates of first observation of selected species at Zackenberg 1996-2007.

Species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Red-throated Diver	≤3.6	30.5	3.6	4.6	6.6	3.6	1.6	≤4.6	≤1.6	29.5	4.6	1.6
Pink-footed Goose	≤3.6	≤28.5	27.5	3.6	4.6	3.6	1.6	≤3.6	≤1.6	≤19.5	≤26.5	≤25.5
Common Eider	13.6	2.6	24.6	29.6	11.6	10.6	12.6	12.6	17.6	4.6	12.6	21.6
King Eider	12.6	4.6	15.6	16.6	≤22.6	9.6	11.6	≤13.6	14.6	21.6	12.6	22.6
Long-tailed Duck	≤1.6	30.5	2.6	6.6	6.6	7.6	3.6	7.6	2.6	1.6	7.6	5.6
Red-necked Phalarope	5.6	30.5	5.6	10.6	7.6	4.6	5.6	11.6	≤1.6	27.5	6.6	28.5

TABLE 4. Median first egg dates for waders at Zackenberg 2007 as estimated from incomplete clutches, egg floating, hatching dates, as well as weights and observed sizes of pulli.* Based on observations of a single fledgling.

Species	Median date	Range	N
Common Ringed Plover	23 May	23 May	1
Red Knot	6.5 June	2.6-21.6	10
Sanderling	15 June	5.6-4.7	48
Dunlin	15 June	6.6-2.7	17
Ruddy Turnstone	7 June	5.6-21.6	13

TABLE 5. Snow cover on 10 June together with median first egg dates in June for waders at Zackenberg 1995-2007. Data based on <0 nests/broods are in brackets, those <5 are omitted. The snow cover is pooled (weighted means) from section 1, 2, 3 and 4 (see Klitgaard and Rasch 2008, section 2.2), from where the vast majority of the egg laying phenology data originate.

Species	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Snow cover on 10 June (cm)	84	82	76	80	91	53	84	79	83	48	28	na	na
Sanderling		(16)	18	18	23.5	16	22.5	17	13	8	(15)	30	15
Dunlin	(18)	11.5	13	16.5	22	11.5	25	8	12	12	12	27	15
Ruddy Turnstone	(12)	18.5	13	12.5	24	11	23	9	8	8	11	(21)	7

TABLE 6. Mean nest predation (%), 1996-2007, according to the modified Mayfield method (Johnson 1979). Poor data (<125 nest days or five predations) are given in brackets. Data from species with <50 nest days have been omitted (dash = no nests found). Nests with at least one pipped egg or one hatched young are considered successful. Also given are total numbers of adult foxes observed by the bird observer in the bird census area during June-July (away from the research station proper), along with the number of fox dens holding pups.

Species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1996-2007
Common Ringed Plover				(60)		(38)				-	(100)	-	62-67
Red Knot	-	-			-		-			-	-	(100)	(28)
Sanderling	(72)	(33-100)	(88)	40	(46)	19	(33)	45	71-85		(7.4)	3.4	27-29
Dunlin			28-47	65	68	(75)		63	93	(43)	47	48	60-65
Ruddy Turnstone	21-68	67-100	16	23-28	29	(60)	52	21-27	83			36	58-64
Red-necked Phalarope	-	-	-		-	-	-	-	-		-	-	
Red Phalarope	-	-	-	-	-	-	-	-	-	-		-	
All waders	33-63	52-100	32-37	42-44	44	43	43	42-44	87-90	22	37	18	41-45
N nests	17	31	44	44	47	32	21	51	55	15	28	60	445
N nest days	163	274	334	521	375	328	179	552	700	104	332	533	4392,5
Fox encounters	14	5	7	13	11	14	21	11	16	18	22	23	
Fox dens with pups	2	0	1	0	2	2	0-1	2	3	0	2	3	

and the fates of one Dunlin (outside the census area) and one sanderling nest is unknown. Only four nests of Red Knot were found this season, and all hatched successfully. No Common Ringed Plover, Red Phalarope (*Phalaropus fulicarius*) nor Red-necked Phalarope (*Phalaropus lobatus*) nests were found in 2007. However, a Common Ringed Plover juvenile – with downy neck and still accompanied by two adults – was seen on 11 July. This suggests that the bird was approximately 20 d old, giving a first egg date around 23 May. That would be the earliest first egg estimated for Zackenberg.

The Arctic fox is the most likely predator of most nests, as only few nests were found with clear signs of avian predators. The number of fox encounters in the bird census area was also high (Table 6).

The mean clutch size was 3.9 in 2007 (Table 7). Nests for Sanderling containing <4 eggs were as follows: two nests of three eggs, one of two eggs, and two of one egg; and for Dunlin: three nests of three eggs.

In July and early August alarming parents – and later juveniles – were found in the fens and marshes (Dunlins), on the slopes of Aucellabjerg and in the dry lowlands (Common Ringed Plovers, Sanderlings and Dunlins). Turnstone juveniles were seen only late in the season, most often in connection with low tide feeding.

Reproductive Phenology and Success in Long-Tailed Skuas

Eight (40 %) of the Long-tailed Skua nests were initiated prior to the census period. Timing of breeding was average (Table 8), with 11 of 15 nests (73%) initiated before 20 June [Considering nests found outside the census area, 18 of 22 (82%) were initiated prior to 20 June]. From 22 June, flocks of up to 34 skuas roamed the lower slopes of Aucellabjerg and the lowlands.

A single observation of a lemming (*Dicrostonyx groenlandicus*, the main food resource for Long-tailed Skuas) by the chief bird observer (J. Hansen) does not reflect the otherwise intermediate lemming season (Table 8). The skuas' average clutch size was 1.64 eggs per nest. Eleven chicks hatched, and nest success was just below average (average nest success 1996-2007: 55%; Table 8). Ten of 11 hatched chicks, however, likely were predated. This last young was spotted on 19 August, at an age of likely 44 d, the only observation of a juvenile bird in 2007.

Four observations of one third- year bird were probably of the same individual: an unringed bird, which must have hatched in the 2005 season, in which fledging success was low (Table. 9).

Barnacle Geese

Conditions did not allow a visit to a barnacle goose (*Branta leucopsis*) colony on the southern face of the mountain Zackenbergfjeldet this season. Previous visits in 2005 and 2006 suggested that the colony is still in use (Hansen et al. 2008).

The first families with goslings were seen on 25 June. The number of broods was as high as 28 (Table 9), and the maximum number of goslings seen at one time, was 13.

The mean 2007 brood size was in the lower end of the scale until late July. With 3.3 young per brood, the highest average brood size recorded in late July was reached this year (Table 9). From Isle of Islay, Western Scotland, it was reported that the percentage of young in the flocks arriving at their wintering quarters was 9.8% (Table 9; Ogilvie, 2008).

Immature barnacle geese moulted in lower than average numbers in 2007 (Table 10). The coastal area west of the closed area has seen increasing numbers of moulting barnacle geese in recent years.

TABLE 7. Mean clutch sizes in waders at Zackenberg 1995-2007. Samples of fewer than five clutches are given in brackets.

Species	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Mean
Common Ringed Plover	(4.00)	(4.00)	(3.50)	(4.00)	(3.50)	(4.00)	(3.50)	(4.00)	(4.00)	(4.00)		(3.75)		3.84
Red Knot				(4.00)	(4.00)		(4.00)		(4.00)	(4.00)			(4.00)	4.00
Sanderling	(4.00)	4.00	3.86	4.00	3.67	4.00	3.43	3.83	4.00	4.00	3.75	3.63	3.73	3.84
Dunlin		(4.00)	(3.75)	3.90	3.70	3.93	3.63	(4.00)	4.00	3.92	4.00	3.13	3.79	3.81
Ruddy Turnstone		3.71	3.79	3.82	3.58	3.80	3.75	4.00	3.77	3.92	3.86	(3.00)	(4.00)	3.75
Average	4.00	3.93	3.73	3.94	3.69	3.93	3.66	3.96	3.95	3.97	3.87	3.38	3.88	3.83

TABLE 8. Egg-laying phenology, breeding effort and success in Long-tailed Skuas at Zackenberg, 1996-2007. Median egg laying is the date when half the supposed first clutches were initiated. Number of clutches found includes replacement clutches. Mean hatching success according to the modified Mayfield method (Johnson 1979). Poor data (<125 nest days or five predations) are given in brackets. Nests with at least one pipped egg or one hatched young are considered successful. Also given, are numbers of lemming winter nests within the 2 km² lemming monitoring area (see section 3.4). Please note that numbers for 1996-2006 are numbers breeding within the currently used census area. Data previously numbers included the now omitted area west of river Zackenbergelven.

Long-tailed skua breeding	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Median 1st egg date		7.6	12.6	17.6	18.6	15.6	9.6	15.6	8.6	8.6	19.6	12.6
No. of clutches found	8	17	23	8	5	21	14	7	21	8	2	15
No. of young hatched	1	25	16	2	2	18	14	5	36	6	1	11
Nest success % (Mayfield)		(80.6)	24.1	(18.1)	(17.5)	39.5	44.1	(76.2)	(100)	(51.8)	(100)	52.9
Estimated no. of young fledged	0	5	6	1	0	5	4	2	22	1	0	1
Lemming winter nests/km²	224.5	247.2	467	227.4	136.8	208.5	178.3	66	238.7	170.8	189.6	236.8

TABLE 9. Average brood sizes of Barnacle Geese in Zackenbergdalen during July and early August, 1995-2007, together with the total number of broods brought to the valley. Samples of <10 broods are given in brackets. Average brood size data from autumn on the Isle of Islay in Scotland are given for comparison, including the percentage of juveniles in the population (M. Ogilvie 2008, pers. comm.).

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Early July		(3.0)	3.1	(2.9)	1.9	(3.2)	(1.8)	2.4	(1.8)	2.6	(1.7)	(2.0)	1.3
Middle July		(2.3)	2.7	2.3	1.8	(3.1)	(1.7)	2.4	(1.2)	2.3	2.7	(1.5)	1.5
Late July	(2.0)	(3.0)	2.6	2.2	1.7	3.1		2.3	(1.1)	2.3	(2.2)	(1.1)	(3.3)
Early August	(2.3)	(2.3)	2.4		1.8		(2.0)	2.2	(1.2)	(1.9)		(1.5)	-
No. of broods	≥7	6-7	19-21	≥18	29	11	4	32	8	26	14	9	28
Scotland	2.00	2.30	1.95	2.28	1.92	2.20	1.94	2.23	1.59	2.35	1.67	1.15	2.14
Per cent juv.	7.2	10.3	6.1	10.5	8.1	10.8	7.1	12.5	6.4	15.9	6.3	3.23	9.8

COMMON BIRDS, NOT BREEDING IN THE CENSUS AREA

In 2007, immature Pink-footed Geese (*Anser brachyrhynchus*) migrated in lower than average numbers, with 1,120 individuals passing over Zackenbergdalen northwards. Only two immature Pink-footed Geese were found moulting at Zackenberg this year (Table 10).

On 21 June, first Common Eiders (*Somateria mollissima*) were seen migrating along the coast and up along river Zackenbergelven. In the following month pairs and smaller flocks of up to 14 individuals were seen regularly. A possible nest was never confirmed, and no hatchings seem to have taken place. Seven young – most likely from the Daneborg or Sandøen colonies (c. 25-30 km east of Zackenberg) – were recorded with an adult female in the bay, Zackenberg Bugt, on 31 August. The last adult male was seen on 6 July. In late September, after the usual monitoring season, approximately 70 eiders assembled in a flock on Young Sund. At Daneborg, the Common Eider colony between the dog pens was once again censused by the Sirius Dog Sledge Patrol, and found to include 2,700 nests (Average nest number for the period 2002-2006 is 2,019). At Daneborg, the first eider ducklings were seen on 18 July.

Two female and one male King Eider (*Somateria spectabilis*) arrived at Zackenberg on 22 June, a date later than usual (Table 3; 1996-2006 average arrival date: 13 June). A pair stayed in the area around the research station until 30 June, occasionally accompanied by an extra female. No nesting attempts were recorded. A single female was seen west of the area on 6 July. The last record was a flock of 9 females and 3 males near the peninsula Halvøen, east of Zackenberg, on 15 July.

There was an estimated two pairs of Common

TABLE 10. The number of immature pink-footed geese and barnacle geese moulting in the study area at Zackenberg 1995-2006. The close area is zone 1c (see http://www.zackenberg.dk/grafik/MapZoner.jpg.

Study area	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
PINK-FOOTED GOOSE													
Closed moulting area and further east	310	246	247	5	127	35	0	30	41	11	17	27	0
Coast west of closed area	230	40	60?	0	29	0	0	0	0	10	0	3	2
Upper Zackenbergdalen	0	0	15	0	0	0	0	0	0	0	0	1	0
Pink-footed Goose total	540	286	322	5	156	35	0	30	41	21	17	31	2
BARNACLE GOOSE													
Closed area at Lomsø and Kystkærene	21	0	29	21	60	84	137	86	120	81	87	148	66
Coast east of closed area	>120	150?	96	55	66	0	109	80	45	0	2	218	46
Coast west of closed area	0	0	0	0	0	30	0	0	0	0	29	29	106
Upper Zackenbergdalen	41	85	2	75	<57	27	60	0	14	0	25	30	6
Barnacle Goose total	>182	235?	127	151	<183	141	306	166	179	81	143	425	224

Raven (*Corvus corax*) covering the valley, both assumed to be nesting in adjacent areas. A possible third pair would have been based in a third, neighbouring valley. The first six young birds were seen on 4 July near the research station. During July, August and into September, this flock was seen regularly around the valley, with numbers varying from three to six.

VISITORS AND VAGRANTS

A Common Snipe (Gallinago gallinago) was seen at the research station on 22 June 2007. This is a very rare sighting in Northeast Greenland (cf. Boertmann 1994) and the first record for Zackenberg (Table 11).

Two Great Northern Divers (*Gavia immer*) were observed flying up the river Zackenbergelven on 11 June. Great Northern Divers are recorded occasionally near Zackenberg, and have been known to breed in adjacent areas (Meltofte 2006b).

On 27 June a Snow Goose (*Anser caerulescens*) and an apparent Snow Goose x Barnacle Goose (*Branta leucopsis*) hybrid flew over the research station. After circling above the station, the hybrid continued eastwards, while the Snow Goose landed in the centre of the research station. The goose was apparently tame, and followed researchers around in the study area for three days.

Canada Geese (*Branta Canadensis*) were recorded for the 3rd consecutive season at Zackenberg, with a single bird in a fen north of the research station on 13 June, and a pair at the coast on 26 June (Table 11).

On 26 May a female Pintail Duck (*Anas acuta*) was seen in a fen just north of the research station, where it stayed until 7 June. This is only the 2nd record at Zackenberg (Meltofte 1999), equalling the northernmost observation (cf. Boertmann 1994).

Gyr Falcons (*Falco rusticolus*) were spotted several times during the season. In June, single individuals were seen on 8 and 19 June and 31 August near the research station. After the normal monitoring season, Gyr Falcons were recorded on 11 occasions, one time with three individuals at once (19 September, at the research station). The other ten observations are thought to be of one individual, most often seen at the research station.

Among waders, the Eurasian Golden Plover (*Pluvialis apricaria*) was once again recorded with a single individual, from 1 to 9 June, near the research station.

A Pectoral Sandpiper (*Calidris melanotos*) – presumably a male – was recorded on 12 and 19 June, in fens near the research station. On 19 June, the sandpiper displayed behaviour (towards a Dunlin), similar to courtship behaviour (H. Schekkerman, pers. comm.). The observation will be submitted to the rarities committee for Denmark, Greenland and Faroe Islands at DOF (BirdLife Denmark). At Zackenberg, this was only the third record of this rare visitor to Greenland.

For the fifth season in 12 years (Table 11), a Whimbrel (*Numenius phaeopus*) was seen on 16 and 17 June, and heard again on 18 June, on the slopes of Aucellabjerg.

TABLE 11. Numbers of individuals and observations of avian visitors and vagrants at Zackenberg 2007, compared with the numbers of individuals observed in the preceding seasons, 1995-2006. Multiple observations reasonably believed to have been of the same individual have been reported as one individual.

	Visitors and vagrants													
	Previous records												2007	
Species	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	No individual	No. observations
Great northern diver	0	0	0	0	0	0	1	0	0	0	0	0	2	1
Wooper swan	0	0	0	0	0	4	0	0	0	0	0	0	0	0
Snow goose[a]	0	0	0	0	0	2	11	0	23	0	0	0	1	1[b]
Canada goose	0	0	0	0	0	0	0	0	0	0	0	9	3	2[c]
Pintail duck[e]	0	0	0	1	0	0	0	0	0	0	0	0	1	3
Common teal	0	0	0	0	0	0	0	1	0	0	0	0	0	0[g]
Merlin	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Gyr falcon	1	1	>1	3-4	>5	4-6	5	2	4	4	2	0	3	2[l]
Eurasian golden plover	0	3	1	4	1	0	2[a]	1	0	1	1	1	1	3
White-rumped sandpiper	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Pectoral sandpiper	0	0	0	1	0	0	0	2	0	0	0	1	1	2
Purple sandpiper	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Red phalarope	0	0	0	4-5[a]	0	0	4[a]	0	1	0	2[f]	11[f]	0	0
Common snipe	0	0	0	0	0	0	0	0	0	0	0	0	1	1[d]
Eurasian curlew	0	0	1	0	1	0	0	0	0	0	0	0	1	3
Whimbrel	0	0	0	0	0	1	1	0	0	2	1	0	0	0
Pomarine skua	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Arctic skua	0	0	12	6	0	2	7	4	3	2	0	1	0	0
Great skua	0	0	0	4	0	0	0	2	0	0	0	0	0	0
Lesser black-backed gull[j]	0	0	0	0	0	0	4	0	1	2	1	4	0	0[e]
Iceland gull	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Great black-backed gull	0	0	0	0	1	1	3	0	0	0	0	0	0	0
Black-legged kittiwake	0	0	0	0	0	0	0	0	14[f]	0	0	0	0	0[f]
Arctic tern	≈200	2	1	2	0	14	0	0	32	17	0	0	0	0
Snowy owl	0	0	2	1	1	1-2	>4[a]	0	0	2	0	0	1	1[j]
Meadow pipit[e]	0	0	0	1	0	0	0	0	0	0	1	1	0	0[g]
White wagtail	0	1	1	0	0	0	0	0	0	0	0	0	1	1
Northern wheatear[e]	4	8	2	>3	1	0[h]	0	0	0	0	2	1	4[k]	1
Arctic redpoll	7	9	16	>11[a]	9	5	4	6	31[i]	12	3[a]	2	8	7[m]
Lapland longspur	0	0	0	0	1-2	0	1-2	0	0	0	1	1	0	0

[a] At least one territory, possible territory or breeding found, see table 1;
[b] Circled over station with a snow goose/barnacle goose hybrid. The snow goose landed in camp and stayed for 3 days. Tame. See text.

TABLE 11. Continued.

Species	Visitors and vagrants													
	Previous records												2007	
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	No individual	No. observations

[c] Subspecies interior
[d] First ever record at Zackenberg
[e] Increasing in East Greenland (Boertmann in press)
[f] 10 adults, 4 juveniles 28 August 2003.
[g] Northernmost records in East Greenland (cf. Bortmann 1994)
[h] One dead individual found
[i] 20 of these, a flock of juveniles in August
[j] Additionally, one individual in neigbouring valley on 22 June and another one in Zackenbergelven 25 September 2007 (outside monitoring programme season).
[k] Uncertain identification
[l] Another 11 observations of 4 individuals in September 2007 (outside monitoring programme season).
[m] A further four observerd on 25 September 2007 (outside monitoring programme season).

A Great Black-backed Gull (*Larus marinus*) was observed 30 June at Lomsø, a lake south of the research station.

Twice during the normal season, Snowy Owls (*Nyctea scandiaca*) were seen. On 22 July, a single individual was seen in neighbouring valley, Cardiocerasdal, while the other bird was spotted on the slopes of Aucellabjerg on 22 August. In the time after the usual monitoring period, a Snowy Owl was seen on the lower slopes of Aucellabjerg, 25 September.

A White Wagtail (*Motacilla alba*) visited Zackenberg on 31 May. This is only the 2nd record for Zackenberg. The White Wagtail is a rare visitor to Northeast Greenland, although it might have bred in Daneborg in 1996 (Meltofte 1997) – c. 25 km from Zackenberg.

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REFERENCES

BOERTMANN, D. 1994. An annotated checklist of the birds of Greenland. Meddelelser om Grønland, Bioscience 38. 63 pp.

BOERTMANN , D. 2008. The Lesser Black-Backed Gull expanding into the Nearctic. Arctic 61:129-132.

CALLAGHAN, T. V., B. RUDELS, AND C. E. TWEEDIE. 2006. International Review of the Zackenberg Research Station. The Danish Environmental Protection Agency. 31 pp. Available at http://www.zackenberg.dk/graphics/Design/Zackenberg/Publications/English/international-review-zero-2006.pdf

HANSEN, J., N. M. SCHMIDT, AND H. MELTOFTE. 2008. Bird monitoring at Zackenberg, Northeast Greenland, 2006. Bird Populations 9:1-12.

JOHNSON, D. H. 1979. Estimating nest success: The Mayfield method and an alternative. Auk 96:651-661.

KLITGAARD, A. B., AND M. RASCH (eds.). 2008. Zackenberg Ecological Research Operations, 13th Annual Report, 2007. Danish Polar Center, Danish Agency for Science, Technology and Innovation, Ministry of Science, Technology and Innovation, Copenhagen. Available at: http://www. zackenberg. dk/graphics/Design/Zackenberg/Publications/English/Zero%202007.pdf

MELTOFTE, H. 1999. Birds. *In* Rasch, M. (ed.), Zackenberg Ecological Research Operations, 5th Annual Report, 1998. Danish Polar Center, Ministry of Research & Information Technology, Copenhagen. Available at: http://www.zackenberg.dk/graphics/Design/Zackenberg/Publications/English/zero-4-annual-report-1998.pdf

MELTOFTE, H. 2006a. Wader populations at Zackenberg, high-arctic Northeast Greenland, 1996-2005. Dansk Ornitologisk Tidsskrift 100:16-28.

MELTOFTE, H. 2006b. Populations and breeding performance of divers, geese and ducks at Zackenberg, northeast Greenland, 1995-2005. Wildfowl 56:129-151.

MELTOFTE, H. 1997. Birds. *In* Meltofte, H., and H. Thing (eds.), Zackenberg Ecological Research Operations, 2nd Annual Report, 1996. Danish Polar Center, Ministry of Research & Information Technology. 80pp. Available at: http://www.zackenberg.dk/graphics/Design/Zackenberg/Publications/English/zero-2-annual-report-1996.pdf

MELTOFTE, H., AND T. B. BERG. 2004. BioBasis, Conceptual design and sampling procedures of the biological programme at Zackenberg Basic. 9th ed. National Environmental Research Institute, Department of Arctic Environment. Available at: http://www2.dmu.dk/1_Viden/2_Miljoe-tilstand/3_natur/biobasis/Manual/BioBasis Manual2004.pdf

MELTOFTE, H., T. B. BERG, AND N. M. SCHMIDT. 2008. BioBasis, Conceptual design and sampling procedures of the biological programme at Zackenberg Basic. 11th ed. National Environmental Research Institute, Department of Arctic Environment, University of Aarhus. 103 pp. Available at http://www.zackenberg.dk/graphics/Design/Zackenberg/Monitoring/BioBasis_manual_2008.pdf

MELTOFTE, H., AND T. T. HØYE. 2007. Reproductive response to fluctuating lemming density and climate of the Long-tailed Skua at Zackenberg, Northeast Greenland, 1996-2006. Dansk Ornitologisk Forenings Tidsskrift 101: 109-119. Available at: http://www. dof.dk/sider/images/stories/doft/dokumenter/2007_4_109-119_LTSkua.pdf

OGILVIE, M. 2008. Breeding success in 2007 of Barnacle Geese wintering on Islay and of Greenland White-fronted Geese wintering on Islay and Kintyre. Privately printed report, Bruichladdich.

Bird Populations 10:77-87

BIRD MONITORING AT ZACKENBERG, NORTHEAST GREENLAND, 2008, WITH COMPARISON TO 1995-2007[1]

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Abstract. During the breeding season of 2008, bird populations were monitored in a 15.8 km^2 area designated at Zackenberg Research Station in central Northeast Greenland. Results are presented and compared with those of previous seasons (1995-2007).

The breeding bird census revealed relatively high numbers of Sanderling (*Calidris alba*) and Dunlin (*Calidris alpine*) territories, whereas territories of Ruddy Turnstone (*Arenaria interpres*) were found in average numbers. However, only a few Ruddy Turnstones seemed to nest. The number of Red Knot (*Calidris canutus*) territories was around the average of the previous seasons. Despite the relatively late snow-melt, wader nest initiation in 2008 was average or a little later, and median first egg dates were also average in all four species. Wader nest success, however, was extremely low, and most nests suffered predation. Long-tailed Skua (*Stercorarius longicaudus*) territories were found in near-average numbers, and with an average median nest initiation date, but with a nest success well below average. Average numbers of Barnacle Goose (*Branta leucopsis*) broods were observed, and with a relatively high mean brood size early in the season and low late in the season.

Key words: Monitoring, Arctic, waders, geese, Long-tailed Skua, Rock Ptarmigan, Snow Bunting, climate.

BIRD MONITORING AT ZACKENBERG, NORTHEAST GREENLAND, 2008, WITH COMPARISON TO 1995-2007

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Key words: Monitoring, Arctic, waders, geese, Long-tailed Skua, Rock Ptarmigan, Snow Bunting, climate.

INTRODUCTION

The monitoring programme, Zackenberg Basic, based at the Zackenberg Research Station in central Northeast Greenland (Figure 1), was conducted for the 14th season. For details of the previous years, please refer to Hansen et al. (2008). This paper presents a summary of the bird monitoring portion of the BioBasis programme from the 2008 season. The results presented here will also be available in the 14th ZERO Annual Report (Jensen and Rasch 2009). Similar reports from previous seasons are available for all previous field seasons (see www.zackenberg.dk/publications.htm#ZAR).

Details on BioBasis methodology are available at the home page of NERI (http://biobasis.dmu.dk), the current sampling protocol (Meltofte et al. 2009) and the database are available online: http://zackenberg.dk/sw12805.asp.

RESULTS AND DISCUSSION

BREEDING POPULATIONS

A complete initial census was performed between 18 and 28 June [Day of year (DOY) 170 and 180, respectively], which is a late start and very late last day of census. The completion of the survey took 45 "person-hours," which is a little above average, considering that the census took a day less than pre-2007. The weather prevented census work on several days in the period. The entire census was performed in decent weather conditions, and most parts of the 15.8 km^2 census area were snow free. For further details on methods, see Hansen et al. (2008) and Meltofte et al. (2008).

In addition, large parts of the census area were surveyed regularly during June, July and most of August, exceptions being the closed goose moulting area along the coast and the Aucellabjerg slopes above 350 m a.s.l. The latter were covered on only five occasions by the census taker (J. Hansen). The team of J. Reneerkens, however, searched for Sanderling (*Calidris alba*) nests and broods in the area regularly.

The total effort in June and July 2007 was similar to previous years. The results of the initial census, supplemented with records during the rest of the season (see Meltofte et al. 2008), are presented in Tables 1 and 2, along with estimates of previous seasons.

The first pair of Red-throated Divers (*Gavia stellata*) to settle was a pair in a pond at the research station on 3 June (DOY: 155), only a few days after the first diver was observed (Table 3). Four pairs attempted to breed within the census area. Two nests were found within the census area. In adjacent areas, Red-throated Diver pairs were recorded in two lakes. In Vesterport Sø, a pair nested near the nest of last season (2007). Most likely, the nest suffered predation. In Lindemandssø, a pair with a large chick was seen in august. Red-throated Divers started to form small flocks 26 July (DOY: 208). The last Red-throated Diver was heard 19 August (DOY: 232).

Sanderling territories were recorded at numbers above average for the third consecutive season, and were comparable to the previous two peak years of 2003 and 2006 (Table 2). Numbers of Dunlin (*Calidris alpine*) territories

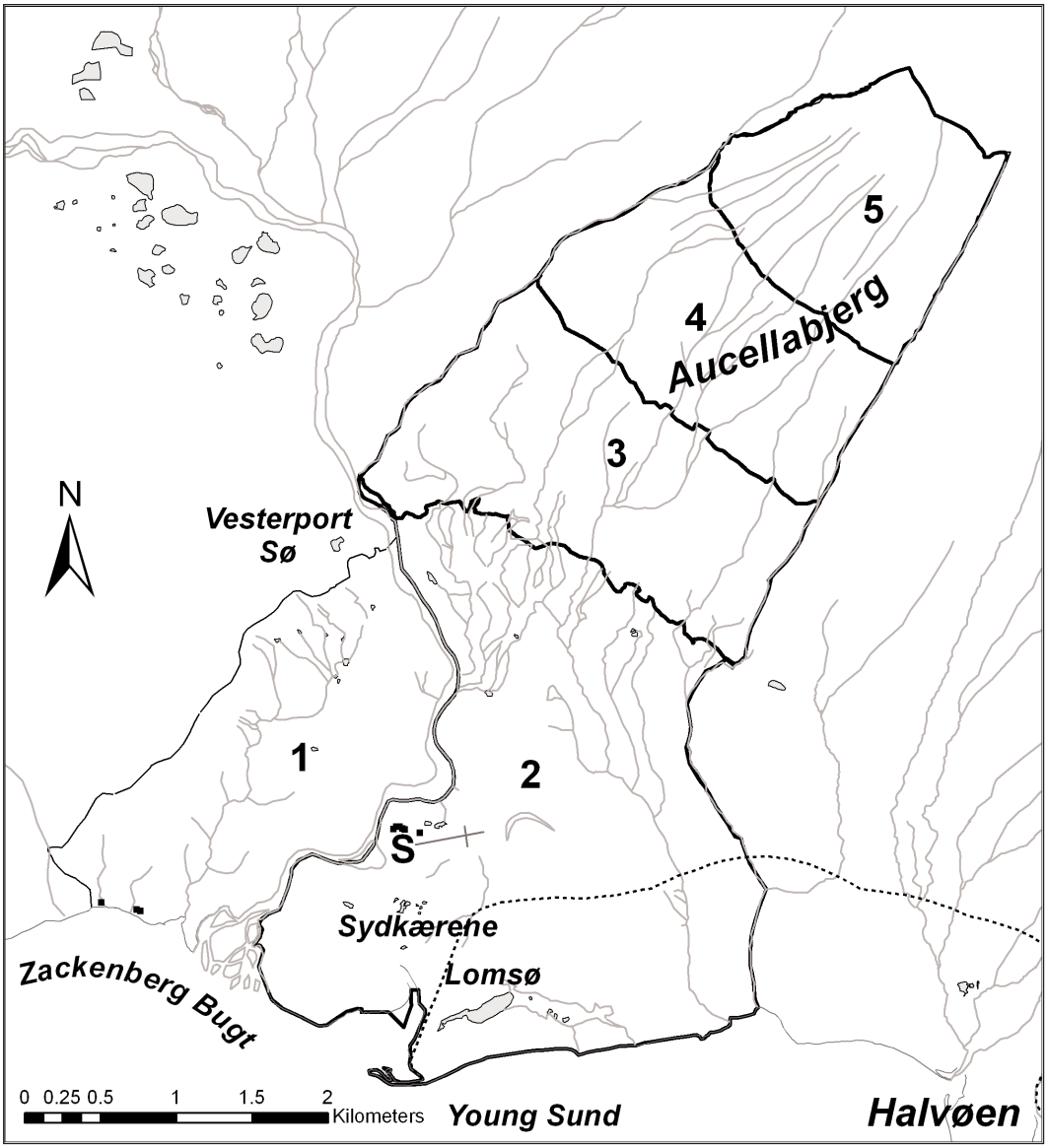

FIGURE 1. Map of the study area in Zackenbergdalen, central Northeast Greenland, with sections 1-5 of the bird census area. Also shown, selected place names mentioned in the text, the research station (S) and the border of the closed goose moulting area, 1c (broken line).

were the highest number so far found in the monitoring program. Meltofte (2006a), with the possibility that numbers were underestimated in early years. Therefore, at least some of the increase seen in numbers might be an artefact of this underestimation. Since 1996, Common Ringed Plover (*Charadrius hiaticula*) territory numbers have varied considerably, and in 2008 numbers were very low. Ruddy Turnstone (*Arenaria interpres*) territories were found in very low numbers, continuing the decrease that followed the two-year peak of above average numbers (2005-2006; below, however, we note that breeding numbers were low). Red Knot (*Calidris canutus*) territory numbers were a little above average (Tables 2, 3).

TABLE 1. Estimated numbers of pairs/territories in four sectors of the 15.8 km² census area in Zackenbergdalen, 2008.

Species	<50 m a.s.l. 7.77 km²	50-150 m a.s.l. 3.33 km²	150-300m a.s.l. 2.51 km²	300-600 m a.s.l. 2.24 km²	
Red-throated Diver	4	0	0	0	4
King Eider	0-1	0	0	0	0-1
Long-tailed Duck	7-8	0	0	0	7-8
Rock Ptarmigan	0-1	0	2-3	0	2-4
Common Ringed Plover	8	3-6	0-1	5-7	16-22
Red Knot	5-7	10-12	8	1	24-28
Sanderling	37-41	2-4	13	8-9	60-67
Dunlin	82-90	14-17	1	0	97-108
Ruddy Turnstone	10-11	14	0-1	0	24-26
Red-necked Phalarope	1-2	0	0	0	1-2
Red Phalarope	1	0	0	0	1
Long-tailed Skua	9-12	9-11	0-1	1	19-25
Glaucous Gull	1	0	0	0	1
Arctic Redpoll	2	0	0	1	3
Snow Bunting	21-23	21-22	10-11	2-4	54-60

Neither Red-necked Phalarope (*Phalaropus lobatus*) nor Red Phalarope *P. fulicarius* nests were found in 2008. Up to two pairs of Red-necked Phalarope were seen between 1 and 12 June (DOY: 153 and 164, respectively), and a single pair of Red Phalarope was seen once on 23 June (DOY: 175).

Long-tailed Skua (*Stercorarius longicaudus*) territories were found in near-average numbers, and have varied little over the years (cf. Meltofte and Høye 2007; Table 2). Nine pairs nested in the census area (see below).

A pair of Glaucous Gulls (*Larus hyperboreus*) bred on an islet in the river, Zackenbergelven. A pair has bred on the islet since 2004. The islet is reshaped most years during surge flooding, and the nest site is not always in the same location. No chicks were seen, and nest fate is uncertain. The Glaucous Gull is a common bird at Zackenberg, and several birds can be seen most of the season patrolling the rivers, shores and fens (cf. Hansen et al. 2008).

The number of Rock Ptarmigan (*Lagopus mutus*) territories was comparable to 2006 and 2007, coming back from a low during 2002-2005. During the census, 2-4 pairs were registered. One brood was found in the census area on 17 July (DOY: 199) with nine pulli on the slopes of upper Aucellabjerg. In adjacent areas, a female with four pulli were seen on the slopes of the mountain Zackenbergfjeld (above the border of the census area).

Numbers of Snow Bunting (*Plectrophenax nivlais*) territories were equal to the last three years, and higher than the period 1996-2003 (Table 2).

Arctic Redpoll (*Carduelis hornemanni*) territories were few and far between, which is normal (Table 2).

Reproductive Phenology in Waders

Nest initiation was a little late in one species (Ruddy Turnstone), and around average in the remainder (Table 4). Only about 7% of the egg laying in all wader nests were initiated before 10 June, and around 60% before 20 June (DOY: 172). In other words, nest initiation was fairly synchronous.

The snow cover on 10 June 2008 (DOY: 162) was approximately 71%, which equals the average of the period 1996-2007. Median nest initiation dates were around average for the previous seasons (Table 5).

Reproductive Success in Waders

The overall wader nest success was extremely low in 2008. Following the modified Mayfield method (Johnson 1979), we found that 84% of

TABLE 2. Estimated numbers of pairs/territories in the 15.8 km² census area in Zackenbergdalen, 1996-2008.

Regular breeders				
Species	No. of territories	Average min. and max. no. territories 1996-2006	No of nests found[a]	Comments
Red-throated Diver	4	2.2-2.6	2	
Common Eider	0	0.4-0.5	0	Flocks seen in June, females with chicks in August*
King Eider	0-1	1.4-2.1	0	
Long-tailed Duck	7-8	5.3-6.9	0	
Rock Ptarmigan	2-4	2.6-3.5	0	
Common Ringed Plover	16-22	30-36.5	4	
Red Knot	24-28	25.1-32.7	1	
Sanderling	60-67	48.8-56.7	29	
Dunlin	97-108	71.8-82	19	
Ruddy Turnstone	24-26	43-48.4	7	
Red-necked Phalarope	1-2	0.8-1.8	0	
Long-tailed Skua	19-25	18.5-22.3	5	
Glaucous Gull	1	0.3	1	
Common Raven	2	-	0	Nests outside the census area.
Snow Bunting	54-60	40.4-45.5	0	Nests of passerines are only found oportunistically.
Irregular breeders				
Species	No. of territories	Average min. and max. no. territories 1996-2006	No of nests found[a]	Comments
Pink-footed Goose	0	0.2	0	Min. 1181 immatures migrated northwards over the area
Eurasian Golden Plover	0	0.1	0	
Red Phalarope	1	0.6-0.8	1	First nest found by BioBasis at Zackenberg
Snowy Owl	0	0.1	0	
Northern Wheatear	0	0.2-0.5	0	
Arctic Redpoll	3	1.1-3.3	0	

[a] Within the census area

the wader nests were subjected to predation. Ruddy Turnstones suffered the lowest predation; 22% of the nests were successful. Sanderling nests suffered heavily from predation again this season, although a little less than in 2007 (Table 6). A single Sanderling nest was abandoned during laying and another two Sanderling nests were abandoned before hatching. All four common ringed plover nests that were found eventually fell victim to predation. Just one nest of red knot was found in 2008, and it suffered predation.

The Arctic fox (*Alopex lagopus*) is the likely predator of most nests, as very few nests were found with clear signs of avian predators. The number of fox encounters was relatively high in 2008 and the minimum number of fox pups produced in the dens within the research area was record high (Table 6).

The mean clutch size across the three target species was 3.7 in 2008, which is a little below average (Table 7). Nests containing fewer than four eggs were: Common Ringed Plovers, two nests of three eggs – Sanderling; one nest of three eggs, two nest of two eggs, and two nests of one egg – Dunlin: four nests of three eggs – Ruddy Turnstone; one nest of two eggs.

In July and early August, alarm calling

TABLE 3. Dates of first observation of selected species at Zackenberg 1996-2008.

Species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Red-throated Diver	≤155	150	154	155	158	154	152	≤155	≤153	149	155	152	152
Pink-footed Goose	≤155	≤148	147	154	156	154	152	≤154	≤153	≤139	≤146	≤145	136
Common Eider	165	153	175	180	163	161	163	163	169	155	163	172	164
King Eider	164	155	166	167	≤174	160	152	≤164	166	172	163	173	170
Long-tailed Duck	≤153	150	153	157	158	158	154	158	154	152	158	156	155
Red-necked Phalarope	157	150	156	161	159	155	156	162	≤153	147	157	148	153

TABLE 4. Median first egg dates for waders at Zackenberg 2008 as estimated from incomplete clutches, egg floating, hatching dates, as well as weights and observed sizes of pulli.

Species	Median date	Range	N
Common ringed plover	167	163 - 181	4
Red Knot	166	165 - 167	2
Sanderling	169	156 -154	39
Dunlin	169	157 - 187	22
Ruddy Turnstone	170	156 - 179	9

TABLE 5. Snow cover on 10 June (DOY: 162) together with median first egg dates for waders at Zackenberg 1995-2008. Data based on less than 10 nests/broods are in brackets, less than five are omitted. The snow cover is pooled (weighted means) from section 1, 2, 3 and 4 (see section 2.2), from where the vast majority of the egg laying phenology data originate. See Jensen and Rasch (2009) regarding estimation of snow.

Species	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Snow cover on 10 June	84	82	76	80	91	53	84	79	83	48	28	85	48	71
Sanderling		(168)	169	169	174.5	168	173.5	168	164	160	(166)	181	166	169
Dunlin	(169)	163.5	164	167.5	173	163.5	176	159	163	164	163	178	166	169
Ruddy Turnstone	(163)	170.5	164	163.5	175	163	174	160	159	160	162	(172)	158	170

TABLE 6. Mean nest success (%) 1996-2008 according to the modified Mayfield method (Johnson 1979). Poor data (below 125 nest days or five predations) are given in brackets. Data from species with below 50 nest days have been omitted ('-' indicates no nests at all). Nests with at least one pipped egg or one hatched young are considered successful. Also given are total numbers of adult foxes observed by the bird observer in the bird census area during June-July (away from the research station proper), along with the number of fox dens holding pups.

Species	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	1008	1996-2008
Common Ringed Plover				(60)		(38)				-	(0)	-	(2)	48-51
Red knot	-	-			-		-			-	-	(100)		(24)
Sanderling	(72)	(33-100)	(88)	40	(46)	19	(33)	45	71-85		(7)	3	5	22-23
Dunlin			28-47	65	68	(75)		63	93	(43)	47	48	17	55-60
Ruddy Turnstone	21-68	67-100	16	23-28	29	(60)	52	21-27	83			36	(22)	38-44
Red-necked Phalarope	-	-	-		-	-	-	-	-		-	-	-	
Red Phalarope	-	-	-	-	-	-	-	-	-	-		-	-	
All waders	33-63	52-100	32-37	42-44	44	43	43	42-44	87-90	22	37	18	16	36-39
N nests	17	31	44	44	47	32	21	51	55	15	28	60	58	503
N nest days	163	274	334	518	375	328	179	552	700	104	332	533	433	4816
Fox encounters	14	5	7	13	11	14	21	11	16	18	22	23	20	
Fox dens with pups	2	0	1	0	2	2	0-1	2	3	0	2	3	5	

parents of Common Ringed Plovers, Red Knots, Sanderlings, Dunlins, and turnstones – and later juveniles – were found in the fens and marshes (dunlins), on the slopes of Aucellabjerg and in the dry lowlands.

Data on chick survival is scarce, but as early as 11 June, flocks of up to 10 individuals of Long-tailed Skuas roamed the lower slopes of Aucellabjerg and the lowlands, which most likely have asserted a significant predation pressure on the chicks.

Reproductive Phenology and Success in Long-Tailed Skuas

Eight (i.e. 80 %) of the Long-tailed Skua nests were initiated prior to the census period. In terms of nest initiation, this season was around average (Table 8), and in the census area only two nests were initiated after 20 June (DOY: 172).

Only one collared lemming (*Dicrostonyx groenlandicus*) observation was made by the chief bird observer (J. Hansen), reflecting a season with few lemmings (Table 8) – the main food resource for Arctic fox and Long-tailed Skua. The average clutch size was 1.6 eggs per nest. Only 5 chicks hatched. Nest success for Long-tailed Skuas was well below average (average nest success 1996-2007: 55%; Table 8). Most hatched chicks are thought to have suffered predation; only two are thought to have survived. The last observation was of a juvenile (accompanied by an adult) on 13 August (DOY: 226). This young bird was likely to be 40 days old.

Barnacle Geese

The Barnacle Goose (*Branta leucopsis*) colony on the southern face of the mountain Zackenbergfjeldet was active with at least three pairs. The colony was first found in 1964, and thereafter revisited and found still in use in 2005 and 2006 (Hansen et al. 2008).

The first families with goslings were seen on 9 July. The number of broods was 15 (Table 9), and the maximum number of goslings seen at one time was 18.

The mean brood size was high until mid July, but ended on a just 1 gosling per brood in early August (Table 9). From Isle of Islay, Western Scotland, it was reported that the percentage of young in the flocks arriving to their wintering quarters was 8.2 (Table 9; M. Ogilvie, pers. comm.).

In 2008, immature Barnacle Geese moulted in numbers well above average (1995-2007 average: 196; Table 10).

Common Bird, Not Breeding in the Census Area

A total of 1,181 individual immature Pink-footed Geese (*Anser brachyrhynchus*) were observed migrating over Zackenbergdalen northwards towards their moulting areas. Only two immature Pink-footed Geese were found moulting at Zackenberg this year (Table 11).

On 12 June (DOY: 164), the first Common Eider (*Somateria mollissima*) was seen on Lomsø (a female). In the following weeks pairs and smaller flocks were seen regularly, but at no time more than ten individuals. Ten young – possibly from the Daneborg or Sandøen colonies (c. 30-35 km west of Zackenberg) – were recorded with an adult female in the former delta, on 18 July (DOY: 200). The last adult male was seen on 23 July (DOY: 205). The 63 adults and three pulli seen at a sandy spit at the former delta on 29 July (DOY: 211) was the largest flock of the season. At Daneborg, the Common Eider colony between the dog pens was once again

TABLE 7. Mean clutch sizes in waders at Zackenberg 1995-2008. Samples of fewer than five clutches are given in brackets.

Species	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Mean
Common Ringed Plover	(4.00)	(4.00)	(3.50)	(4.00)	(3.50)	(4.00)	(3.50)	(4.00)	(4.00)	(4.00)		(3.75)		(3.75)	3.83
Red knot				(4.00)	(4.00)		(4.00)		(4.00)	(4.00)			(4.00)	(4.00)	4.00
Sanderling	(4.00)	4.00	3.86	4.00	3.67	4.00	3.43	3.83	4.00	4.00	3.75	3.63	3.73	3.77	3.83
Dunlin		(4.00)	(3.75)	3.90	3.70	3.93	3.63	(4.00)	4.00	3.92	4.00	3.13	3.79	3.67	3.80
Ruddy Turnstone		3.71	3.79	3.82	3.58	3.80	3.75	4.00	3.77	3.92	3.86	(3.00)	(4.00)	3.71	3.75
Average	4.00	3.93	3.73	3.94	3.69	3.93	3.66	3.96	3.95	3.97	3.87	3.38	3.88	3.73	3.83

TABLE 8. Egg-laying phenology, breeding effort and success in Long-tailed Skuas at Zackenberg 1996-2008. Median egg laying date is the date when half the supposed first clutches were laid. Number of clutches found includes replacement clutches. Mean hatching success according to the modified Mayfield method (Johnson 1979). Poor data (below 125 nest days or five predations) are given in brackets. Nests with at least one pipped egg or one hatched young are considered successful. Also given are numbers of lemming winter nests within the 2 km² lemming census area (see section 3.4). *Please note that in 2006, only one of two eggs hatched (other never hatched)..

Long-tailed skua breeding	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Median 1st egg date		7.6	12.6	17.6	18.6	15.6	9.6	15.6	8.6	8.6	19.6	12.6	12.6
No. of clutches found	8	17	23	8	5	21	14	7	21	8	2	15	9
No. of young hatched	1	25	16	2	2	18	14	5	36	6	1	11	3
Nest success % (Mayfield)		(80.6)	26.7	(18.1)	(17.5)	39.5	44.1	(76.2)	(94)	(51.8)	(100)	23	33
Estimated no. of young fledged	0	5	6	1	0	5	4	2	22	1	0	1	2
Lemming winter nests pr. km²	224.5	247.2	467	227.4	136.8	208.5	178.3	66	238.7	170.8	189.6	236.8	75.5

TABLE 9. Average brood sizes of Barnacle Geese in Zackenbergdalen during July and early August, 1995-2008, together with the total number of broods brought to the valley. Samples of less than 10 broods are given in brackets. Average brood size data from autumn on the Isle of Islay in Scotland are given for comparison, including the percentage of juveniles in the population (M. Ogilvie, pers. comm.).

Decade	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Primo July		(3.0)	3.1	(2.9)	1.9	(3.2)	(1.8)	2.4	(1.8)	2.6	(1.7)	(2.0)	1.3	(4)
Medio July		(2.3)	2.7	2.3	1.8	(3.1)	(1.7)	2.4	(1.2)	2.3	2.7	(1.5)	1.5	1.6
Ultimo July	(2.0)	(3.0)	2.6	2.2	1.7	3.1		2.3	(1.1)	2.3	(2.2)	(1.1)	(3.3)	(1.5)
Primo August	(2.3)	(2.3)	2.4		1.8		(2.0)	2.2	(1.2)	(1.9)		(1.5)	-	(1)
No. of broods	≥7	6-7	19-21	≥18	29	11	4	32	8	26	14	9	28	15
Scotland	2.0	2.3	2.0	2.3	1.9	2.2	1.9	2.2	1.6	2.6	1.7	1.2	2.1	1.9
Per cent juv.	7.2	10.3	6.1	10.5	8.1	10.8	7.1	12.5	6.4	15.9	6.3	3.2	9.8	8.2

censused, and estimated to hold 2,135 nests (Sirius Dog Sledge Patrol, pers. comm.; 2002-2007 average nest numbers: 2290).

A pair of King Eiders (*Somateria spectabilis*) was seen on 18 June (DOY: 170), which is a little later than usual (Table 3). The 1996-2005 average arrival date was 13 June (DOY: 164). During late June, another five pairs were seen – mainly migrating past Zackenberg or in through the valley. No nesting attempts were recorded. The last observation this year was a pair observed on 13 July (DOY: 195).

Long-tailed Ducks (*Clangula hyemalis*) were seen from 3 June (DOY: 155), with pairs seen regularly – almost daily – until late June. In early July, only a few pairs were seen. From mid-July, only females were seen in flocks of up to 22 (former delta, 4 August; DOY: 217). This is also the last record of Long-tailed Ducks from 2008. No pulli were seen in 2008.

Juveniles of both Arctic Redpoll and Snow Bunting were seen in adjacent areas. For the Snow Bunting, several juveniles were observed within the census area.

There was an estimated two pairs of Common Raven (*Corvus corax*) roaming in the valley, both assumed to be nesting in adjacent areas. The first six juvenile birds were seen on 24 June (DOY: 176) near the research station. During July and August, birds from this flock were seen regularly around the valley, with numbers varying from one to four.

VISITORS AND VAGRANTS

Two Great Northern Divers (*Gavia immer*) were seen on 6 June (DOY: 158) on Østersøen, a lake adjacent to the Zackenberg bird census area. The same birds were seen on the shore nearby the following day (M. Bjerrum, pers. comm.). Great Northern Divers are occasionally visitors to Zackenberg, likely breeding in a neighbouring valley, Store Sødal (Meltofte 2006b).

TABLE 10. The number of immature Pink-footed Geese and Barnacle Geese moulting in the study area at Zackenberg 1995-2008. The closed area is zone 1c (Fig. 1)..

Study area	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
PINK-FOOTED GOOSE														
Closed moulting area and further east	310	246	247	5	127	35	0	30	41	11	17	27	0	0
Coast west of closed area	230	40	60?	0	29	0	0	0	0	10	0	3	2	0
Upper Zackenbergdalen	0	0	15	0	0	0	0	0	0	0	0	1	0	2
Pink-footed Goose total	540	286	322	5	156	35	0	30	41	21	17	31	2	2
BARNACLE GOOSE														
Closed area at Lomsø and Kystkærene	21	0	29	21	60	84	137	86	120	81	87	148	66	106
Coast east of closed area	>120	150?	96	55	66	0	109	80	45	0	2	218	46	125
Coast west of closed area	0	0	0	0	0	30	0	0	0	0	29	29	106	65
Upper Zackenbergdalen	41	85	2	75	<57	27	60	0	14	0	25	30	6	41
Barnacle Goose total	>182	235?	127	151	<183	141	306	166	179	81	143	425	224	337

Gyr Falcons (*Falco rusticolus*) were spotted several times during the season. There was a single observation of one falcon on 9 May (DOY: 130). In late May, a single individual was seen on two occasions, near the research station. Only one more observation from the summer was made on 11 June. One to three Gyr Falcons were seen four times during September and October (T. Tagesson and J. Skafte, pers. comm.).

This year's most surprising visitor was a Redshank (*Tringa tetanus*) seen in the fens just south of research station on 18 and 20 June (DOY: 170 and 172, respectively). This is a very rare sighting in Northeast Greenland (cf. Boertmann 1994), and only the second record at Zackenberg. The previous Redshank record from Zackenberg dates back to 1947 (Møhl-Hansen 1949) (Table 11).

Apart from the Redshank, other non-breeding waders were recorded as well. The Eurasian Golden Plover (*Pluvialis apricaria*) was once again recorded with a single individual, from the 7 to 10 June (DOY: 162), at the foot of Aucellabjerg.

In six of thirteen seasons, Whimbrels (*Numenius phaeopus*) have been observed at Zackenberg. In 2008, a pair was seen on 17 June (DOY: 169) on the edge of a large fen area in the census area proper (Table 11). One bird was heard nearby the following day, and a "large wader" seen 25 June (DOY: 177) could have been the same bird.

On 15 May (DOY: 136), an Arctic Skua (*Stercorarius parasiticus*) was seen at Langemandsø, outside the census area.

Arctic Terns (*Sterna paradisaea*) were seen at Zackenberg twice this season. A flock of 45 were flying past the shores south of the research station on 10 July (DOY: 192). Three days later, another 12 flew the same way.

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REFERENCES

BOERTMANN, D. 1994. An annotated checklist of the birds of Greenland. Meddelelser om Grønland, Bioscience 38. 63 pp.

BOERTMANN, D. 2008. The Lesser Black-Backed Gull expanding into the Nearctic. Arctic 61:129-132.

HANSEN, J., N. M. SCHMIDT, AND H. MELTOFTE. 2008. Bird monitoring at Zackenberg, Northeast Greenland, 2006. Bird Populations 9:1-12.

JENSEN, L. M. AND M. RASCH (eds.). 2009. Zackenberg Ecological Research Operations, 14th Annual

TABLE 11. Numbers of individuals and observations of avian visitors and vagrant at Zackenberg 2007, compared to the numbers of individuals observed in the preceding seasons, 1995-2006.

	Visitors and vagrants														
	Previous records													2008	
Species	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	No individual	No. observations
Great Northern Diver	0	0	0	0	0	0	1	0	0	0	0	0	2	2	2
Wooper Swan	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
Snow Goose	0	0	0	0	0	2	11	0	23	0	0	0	1	0	0
Canada Goose	0	0	0	0	0	0	0	0	0	0	0	4[a]	3[a]	0	0
Merlin	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Gyr Falcon	1	1	1	3	0	4	5	1	3	4	2	0	3[b]	2[c]	4
Pintail Duck	0	0	0	1[d]	0	0	0	0	0	0	0	0	3[d]	0	0
Common Teal	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Eurasian Golden Plover	0	3	1	3	1	0	1e	1	0	1	1	1	1	1	2
White-rumped Sandpiper	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
Pectoral Sandpiper	0	0	0	1	0	0	0	2	0	0	0	1	1	0	0
Purple Sandpiper	0	0	0	0	0	0	0	1[f]	0	0	0	0	0	0	0
Red Phalarope	0	0	0	4-5[e]	0	0	4[e]	0	1	0	2[e]	11[e]	0	2	1
Common Snipe	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Whimbrel	0	0	0	0	0	1	1	0	0	2	1	0	1	2	3
Eurasian Curlew	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Redshank	0	0	0	0	0	0	0	0	0	0	0	0	0	1[g]	3
Pomarine Skua	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Arctic Skua	0	0	11	6	0	2	7	4	3	2	0	1	0	0[h]	0
Great Skua	0	0	0	4	0	0	0	1	0	0	0	0	0	0	0
Lesser Black-backed Gull[i]	0	0	0	0	0	0	1	0	1	2	1	4	0	0	0
Iceland Gull	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Great Black-backed Gull	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0
Black-legged Kittiwake	0	0	0	0	0	0	0	0	14[b]	0	0	0	0	0	0
Arctic Tern	≈200	2	1	2	0	14	0	0	32	0	0	0	0	57	2
Snowy Owl	0	0	2	1	1	1-2	≥4[d]	0	0	0	0	0	1b	0	0
Meadow Pipit	0	0	0	1	0	0	0	0	0	0	1c	1c	0	0	0
White Wagtail	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Northern Wheateard	4	8	4	3	1-2	0j	0	0	0	0	2	1	4[b]	2	1
Arctic Redpoll	7	9	16	23	8	5	3	6	31[b]	12	3[d]	2	8[b]	10[k]	14
Lapland Longspur	0	0	0	0	1-2	0	1	0	0	0	1	0	0	0	0

[a] Subspecies *interior* [b] See Hansen et al. 2008. [c] After regular season, 4 observations of 1-3 birds. [d] Northernmost records in East Greenland (cf. Bortmann 1994).
[e] At least one territory, possible territory or breeding found; see Table 1. [f] Juvenile. [g] 2nd record at Zackenberg (cf. Møhl-Hansen 1949). First record during BioBasis.
[h] Before the regular season, 1 in ajdacent areas. [i] Increasing in East Greenland (Boertmann 2008). [j] One dead individual found.
[k] In addition, one juvenile at Dombjerg 28 July.

Report, 2008. National Environmental Institute, University of Aarhus, Roskilde.

JOHNSON, D. H. 1979. Estimating nest success: The Mayfield method and an alternative. Auk 96:651-661.

MELTOFTE, H. 2006. Populations and breeding performance of divers, geese and ducks at Zackenberg, northeast Greenland, 1995-2005. Wildfowl 56:129-151.

MELTOFTE, H., BERG, T. B., AND N. M. SCHMIDT. 2009. BioBasis, Conceptual design and sampling procedures of the biological programme at Zackenberg Basic. 12th ed. – National Environmental Research Institute, Department of Arctic Environment, University of Aarhus, Roskilde.

MELTOFTE , H. AND T. T. HØYE. 2007. Reproductive response to fluctuating lemming density and climate of the Long-tailed Skua *Stercorarius longicaudus* at Zackenberg, Northeast Greenland, 1996-2006. Dansk Ornitologisk Forenings Tidsskrift 101:109-119.

MØHL-HANSEN, U. 1949. The Bird-life in Pearyland, North Greenland. Observations on "Dansk Pearyland Ekspedition" in the summer 1947. Dansk Ornithologisk Forenings Tidsskrift 67: 95-104. (Danish, with English summary).

BIRD POPULATIONS

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REPORTS OF AVIAN MONIOTORING PROGRAMS

INTRODUCTION TO THE REPORTS

Standardized broad-scale bird-banding programs (or bird-ringing programs as they are known in Europe and elsewhere in the eastern hemisphere) are an important component of national and international integrated avian monitoring efforts. Such programs include the Monitoring Avian Productivity and Survivorship (MAPS) program in North America and the Constant Effort Sites (CES) schemes in Britain and a number of other European countries, and provide critical information on post-fledging productivity and annual apparent adult survival rates. Despite the rich spatial structure of the data provided by these programs and widespread interest in understanding spatial patterns of population processes, little attention had been paid to spatial modeling of demographic rates. Recently, however, researchers at The Institute for Bird Populations and the USGS Patuxent Wildlife Research Center implemented Bayesian hierarchical analyses of a spatial autoregressive model based on the transient Cormack-Jolly-Seber (CJS) capture-recapture model to provide spatially explicit and year-specific survival and residency probabilities for Wood Thrush (Saracco et al. 2010. Ecology 91:1885-1891) and Common Yellowthroat (Saracco et al. 2010. J. Ornithology, Online First, 10 August) from 12 years (1992-2003) of MAPS data.

Most previous studies that applied transient CJS models to capture-recapture data had largely been concerned with reducing the negative bias of transient individuals on survival estimates. Little attention had been paid to spatial or temporal modeling of residency probability itself. The clear spatial patterns in residency probability revealed by these recent studies, however, suggest that the residency parameter has important ecological relevance. Indeed, for both Wood Thrush and Common Yellowthroat, these recent spatial autoregressive models showed that spatial variation in survival and residency tended to be independent of each other. Areas where survival probability was high and residency probability was low could suggest a combination of good non-breeding season conditions and breeding habitat limitation. In contrast, areas with low survival and high residency could suggest areas where individuals experienced low survival due to poor non-breeding season conditions, with subsequent ample opportunity for new territory establishment (and thus few floaters).

Clearly, the spatial modeling of avian survival and residency probabilities, and of productivity and recruitment rates, especially in relationship to climate, weather, and habitat, can provide valuable data useful for informing conservation and management. Such data can provide insights into causes of avian population trends, can help identify areas where problems are acute and areas where they will be further exacerbated by climate change, can lead both to management strategies for reversing population declines and to adaptation strategies for climate change, and can provide a means for evaluating the effectiveness of conservation, management, and adaptation strategies. This will only happen, however, with continued spatially-extensive avian population and demographic monitoring, which, in turn, will require long-term commitments of

human and financial resources. Obtaining such commitments in these difficult times depends in no small part upon the timely production and widespread dissemination of results from these avian demographic monitoring programs.

Just as during the 1980s and 1990s, when researchers at the British Trust for Ornithology provided leadership in the development and implementation of integrated avian population monitoring, they have more recently provided leadership in disseminating the results of that monitoring. Moreover, the manner they have implemented for disseminating their results has provided land managers and stewards, including those from both public and private sectors, with information for identifying avian species and populations at risk, as well as information and direction for managing and conserving not only those at-risk populations but populations of common species as well. The heart of the BTO's effort at disseminating the results of integrated population monitoring is its annual *Breeding Birds in the Wider Countryside: Their Conservation Status* report, a web-based compendium of trends, from 1966 to the present, in numbers and breeding performance for 115 species breeding in the UK. Each species has its own "page" in this report on which is provided its conservation listing, its status summary, and, in graphical and tabular formats, its population and demographic trends, including laying date, clutch and brood sizes, egg and chick nest failure rates, fledglings per breeding attempt, and CES productivity indices and adult apparent survival rates. Links are also provided for each species to other monitoring results and resources, including the British and Irish Bird Atlases and Birdtrack and Garden BirdWatch results.

We are very pleased, therefore, to announce that, beginning with Volume 10, *Bird Populations* will be publishing links to the annual BTO *Breeding Birds in the Wider Countryside* reports. In addition, beginning with Volume 10, we will also include links to the annual reports of the British Breeding Bird Survey (BBS), Wetland Bird Survey (WeBS), and Constant Effort Sites (CES) scheme, the last as presented in the BTO's *CES News*. We believe that by providing direct access to these reports on the BTO's website, rather than by providing reprints of reports of these programs from the *BTO News*, we will allow readers of *Bird Populations* to gain better access to increasingly detailed information and results from these important monitoring programs. Volume 10 will continue to provide reprints from *BTO News* of the annual reports of the Nest Record Scheme and Garden Bird Feeding Survey, for which there are no comparable electronic reports to which we can link.

We hope that by publishing, reprinting, and providing links in *Bird Populations* to reports of major avian monitoring programs, we will draw attention in a timely manner to short-term avian population fluctuations that may ultimately prove to be geographically widespread or that may signal the beginnings of longer-term trends. We hope further that by disseminating these reports we will help provide a global informational network for addressing avian population changes, will encourage an integrative global approach to avian monitoring studies, will stimulate the establishment of additional avian monitoring programs, and ultimately will aid in the conservation of global avian diversity. – David F. DeSante.

Bird Populations 10:90-109

THE 2003-2008 SUMMARY OF THE NORTH AMERICAN BREEDING BIRD SURVEY[1]

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Abstract. Data from the North American Breeding Bird Survey were used to estimate continental and regional changes in bird populations for the 6-yr period 2003-2008 and the 2-yr period 2007-2008. These short-term changes were placed in the context of population trends estimated over the 1966-2008 interval. Across the entire survey area, a higher proportion of species exhibited positive growth during 2003-2008 (64%) than during the long-term (46%) or the more recent 2-yr-term (39%). The 2003-2008 growth occurred relatively evenly across the Western, Central, and Eastern BBS regions, with 59%, 66%, and 61% of all species increasing, respectively. We additionally evaluated the proportion of species with positive trend estimates in each of 12 life-history based groupings at continental and regional levels. Survey-wide, birds in the grassland guild demonstrated the lowest proportion of positive trends over the entire survey period (21% increasing), with significant declines occurring in both the Eastern and Western regions (5% increasing and 18% increasing, respectively). Birds in the wetland breeding guild exhibited the greatest proportion of positive trends, with a significant number of increasing species (between 77-90%) occurring in all three BBS regions during 2003-2008.

Key Words: North American Breeding Bird Survey, population trends, roadside surveys, species group analysis.

RESUMEN DEL CONTEO DE AVES REPRODUCTORAS (BBS) DE NORTEAMÉRICA DESDE 2003 Y 2008

Resumen. Datos del Conteo de Aves Reproductoras (BBS) de Norteamérica fueron utilizado para estimar los cambios continental y regional en las poblaciones de aves en el periodo de 6 años 2003-2008 y el periodo de dos años 2007-2008. Estos cambios a corto plazo fueron situados en el contexto de las tendencias poblacionales estimadas en el intervalo 1966-2008. En la escala continental, una mayor proporción de las especies mostraron un crecimiento positivo durante 2003-2008 (64%) que en el periodo de largo plazo (46%) o en el período más reciente de 2 años (39%). El crecimiento de 2003-2008 se ocurrió de manera relativamente uniforme a través de las regiones Oeste, Central y Este del BBS, con el 59%, 66% y el 61% de las especies aumentando, respectivamente. Además, evaluamos la proporción de especies con tendencias positivas en las escalas continental y regional para 12 grupos de especies que comparten características de historia de vida. En la escala continental, las aves de pradera mostraron el porcentaje más bajo de especies con tendencias positivas (21% aumentando) con declives significativos detectado en las regiones Este y Oeste del BBS (5% aumentando y 18% aumentando, respectivamente). Aves que se reproducen en humedales mostraron la mayor porcentaje de las tendencias positivas, con un número sigivicativo de especies con tendencias positivas (77-90%) detectado en las tres regiones del BBS durante 2003-2008.

Palabras clave: Conteo de Aves Reproductoras de Norteamérica, tendencias poblacionales, conteos en carreteras, análisis por grupos de especies.

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INTRODUCTION

Initiated in 1966, the North American Breeding Bird Survey (BBS) is the primary source of standardized population data for breeding birds in the U.S. and Canada. For most avian breeding species in North America, it is the only available source for long-term population trend estimates and relative abundance measures at large geographic scales. The BBS was initiated by the U.S. Fish and Wildlife Service and Canadian Wildlife Service and is currently administered by the U.S. Geological Survey (USGS) and Canadian Wildlife Service (CWS). In 2007, Mexico's National Commission for the Knowledge and Use of Biodiversity (CONABIO) partnered with the USGS and CWS to expand the BBS into Mexico. A sampling framework, including hundreds of new routes, is currently in development across the northern tier of Mexican states, putting the survey closer to its goal of making the BBS a fully North American program.

This summary presents continent-wide estimates of population trends for 422 bird species and four species groups [Western/Clark's Grebe (*Aechmophorus clarkii/A. occidentalis*), Willow/Alder Flycatcher (*Empidonax traillii/E. alnorum*), Pacific-slope/Cordilleran Flycatcher (*Empidonax difficilis/E. occidentalis*), and Yellow-bellied/Red-naped/Red-breasted Sapsucker (*Sphyrapicus varius/S. nuchalis/S. ruber*)] for the period 1966-2008. Although these four groupings currently consist of taxonomically distinct species (AOU 1998), each was viewed as a single taxon when the BBS was initiated and early data collected from areas of sympatry cannot be discriminated adequately to permit contemporary range-wide species-level analyses. In this report we discuss the 6-yr trends, 2003-2008, and 2-yr trends, 2007-2008, within the context of long-term changes estimated over the 1966-2008 interval. Detailed analyses and discussion of population changes for individual species within specific regions, states, provinces, territories, and physiographic strata are beyond the scope of this summary. Also included in this summary are the continental and regional trends for 12 groups of birds sharing similar life-history traits. Analyses of group trends can provide insight into the broad temporal and geographic patterns of population trends, especially when viewed in the context of previous BBS summaries (Pardieck and Sauer 2007, 2000; Peterjohn and Sauer 1993; Peterjohn et al. 1994, 1996).

METHODS

The BBS consists of over 4600 active survey routes randomly located across the continental United States, Canada, and northern Mexico [See the North American Breeding Bird Survey web site (www.pwrc.usgs.gov/bbs/) for maps depicting the approximate locations of these routes]. Since 1994, the number of routes surveyed in the United States and Canada has remained relatively constant at about 3000 routes. A total of 2980 routes were sampled in 2003, 2995 in 2004, 3059 in 2005, 3058 in 2006, 3111 in 2007, and 3022 in 2008.

The BBS methodology is described briefly here; see Robbins et al. (1986) for a detailed description. The BBS is a roadside survey program consisting of 39.4-km (24.5-mi) routes, with stops placed at 0.8-km (0.5-mi) intervals for a total of 50 stops. Routes are randomly established on suitable roads and surveyed once per year during the height of the breeding season (June for most of the U.S. and Canada). At each stop, a skilled amateur or professional ornithologist records all birds seen within a 0.4-km (0.25-mi) radius and every bird heard, during a 3-min point count. For each species, the sum of the counts from the 50 points is used as an index to abundance along the route for that year.

ESTIMATION OF POPULATION TREND

Population change was estimated using a hierarchical log-linear model fit to BBS data with Markov chain Monte Carlo (MCMC) methods. Hierarchical models provide a natural framework for accommodating differences in quality of information among regions and the MCMC procedure provides a convenient tool for estimating composite results. The hierarchical model analysis was first described by Link and Sauer (2002) and we note that this report is the inaugural summary report using this analysis. Sauer and Link (2010) conducted a comprehensive comparative analysis of BBS data using hierarchical model and route regression results, and we refer readers to that evaluation for details of both the analytical method, its implementation for BBS data, and the similarity of results

from the two approaches.

Analyses of BBS data produce a single composite estimate of population change, or trend (an interval-specific geometric mean of proportional changes in population size), presented as mean percentage change per year (Link and Sauer 1998). In the hierarchical model, composite trends are functions of the model's parameters and hyperparameters, combined using abundance weights reflecting the typical magnitude of counts on routes in the survey area. We estimated trends at the scale of the entire survey area and separately for Eastern, Central, and Western BBS regions (Bystrak 1981), for the interval 1966–2008, noting that the survey did not begin until 1968 in some parts of the survey area. Alaska, northern Canada (territories and northern portions of most provinces), Newfoundland, and northern Mexico were excluded from the analyses because of insufficient data to estimate long-term trends.

As the analysis was conducted using Bayesian methods, estimates of parameters and their credible (Bayesian confidence) intervals are taken from the Posterior Distribution of the parameters; for mean change, we used the 2.5 and the 97.5 percentiles of the distribution as our estimate of the composite change and its 95% credible (Bayesian confidence) intervals. We used width of the interval to measure precision of the results and considered an estimate to be imprecise if the half-width of the credible interval was larger than 3%/yr change for the species (Sauer et al. 2003). Although the magnitude of a trend estimate may be quite large, if the credible interval includes zero the trend is not considered significantly different from zero. See the BBS Analysis and Summary Website (http://www. mbr-pwrc.usgs.gov/bbs.html) for additional discussion about trend quality and precision. As in earlier BBS summaries (Pardieck and Sauer 2007), we have incorporated an overall Trend Quality (TQ) score to identify trends that contain certain deficiencies. TQ is a ranked score ranging from 1-3; we categorized each species' results into TQ1: acceptable, TQ2: use with caution, or TQ3: possibly questionable based on (1) precision [CI not small enough to exclude 0 for a 3%/yr change = TQ2, or not small enough to exclude 0 for a 5 %/yr change= TQ3]; (2) sample size [N routes < 15 = TQ2, or N routes < 5 = TQ3]; and (3) Relative Abundance [annual index in final year <1 = TQ2, or annual index in final year <0.1 = TQ3. Overall TQ value was determined based on the largest concern level in any of the criteria.

Sample size was determined as the number of routes on which the species was encountered during any year of the survey. This quantity is larger than the sample size presented in earlier reports, which was based on the number of routes providing acceptable data for the route regression analysis. Because the interval-specific trends are calculated directly from the composite indices, rather than in a separate analysis as was presented in earlier reports, we do not provide separate sample sizes for interval results.

SUMMARIES FOR GROUPS OF SPECIES

We estimate the median percentage of species having increasing populations for each region and time period. Because the collection of species in our analyses tends to vary greatly in quality of information, we used a hierarchical model similar to that described by Sauer and Link (2002), but assuming a lognormal distribution of counts (Sauer and Link 2010). This procedure provides a group estimate of the proportion of species exhibiting positive trends, incorporating uncertainty in estimates of variances of trend for individual species. As with the estimation of the individual species trends, we estimated the Posterior Distribution of the mean change using Bayesian methods; the 2.5 and 97.5 percentiles of the posterior distribution being our estimate of the composite change and its 95% credible (Bayesian confidence) interval. We considered a group trend to be significant if the 95% credible interval did not overlap 50%.

BBS trend results are summarized for all species collectively as well as 12 groups of species in five life-history categories: all species, breeding habitat (grassland, successional/scrub, wetland/open water, woodland, and urban habitats), nest type (cavity, open cup), migration (short-distance, permanent resident, and neotropical), and nest location (ground/low, midstory/canopy). Composition of the species groups are described in Peterjohn and Sauer (1993) but have been revised as per the seventh edition of the American Ornithologists' Union Check-list of North American Birds (AOU 1998) and subsequent supplements.

We note several constraints among the

comparisons presented. Data from the intervals are not independent, as the subintervals are contained within the longer interval. Consequently, we did not formally test for differences among intervals, and merely note differences among point estimates. All tests of the species group analyses address the null hypothesis that the percentage of increasing species does not differ from 50% within an interval. Sample sizes and precision of estimates differ among regions and time periods. Readers are cautioned that the underlying species groups in each guild can differ among regions. See the BBS Analysis and Summary Website (www.mbr-pwrc.usgs.gov/bbs) for additional discussion about species-group results for time periods and regions.

RESULTS

Among the the 426 species that we provide continent level trend estimates for, 216 (51%) exhibited significant long-term population change (Table 1, Appendix 1). Of these, 85 (39%) experienced population growth and 131 (61%) showed an overall decline. The majority of these significant long-term trend estimates had high trend quality; 144 (67%) species had TQ=1, 57 (26%) species had TQ = 2, and 15 (7%) species had TQ = 3. Continental trend estimates from the more recent 2-yr interval were similar, with 31% of all species exhibiting significant population growth and 69% experiencing significant population loss. This pattern was reversed during 2003-2008, when 66% of species showed significant positive trends and only 34% exhibited significant declines.

The results of the group analyses represent the trend and precision estimates of all constituent species in aggregate, thereby providing a more refined assessment of the proportion of species exhibiting increasing trends. Of the 12 life-history groups in each of the three BBS regions during 1966-2008, only 6 saw significantly more than half of their constituent species undergo population increase while 17 saw significantly more species decline. Results during 2007-2008 mirrored this long-term pattern (0 groups with >50% of species increasing vs. 7 with overall losses) but contrasted the 2003-2008 results where 13 groups saw significantly more species increase and none experienced a significantly greater proportion of declines.

At the survey-wide level, 46% of all species exhibited positive trend estimates during 1966-2008, with the greatest proportion of increases occurring in the Central region (58%; Fig. 1A).

All regions, but especially Western and Eastern, demonstrated appreciable gains during 2003-2008, with 64% of all species showing positive trends survey-wide. The proportion of species increasing survey-wide in the more recent 2-yr interval, however, fell to 39% due to declining populations in all regions.

The grassland bird guild contained the lowest number of species exhibiting increasing long-term trends of any group over the entire survey area (21%, Fig. 1B). The Eastern region reached a significant low point during 1966-2008 with just 5% of grassland species experiencing population growth. Grassland bird trends improved in all regions during 2003-2008 with the proportion of positive trend estimates ranging from 25% in the Eastern region to 57% in the Central region; this apparent tendency for increase, however, was not significant. Percentages dropped in all regions in the 2007-2008 interval but these declines also were not significant.

Wetland species exhibited the greatest significant proportions of positive trend estimates in

TABLE 1. Summary of Trend Quality (TQ) values for 1966-2008. Total number of species trends (N) in each trend category as well as their significance ($P < 0.05$) and direction are presented. The TQ values are defined as follows: 1 = acceptable, 2 = use with caution, 3 = possibly questionable.

Trend Quality	N	Number of Significant Trends	Number of Significant Trends: Increasing	Number of Significant Trends: Decreasing
All	426	216	85	131
1	250	144	46	98
2	124	57	33	24
3	52	15	6	9

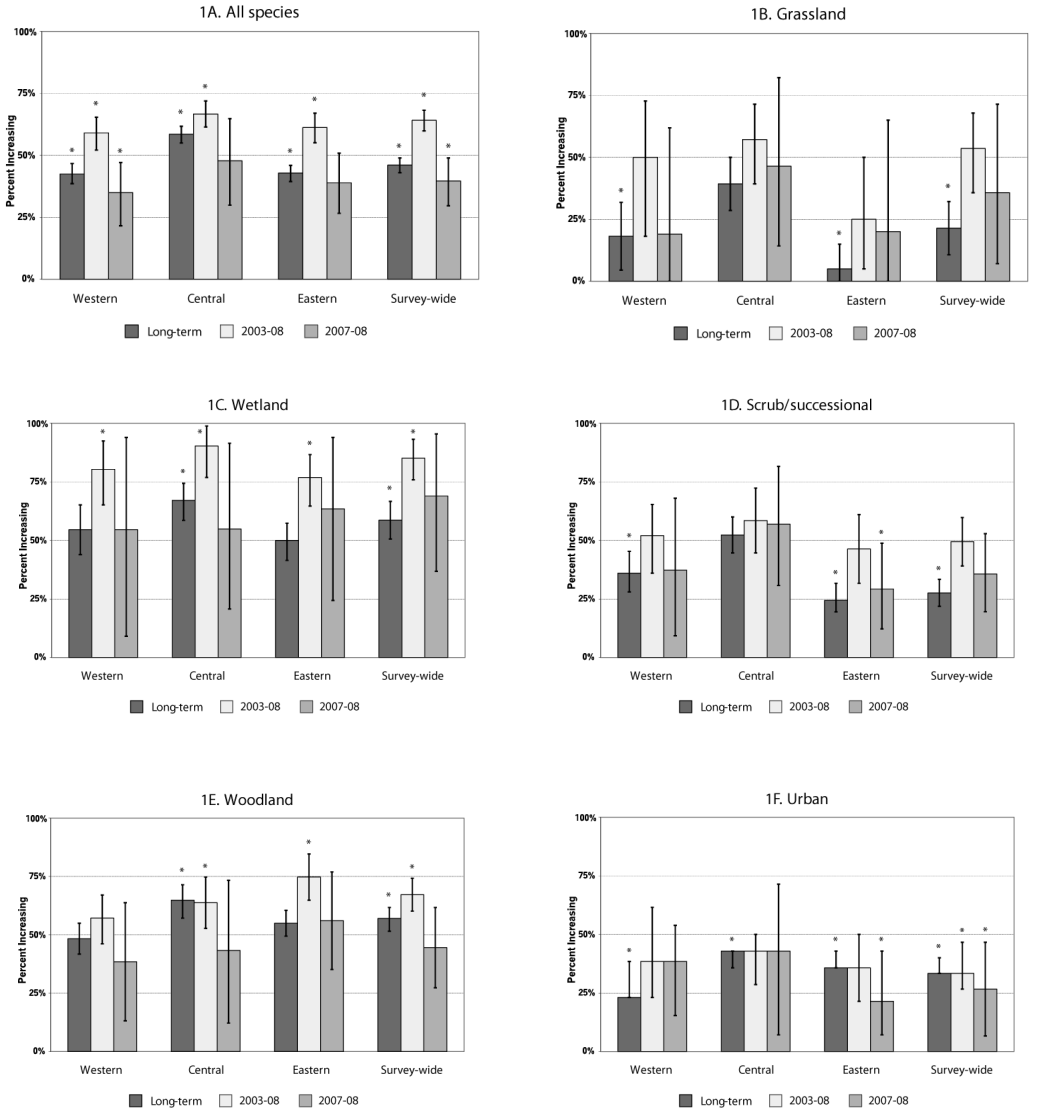
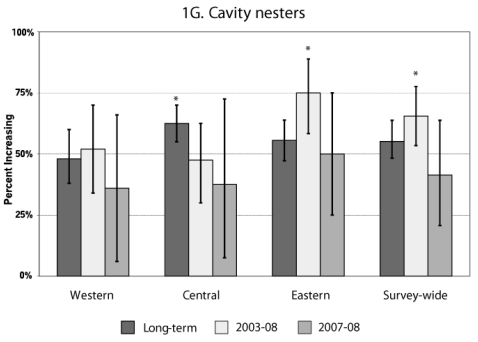
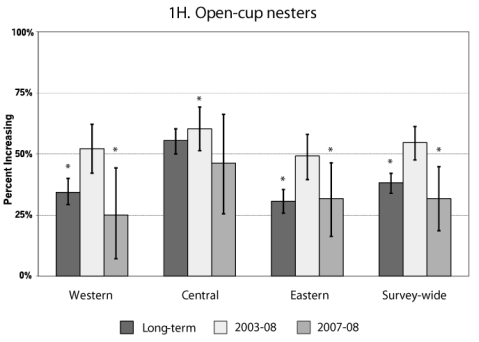
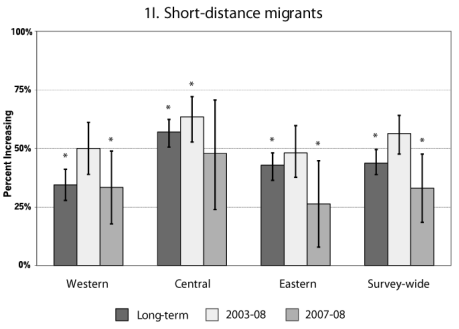
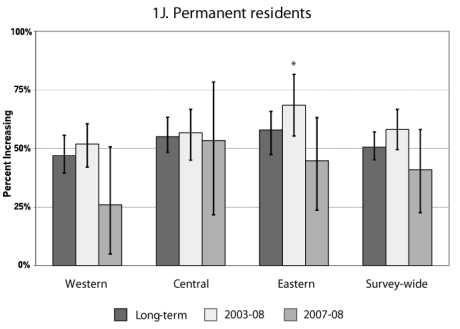


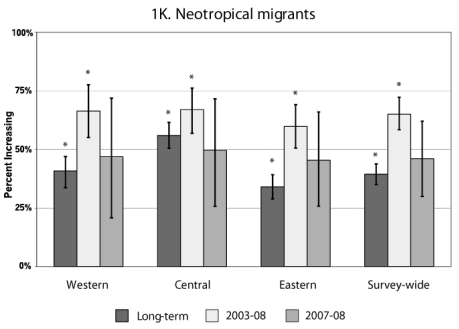
FIGURE 1 (A-M). The percentages of species, with credible intervals, having positive trend estimates during 1966-2008, 2003-2008, and 2007-2008, shown by species group. Trend is considered significant ($P < 0.05$) if the credible interval does not overlap 50% (indicated by *).

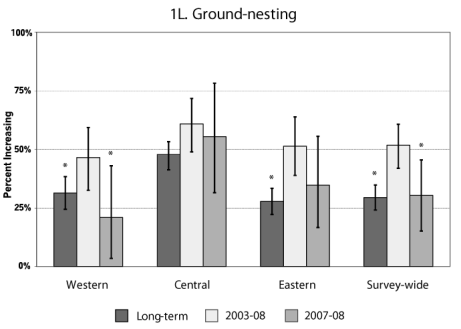












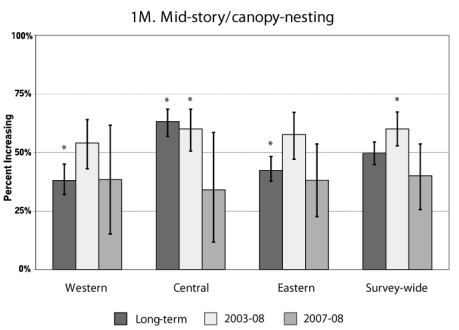


FIGURE 1 (A-M). Continued.

the Western, Central, and Eastern BBS regions with 80%, 90%, and 76% of species increasing, respectively, during 2003-2008 (Fig. 1C). Survey-wide, more wetland species demonstrated increase over the long-term (58%) than not, a result that appears to be driven by a significant and relatively high proportion of increases in the Central region (67%). Compared to the long-term, wetland birds apparently fared well during 2007-2008, with all regional percentages exceeding, although not significantly different from, 50%.

Scrub/successional species, on the other hand, continued to fare poorly over the long-term and a significantly low proportion of species experienced population growth across all regions (27%, Fig. 1D). The 2003-2008 time period appeared more favorable for this guild survey-wide (49%positive trends), but neither this, nor any of the regional values from this period, are distinguishable from 50%. The 29% of increases witnessed in the Eastern region during 2007-2008 is the only regional result statistically distinguishable from 50%, and it is similar to the long-term results for this region (24%).

During 2003-2008, a significant number of woodland birds exhibited increasing trends survey-wide (67%), and this was greater than the proportion observed over the long-term (57%; Fig. 1E). This result appears to be driven by significant gains made in the Eastern region during 2003-2008 (74% increasing trends). The 63% of species with increasing long-term trends from the Central region remained nearly unchanged and significantly high in the 2003-2008 period (64%). In contrast, the proportions of woodland birds with increasing trends in all regions during the 2-yr time interval, and also those from the Western region during the two longer intervals, were indistinguishable from 50%.

Urban bird populations showed a significant tendency for decline in all regions during 1966-2008 (Fig. 1F). During that period, the 42% of increasing trends in the Central region balanced out the low 23% seen in the Western region, yielding a survey-wide estimate of just 33% of urban birds increasing survey-wide. Regional estimate from the 2003-2008 period are not distinguishable from 50% but the continent-wide result of 33% is significant and equivalent to the 1966-2008 estimate. Each region exhibited a greater number of declines than increases during the 2-yr interval, although only the survey-wide results (26% increasing trends) and Eastern region results (21% increasing trends) were significant.

Cavity nesting birds fared relatively well with proportions of increasing species either equal to or significantly greater than 50% in all regions and time periods (Fig 1G). For instance, 65% of cavity nesting birds showed positive trend estimates across the entire survey area during 2003-2008, including a significantly high proportion of gains in the Eastern region (75% species increasing). During 1966-2008, only the Central region demonstrated a significant proportion of increasing species (62%).

Over the long-term and across the survey, significantly more open-cup nesting species experienced population declines than increases (38%; Fig. 1H). This declining pattern was evident in Western (34% increasing trends) and Eastern (30% increasing trends) BBS regions but not in the Central region where results were indistinguishable from 50%. A similar pattern was seen during the 2-yr interval where only 25% of Western species and 31% of Eastern species exhibited increasing trends. In contrast, during 2003-2008, only the Central region demonstrated a significant result with 60% of species showing increasing trends.

Short-distance migrants did not fare especially well over the long-term and only 43% of species exhibited positive trends survey-wide (Fig. 1I). This appears to be due in large part to the significantly low proportion of population increases in the Western and Eastern regions (34% and 30%, respectively), relative to the significant number of long-term increases seen in the Central region (56%). The tendency for decline in the West and East was similarly reflected in the 2-yr interval, although the proportions were lower (33% and 26%, respectively), thus dropping the survey-wide estimate to 33% of species increasing during the period. Short-distance migrants experienced their strongest increases in the Central region during both 1966-2008 (56% increasing trends) and 2003-2008 (63% increasing trends), although the result from the later interval was not statistically significant.

During the long-term and more recent 2-yr periods, increases in permanent residents did not

differ significantly from 50% in any region (Fig. 1J). Results from the 6-yr period were similar with exception of the Eastern region, where a significant number of species (68%) showed positive population trends. Noteworthy is that, although 1966-2008 and 2003-2008 results from the East and West are not statistically significant, the credible intervals are relatively short and suggest that a nearly even proportion of species experienced gains and losses.

Significantly fewer than 50% of neotropical migrant species exhibited increasing population trends in the Western (40%) and Eastern (34%) regions over the long-term (Fig. 1K). In contrast, neotropical migrants were significantly more likely to experience population growth in the Central region during that period (55% species increasing). All regions surpassed that proportion during 2003-2008 with a significant percentage of species in both the Western and Central regions (66%) and in the Eastern region (59%) experiencing positive trends, yielding an overall increase of 64% positive trends survey-wide. No such pattern could be discerned during the 2-yr period because regional results were not statistically distinguishable from 50%.

The ground nesting bird guild was amongst the groups most likely to experience declines (Fig. 1L). Many of the long-term declines were severe, as evidenced in the significantly low proportion of positive trends from Western (31%) and Eastern regions (27%) and the low 29% of increases demonstrated survey-wide. The 2003-2008 interval portrays a more positive picture with 46%, 60%, and 51% of ground nesters increasing, respectively, in the Western, Central, and Eastern regions. However, no significant deviations from 50% were detected for any region during this period. Declines were again apparent in the more recent 2-yr interval but only the results from the Western region were statistically significant, where only 20% of species experienced increasing population trends.

During 1966-2008, mid-story and canopy-nesting birds fared relatively well in the Central BBS region (63% increasing trends). Populations, however, experienced significantly fewer increases in the Western (38%) and Eastern (42%) regions (Fig. 1M). These opposing proportions likely account for the survey-wide result being indistinguishable from 50%, despite having a narrow credible interval. Western and Eastern regional results were equivocal and not significant during 2003-2008, but populations in the Central region demonstrated a significant tendency for increase during this period (60% increasing trends). More mid-story and canopy-nesting birds experienced population declines than increases in all BBS regions during the 2-yr interval but these results were not significant.

DISCUSSION

The 2-yr and 6-yr trends provide general indication of how populations fluctuated during these intervals. These trends show temporal and spatial heterogeneity and thus should be viewed with caution and only interpreted within the context of the long-term trend results. Although the majority of significant long-term trend estimates had high trend quality (Table 1), the quality of the shorter interval trend estimates varies considerably among regions and species. Any analysis of BBS data should carefully consider the possible limitations of the data and potential trend quality issues. Additionally, the BBS is not designed to determine causal factors of population changes. Therefore, we were unable to identify specific factors responsible for the various temporal and regional patterns evident in this analysis. Nevertheless, it can be instructive to examine the overall patterns within the context of previous analyses to identify general tendencies that could provide insight for future research and conservation efforts.

The 2007-2008 period was relatively poor for most species across the survey, producing one of the lowest proportions of positive 2-yr trends (39%) ever reported in the BBS. Trends are rarely exactly zero, so when considering combined trends for life-history guilds, if a group were essentially stable, one would expect 50% of constituent species to have increasing trends and 50% to have decreasing trends simply by chance. In 2007-2008, all groups with results deviating significantly from 50% had 2/3 or more of their constituent species in population decline. Three guilds (open-cup nesters, short-distance migrants, and ground or low nesting birds) experienced greater declines in the Western region and 4 (successional or scrub, urban, open-cup nesters, and short-distance migrants) experienced greater decline in the East. Results

from the Central region suggest that conditions in that portion of the continent generally favored stability more so than did conditions in the West and East.

Although the causes of such declines cannot be divined from analysis of BBS data alone, it is possible that extreme weather patterns during 2007-2008 may have played a role. Mild El Niño – Southern Oscillation (ENSO) conditions developed in early Autumn 2006 (Arguez 2007), as indicated by a warming of the sea surface in the eastern and central tropical Pacific Ocean (Larkin and Harrison 2002). These warmed waters had cooled by early winter, changing wind patterns, and yielding relatively cool and dry winter conditions in the Western region, cool and wet conditions in the Central region, and warm and dry conditions over much of the Eastern region. The 2007 BBS field season met with drier than average summer conditions in the Western and Eastern BBS regions, including 41% of the contiguous U.S. in moderate to extreme drought (Levinson and Lawrimore 2008). Portions of the Central region, however, received record amounts of precipitation during this time. As the Pacific surface waters progressed to a hypercooling phase in autumn 2007 (Peterson and Baringer 2009), a strong La Niña produced relatively cool winter conditions in the Western and north-Central regions, warm and dry winter conditions in the southeast, and notably warm and wet conditions in the northeast. These conditions prevailed in the 2008 BBS field season, with below normal summer precipitation confined to the Western region and the South-East.

North American land bird population changes have been correlated to earlier ENSO events (Morrison and Bolger 2002; Sillett et al. 2000; Nott et al. 2002) and previous BBS summary reports have noted increases in Western bird populations and/or reductions in regional migrant groups in the subsequent 2-yr periods (Peterjohn et al. 1994, Pardieck and Sauer 2000, Pardieck and Sauer 2007). Comparison between El Niño and La Niña is complicated given that 'typical' weather patterns represent average effects, and actual effects can vary considerably depending on the time of year of occurrence (Ropelewski and Halpert 1986). Also, other substantial atmospheric and oceanic phenomena, such as the Pacific/North American "teleconnection" pattern and the North Atlantic Oscillation (Wallace and Gutzler 1981, Nott et al. 2002), are likely influencing bird populations as well. During 2007-2008, amongst the three resident/migratory guilds, short-distance migrants in the Western and Eastern regions and permanent residents in the West experienced the greatest proportion of declines. Neotropical migrants, on the other hand, were relatively stable across all regions, suggesting that winter weather patterns may have been an important factor contributing to declines in birds wintering in the United States. The relationship between land bird populations and large-scale atmospheric and oceanic patterns deserves additional study.

The pattern of trends in the 2007-2008 period was similar to that seen in the 1966-2008 trends. Over the long-term, a species was 1.5 times more likely to exhibit a significant decline than a significant increase (Appendix 1). Life-history groups during this time were also nearly three times more likely to contain a significantly greater proportion of species with negative trends (Figs. 1A-M). Only six of the 23 regional life-history groups that deviated significantly from 50% did so in the positive direction, and all six occurred in the Central region.

Overall, the tendency during the 2003-2008 period was for all species to experience significant range-wide population gains. All 13 of the regional life-history groups with results that deviated significantly from 50% during this period were positively oriented. This is a departure from the pattern seen in the previous two BBS summary reports, where mid-term and long-term results demonstrated proportions of increasing species that were both similar to one another and lower than the 2-yr term results (Pardieck and Sauer 2000, Pardieck and Sauer 2007). Whether or not the period of general decline during 2007-2008 reflects a meaningful biological correction following the 2003-2008 growth spell is uncertain but worthy of further evaluation.

Most grassland bird species have experienced steep long-term continent-wide declines and only 5% of Eastern and 21% of Western populations demonstrated positive growth during 1966-2008 (Fig. 1B). The fact that the 6-yr

and 2-yr percentages were generally larger than the long-term percentages in the Eastern and Central regions is encouraging and, despite many having credible intervals that span 50%, this is still indicative of progress and suggestive that conditions may have improved for grassland birds in recent years. Scrub/successional species also have declined dramatically in some areas so increases during the 6-yr and 2-yr intervals, relative to the long-term, were of special interest (Fig. 1D). Unfortunately, estimates during these intervals were comparatively imprecise and additional years of favorable population change will be needed before a reversal in the long-term declines would become apparent.

Wetland and woodland species exhibited the greatest overall number of increasing trends amongst the habitat groupings (Figs. 1C, E). Within the 2003-2008 period of growth, the Eastern region experienced the fewest number of wetland-breeding population gains, but even this proportion was above 75%. Woodland birds, on the other hand, experienced their greatest proportional increases in the Eastern region during both the 6-yr (74%) and 2-yr (56%) terms, with fewer gains observed in the Central region than might have been expected. The survey-wide long-term trend of the wetland group was slightly lower than that reported in the previous BBS summary, while the woodland group value was slightly higher.

Detailed analyses of regional patterns of population trends within individual species are beyond the scope of this paper. Species-specific trend and relative abundance data, as well as additional information regarding the survey are available at the North American Breeding Bird Survey home page (http://www.pwrc.usgs.gov/BBS/).

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LITERATURE CITED

AMERICAN ORNITHOLOGISTS' UNION. 1998. Check-list of North American Birds. 7th edition. American Ornithologists' Union, Washington, D.C.

ARGUEZ, A. (ed.). 2007. State of the Climate in 2006. Bulletin of the American Meteorological Society 88:S1-S135.

BYSTRAK, D. 1981. The North American Breeding Bird Survey. Pp. 34-41 *in* C.J. Ralph and J.M. Scott (eds.), Estimating Numbers of Terrestrial Birds. Studies in Avian Biology6.

LARKIN, N.K., AND D.E. HARRISON. 2002. ENSO warm (El Niño) and cold (La Niña) event life cycles: Ocean surface anomaly patterns, their symmetries, asymmetries, and implications. Journal of Climate 15:195–213.

LEVINSON, D.H., AND J.H. LAWRIMORE (eds.). 2008. State of the Climate in 2007. Bulletin of the American Meteorological Society 89:S1-S179.

LINK, W.A., AND J.R. SAUER. 1998. Estimating population change from count data: application to the North American Breeding Bird Survey. Ecological Applications 8:258-268.

LINK, W.A., AND J.R. SAUER. 2002. A hierarchical model of population change with application to Cerulean Warblers. Ecology 83:2832-2840.

MORRISON, S.A., AND D.T. BOLGER. 2002. Variation in a sparrow's reproductive success with rainfall: food and predator-mediated processes. Oecologia 133:315–324.

NOTT, P.M., D.F. DESANTE, R.B. SIEGEL, AND P. PYLE. 2002. Influences of the El Nino/Southern Oscillation and the North Atlantic Oscillation on avian productivity in forests of the Pacific Northwest of North America. Global Ecology & Biogeography 11:333-342.

PARDIECK, K.L., AND J.R. SAUER. 2000.The 1995-1999 summary of the North American Breeding Bird Survey. Bird Populations 5:30-48.

PARDIECK, K.L., AND J.R. SAUER. 2007. The 1999-2003 summary of the North American Breeding Bird Survey. Bird Populations 8:28-45.

PETERJOHN, B.G., AND J.R. SAUER. 1993. North American Breeding Bird Survey annual summary 1990-1991. Bird Populations 1:1-15.

PETERJOHN, B.G., J.R. SAUER, AND W.A. LINK. 1994. The 1992 and 1993 summary of the North American Breeding Bird Survey. Bird Populations 2:46-61.

PETERJOHN, B.G., J.R. SAUER, AND W.A. LINK. 1996. The 1994 and 1995 summary of the North American Breeding Bird Survey. Bird Populations 3:48-66.

PETERSON, T.C., AND M.O. BARINGER (eds.). 2009. State of the Climate in 2008. Bulletin of the American Meteorological Society 90:S1-S196.

ROBBINS, C.S., D. BYSTRAK, AND P.H. GEISSLER. 1986. The Breeding Bird Survey: its first fifteen years, 1965-1979. U.S. Fish and Wildlife Service Resource Publication157.

ROPELEWSKI, C., AND M. HALPERT. 1986. North American Precipitation and Temperature Patterns Associated with the El Niño/Southern Oscillation (ENSO). Monthly Weather Review114: 2352–2362.

SAUER, J. R., J. E. FALLON, AND R. JOHNSON. 2003. Use of North American Breeding Bird Survey Data to estimate population change for bird conservation regions. Journal of Wildlife Management 67:372-389.

SAUER, J. R., AND W. A. LINK. 2002. Hierarchical modeling of population stability and species group attributes using Markov Chain Monte Carlo methods. Ecology 83:1743-1751.

SAUER, J. R., AND W. A. LINK. 2010. Analysis of the North American Breeding Bird Survey using hierarchical models. Auk *In Press*.

SILLETT, T.S., R.T. HOLMES, AND T.W. SHERRY. 2000. Impacts of global climate cycle on populations dynamics of migratory songbird. Science 288: 2040-2042.

WALLACE, J.M., AND D.S. GUTZLER. 1981. Teleconnections in the geopotential height field during the Northern Hemisphere winter. Monthly Weather Review 109:784–812.

APPENDIX 1.. Long-term (1966-2008) trends, 6-yr (2003-2008) trends, and 2-yr (2007-2008) trends for all species detected on BBS routes, 1966-2008. For the three intervals, we present trend (average % change/y) and 95% credible (Bayesian confidence) intervals. Trend is considered significant (P < 0.05) if the credible interval does not include zero (indicated by *). For the long-term trends, sample size (N of routes) and TQ-values are also provided. Species names based on AOU (1998).

		1966-2008			2003-2008		2007-2008	
Species	TQ	N	Trend	Credible Interval	Trend	Credible Interval	Trend	Credible Interval
Black-bellied Whistling-Duck	2	101	7.9 *	3.7, 11.6	15.9 *	5.0, 27.6	80.7 *	24.8, 187.4
Fulvous Whistling-Duck	2	43	2.6	-2.1, 7.1	12.2 *	1.3, 29.2	24.0	-26.0, 158.5
Canada Goose	2	2585	11.8 *	9.3, 16.5	14.4 *	7.3, 24.1	16.9	-11.0, 77.0
Mute Swan	3	93	4.1	-0.8, 10.1	5.2	-13.4, 40.5	8.9	-62.3, 346.0
Wood Duck	2	2117	2.8	-0.1, 3.6	5.0 *	2.0, 8.8	5.4	-7.8, 26.3
Gadwall	1	703	2.6 *	1.5, 3.5	5.3 *	0.5, 10.6	2.4	-19.5, 27.4
American Wigeon	1	547	-3.5 *	-5.4, -2.3	-1.6	-5.8, 2.9	-19.2	-38.4, 1.5
American Black Duck	2	548	0.3	-2.3, 3.2	1.0	-4.9, 7.9	2.2	-25.8, 39.4
Mallard	1	3146	-0.1	-0.9, 0.6	1.4	-1.3, 4.2	2.0	-10.7, 15.8
Mottled Duck	1	107	-3.3 *	-5.2, -1.3	-1.5	-8.0, 4.6	0.8	-29.0, 33.0
Blue-winged Teal	3	1211	-0.3	-20.7, 1.0	6.0	-0.1, 13.2	-13.3	-35.1, 16.3
Cinnamon Teal	3	465	-2.3 *	-21.5, -0.5	0.1	-8.2, 8.5	-14.7	-55.7, 23.5
Northern Shoveler	1	640	1.2	-0.9, 2.5	6.4	-0.3, 13.8	-18.0	-43.0, 14.8
Northern Pintail	1	719	-3.5 *	-6.3, -1.1	-2.3	-11.1, 12.2	-35.1	-61.0, 28.2
Green-winged Teal	2	759	-0.4	-2.3, 1.1	2.9	-3.4, 13.3	9.0	-25.5, 73.6
Canvasback	3	280	-1.2	-12.4, 1.4	0.9	-8.5, 14.2	-11.4	-53.5, 66.3
Redhead	2	417	-0.4	-4.4, 1.7	2.2	-6.2, 13.0	-12.6	-47.5, 34.0
Ring-necked Duck	3	445	3.6	-1.9, 8.9	9.3 *	2.5, 18.9	0.3	-54.8, 42.8
Lesser Scaup	2	470	-3.0 *	-8.0, -1.0	1.4	-7.6, 10.5	-4.9	-38.3, 54.2
Bufflehead	2	225	2.6	-0.5, 4.5	5.0 *	0.2, 11.3	6.8	-16.2, 41.5
Common Goldeneye	3	303	1.1	-10.1, 4.5	6.6 *	0.1, 16.3	17.2	-16.1, 78.9
Barrow's Goldeneye	2	95	-1.6	-4.7, 0.7	-0.1	-7.5, 9.7	-3.5	-41.4, 37.2
Hooded Merganser	3	376	5.2 *	0.5, 8.5	6.6	-3.2, 13.6	5.3	-32.4, 43.0
Common Merganser	3	821	-1.0	-10.1, 1.1	2.0	-1.3, 7.1	3.1	-12.3, 31.5
Red-breasted Merganser	3	75	-6.3	-27.7, 2.6	3.4	-19.2, 46.3	3.5	-83.0, 448.4
Ruddy Duck	2	429	0.5	-3.0, 3.4	3.0	-6.9, 24.2	-1.9	-41.6, 141.3
Chukar	2	163	0.2	-2.8, 2.4	0.5	-11.1, 11.0	-20.2	-58.3, 24.9
Gray Partridge	2	434	-0.6	-2.5, 0.6	-0.2	-7.1, 6.2	-11.5	-48.3, 20.4
Ring-necked Pheasant	1	1807	-0.2	-0.7, 0.3	1.9	-0.3, 4.2	5.9	-4.3, 16.9
Ruffed Grouse	2	1166	1.0	-0.7, 2.4	5.1	-0.2, 11.3	5.2	-21.2, 38.6
Sage Grouse	2	149	-3.9 *	-7.7, -1.0	-0.3	-10.1, 12.4	-10.4	-57.0, 58.1
Blue Grouse	2	230	-1.2	-2.6, 0.3	0.3	-3.6, 7.6	-1.1	-18.8, 31.5
Sharp-tailed Grouse	2	292	-0.1	-2.5, 1.5	4.8	-1.6, 12.9	9.1	-56.9, 60.6
Greater Prairie-Chicken	3	95	4.3	-1.0, 9.1	19.8 *	4.3, 56.0	41.6	-24.2, 393.6
Wild Turkey	2	1963	9.1 *	7.6, 10.1	13.9 *	10.1, 17.6	19.6 *	4.0, 39.0
Mountain Quail	1	180	-0.3	-2.1, 1.1	-8.3 *	-13.7, -3.1	5.7	-17.2, 35.0
Scaled Quail	1	206	-2.0 *	-3.3, -0.9	-5.9 *	-10.9, -0.7	-35.2 *	-50.4, -15.7
California Quail	1	418	1.2 *	0.3, 2.0	-2.2	-5.3, 1.0	7.4	-7.4, 24.5
Gambel's Quail	3	143	0.0	-11.9, 1.6	-0.1	-4.9, 5.1	-9.0	-29.6, 18.3
Northern Bobwhite	1	1912	-3.7 *	-4.0, -3.5	-5.5 *	-6.7, -4.3	-7.3 *	-12.7, -1.4
Common Loon	1	781	0.8	-0.6, 2.0	1.6	-0.3, 3.4	2.0	-6.1, 11.2
Pied-billed Grebe	2	1025	-0.3	-3.3, 1.4	8.9 *	0.3, 18.8	-12.5	-42.6, 30.3
Horned Grebe	2	172	-2.5 *	-4.4, -0.8	-1.7	-10.1, 7.1	-14.9	-50.6, 24.5
Red-necked Grebe	2	182	0.4	-1.0, 2.1	1.7	-2.1, 8.3	0.1	-22.2, 28.5

APPENDIX 1. Continued.

		1966-2008			2003-2008		2007-2008	
Species	TQ	N	Trend	Credible Interval	Trend	Credible Interval	Trend	Credible Interval
Eared Grebe	3	281	-0.4	-11.5, 3.6	7.6	-7.1, 32.6	-12.1	-87.2, 117.3
Western/Clark's Grebe	2	239	-0.5	-5.9, 3.0	6.0	-5.2, 29.3	20.0	-28.3, 189.0
American White Pelican	2	371	6.0 *	1.4, 11.1	14.9 *	3.9, 31.2	3.5	-51.1, 106.0
Brown Pelican	3	58	6.5 *	1.2, 11.9	10.0	-6.3, 44.4	5.5	-57.8, 328.3
Double-crested Cormorant	1	1076	5.3 *	2.4, 8.2	8.9 *	0.2, 18.9	17.3	-24.1, 67.2
Pelagic Cormorant	3	20	-5.4	-12.1, 0.9	-3.9	-19.2, 16.6	-8.3	-75.9, 114.0
Anhinga	2	208	0.2	-1.2, 1.4	-0.1	-6.9, 4.9	-1.1	-24.7, 23.0
American Bittern	2	1079	-0.6	-2.9, 0.9	8.3 *	2.8, 15.4	4.9	-28.3, 44.2
Least Bittern	2	148	-0.3	-2.9, 2.4	1.4	-7.7, 9.5	-0.3	-32.4, 44.4
Great Blue Heron	2	3300	1.2 *	0.8, 1.5	2.5 *	1.2, 4.2	5.3	-0.6, 13.2
Great Egret	1	950	3.1 *	1.8, 4.5	5.5 *	1.4, 10.9	7.0	-9.5, 27.6
Snowy Egret	1	471	1.9	-1.2, 4.1	5.0	-3.7, 16.4	5.6	-27.1, 58.3
Little Blue Heron	1	632	-0.6	-1.6, 0.5	-1.4	-9.1, 2.6	-6.0	-22.2, 11.5
Tricolored Heron	1	180	-0.2	-1.9, 1.4	1.8	-3.2, 9.3	2.7	-21.5, 42.0
Cattle Egret	1	803	0.3	-1.1, 1.3	2.8	-0.3, 6.3	8.3	-6.4, 29.5
Green Heron	2	2184	-1.4 *	-1.7, -1.1	-0.7	-2.0, 0.7	-0.9	-7.2, 5.6
Black-crowned Night-Heron	2	766	-0.1	-2.4, 1.9	4.0	-2.4, 13.6	11.6	-18.6, 70.5
Yellow-crowned Night-Heron	2	381	-0.6	-2.6, 1.1	-0.1	-8.8, 6.5	-1.9	-34.3, 35.7
White Ibis	1	285	5.8 *	3.4, 7.8	8.8	-3.1, 20.9	7.8	-34.1, 86.8
Glossy Ibis	2	93	2.0	-2.4, 5.6	4.9	-16.0, 16.5	7.4	-48.1, 130.9
White-faced Ibis	3	164	5.0	-1.7, 13.1	30.7 *	5.5, 78.1	15.0	-89.8, 507.1
Roseate Spoonbill	2	58	8.8 *	5.0, 12.7	8.3	-7.3, 20.5	9.8	-33.3, 79.5
Wood Stork	3	138	1.8	-10.8, 6.8	-0.6	-29.8, 30.1	21.9	-34.0, 464.1
Black Vulture	1	910	4.3 *	2.9, 5.2	6.2 *	3.3, 8.9	8.4	-4.9, 22.5
Turkey Vulture	1	3104	2.3 *	1.9, 2.7	3.6 *	2.6, 4.7	4.9	-0.4, 10.3
Osprey	2	931	2.8 *	1.7, 3.8	4.3 *	2.2, 6.3	2.5	-6.5, 11.6
Swallow-tailed Kite	2	109	6.0 *	4.4, 7.6	5.2	-3.2, 11.0	10.7	-10.2, 42.3
White-tailed Kite	2	130	-0.3	-2.1, 1.1	1.5	-4.6, 9.3	-12.3	-46.4, 22.2
Mississippi Kite	2	383	0.2	-1.1, 1.4	3.7 *	0.5, 7.4	7.2	-8.2, 26.1
Bald Eagle	2	686	5.1 *	3.6, 6.3	8.7 *	5.2, 12.0	6.3	-9.7, 22.0
Northern Harrier	2	1790	-0.7 *	-1.4, -0.2	1.3	-0.6, 3.3	0.9	-8.9, 12.1
Sharp-shinned Hawk	3	1236	1.2	-2.7, 2.3	2.9	-0.3, 6.0	-1.7	-17.0, 14.9
Cooper's Hawk	3	1839	2.4 *	0.3, 3.1	6.4 *	4.1, 8.7	10.7 *	0.5, 22.9
Northern Goshawk	3	404	-0.2	-3.5, 1.6	-1.5	-10.0, 6.1	-1.3	-32.5, 39.7
Harris's Hawk	2	69	-1.8 *	-3.6, -0.1	-0.3	-7.3, 7.9	8.6	-18.8, 59.6
Red-shouldered Hawk	2	1493	3.0 *	2.6, 3.4	3.6 *	2.0, 5.3	4.3	-3.2, 12.5
Broad-winged Hawk	2	1419	1.1 *	0.2, 1.9	0.7	-1.6, 2.6	2.0	-7.3, 12.1
Swainson's Hawk	2	1076	0.4	-0.1, 0.9	1.6 *	0.2, 3.2	1.7	-5.1, 9.2
Red-tailed Hawk	2	3893	1.8 *	1.5, 2.0	2.2 *	1.4, 3.0	1.4	-2.7, 5.4
Ferruginous Hawk	2	467	1.5 *	0.4, 2.5	3.2 *	0.2, 6.8	4.6	-9.4, 22.3
Golden Eagle	2	646	0.2	-1.0, 0.9	0.7	-2.1, 3.4	-2.6	-16.6, 10.8
Crested Caracara	2	96	7.4 *	5.8, 9.2	14.7 *	7.1, 25.5	36.3 *	3.6, 97.4
American Kestrel	2	3348	-1.4 *	-2.3, -0.9	-0.7	-1.8, 0.6	-3.1	-8.4, 2.9
Merlin	3	504	2.7 *	0.7, 4.2	5.6 *	1.4, 9.9	0.3	-19.1, 20.8
Peregrine Falcon	3	128	2.0	-9.7, 7.0	7.0	-9.3, 21.7	-11.2	-63.0, 59.8
Prairie Falcon	3	533	1.1	-0.1, 2.2	2.3	-2.1, 7.9	-2.8	-25.7, 21.3
Clapper Rail	2	71	-1.1	-3.7, 1.4	1.8	-4.3, 8.5	5.5	-19.2, 47.2
King Rail	2	84	-4.7 *	-7.7, -1.8	-3.6	-15.5, 13.0	-9.0	-54.9, 65.4

APPENDIX 1. Continued.

Species	TQ	N	1966-2008 Trend	1966-2008 Credible Interval	2003-2008 Trend	2003-2008 Credible Interval	2007-2008 Trend	2007-2008 Credible Interval
Virginia Rail	3	368	0.6	-4.6, 2.8	4.8	-3.3, 13.9	8.0	-35.5, 60.4
Sora	2	970	0.1	-8.3, 1.5	15.7 *	9.6, 23.0	-15.2	-36.8, 14.7
Purple Gallinule	2	52	-1.8	-5.1, 1.4	-0.4	-13.7, 15.3	3.4	-43.2, 115.8
Common Moorhen	2	257	-0.8	-2.5, 1.0	-2.0	-8.6, 4.4	-10.2	-35.0, 20.8
American Coot	1	997	0.0	-2.9, 2.1	18.3 *	7.1, 37.0	-7.7	-42.9, 66.4
Sandhill Crane	1	622	5.7 *	3.9, 6.9	9.6 *	6.2, 13.4	16.0 *	1.3, 35.4
Killdeer	1	3954	-1.1 *	-1.7, -0.9	0.4	-0.3, 1.2	-0.8	-4.3, 2.8
Mountain Plover	2	80	-2.9 *	-6.1, -0.4	-0.4	-15.6, 12.4	-1.9	-38.8, 61.2
Black-necked Stilt	1	262	3.1 *	0.8, 5.4	5.1	-3.8, 13.7	10.9	-20.9, 57.6
American Avocet	1	444	0.4	-2.2, 2.6	2.0	-4.5, 8.5	-3.0	-28.4, 31.9
Greater Yellowlegs	2	89	1.6	-4.2, 4.6	-1.8	-13.9, 8.1	-10.5	-49.7, 46.2
Lesser Yellowlegs	2	126	-4.9 *	-7.7, -2.6	-3.1	-9.7, 5.3	-4.2	-35.7, 36.7
Solitary Sandpiper	3	96	-1.7	-9.4, 1.9	0.0	-11.4, 10.7	5.7	-35.2, 69.4
Willet	1	476	-0.7	-1.5, 0.0	1.3	-1.4, 4.8	0.8	-12.5, 17.9
Spotted Sandpiper	2	1778	-1.4 *	-2.0, -0.8	-0.5	-2.2, 1.7	0.3	-7.8, 10.1
Upland Sandpiper	1	971	0.6	0.0, 1.2	1.1	-1.4, 3.2	2.3	-7.8, 13.1
Long-billed Curlew	1	420	0.1	-1.1, 1.1	1.8	-1.2, 4.9	4.8	-9.4, 22.1
Marbled Godwit	1	318	-0.1	-0.9, 0.7	2.0	-1.1, 5.8	9.1	-4.9, 31.7
Wilson's Snipe	1	1648	0.3	-0.4, 0.8	4.8 *	2.4, 7.4	-0.5	-10.9, 11.4
American Woodcock	3	594	-1.8 *	-3.2, -0.7	-0.8	-6.9, 5.0	1.5	-21.4, 34.0
Wilson's Phalarope	2	557	0.0	-3.6, 5.5	9.9 *	0.8, 53.1	20.3	-20.6, 550.4
Laughing Gull	1	193	4.8 *	2.6, 6.7	5.4	-1.8, 13.0	8.9	-20.9, 61.7
Franklin's Gull	2	343	-3.6 *	-9.1, -1.6	-1.6	-10.9, 8.8	-8.7	-58.7, 46.5
Ring-billed Gull	2	1179	4.6 *	0.2, 8.0	7.8 *	1.2, 16.2	3.5	-25.0, 42.6
California Gull	2	388	-0.4	-3.6, 4.4	8.3	-3.0, 42.3	19.6	-28.5, 301.4
Herring Gull	2	624	-2.7 *	-6.7, -0.2	-2.2	-6.1, 1.9	-0.6	-16.0, 21.1
Western Gull	2	25	-1.9	-4.8, 2.0	0.1	-10.7, 13.0	0.9	-42.1, 84.9
Glaucous-winged Gull	1	54	1.5	-1.2, 4.1	2.1	-5.7, 12.6	-0.7	-41.9, 43.2
Great Black-backed Gull	1	150	-1.9 *	-3.7, -0.2	1.1	-4.7, 9.1	-6.7	-46.0, 24.4
Gull-billed Tern	3	36	1.8	-5.0, 8.8	6.5	-10.0, 19.6	1.6	-63.7, 54.6
Caspian Tern	3	213	1.2	-6.3, 4.1	6.8	-5.3, 23.2	2.3	-57.6, 95.0
Royal Tern	2	62	-1.5	-5.0, 1.5	-0.6	-8.2, 7.7	-4.9	-43.6, 37.5
Common Tern	2	258	-0.1	-4.2, 5.1	-1.8	-13.6, 12.9	2.3	-40.2, 101.5
Forster's Tern	3	268	-1.4	-10.6, 1.5	1.5	-10.2, 12.6	2.1	-39.4, 59.8
Least Tern	2	148	-3.9	-9.0, 0.2	-2.0	-12.2, 15.4	-1.9	-46.5, 70.1
Black Tern	3	532	-3.8 *	-17.1, -1.7	-1.1	-9.5, 9.4	-23.4	-56.3, 24.9
Black Skimmer	2	62	-3.6	-8.7, 1.3	2.7	-8.1, 19.1	5.2	-39.3, 110.4
Rock Pigeon	1	3237	-0.7 *	-1.1, -0.3	-0.1	-1.5, 1.4	-1.9	-8.2, 5.4
Band-tailed Pigeon	1	318	-2.8 *	-7.2, -1.4	2.6	-1.7, 8.9	15.7	-6.8, 51.4
Eurasian Collared-Dove	3	842	41.8 *	35.1, 46.7	31.5 *	25.4, 37.8	39.8 *	21.2, 59.7
White-winged Dove	1	252	1.2	-0.9, 2.6	3.7 *	0.2, 8.8	3.7	-11.6, 27.9
Mourning Dove	1	4088	-0.3 *	-0.5, -0.2	-1.0 *	-1.5, -0.5	-7.4 *	-9.6, -5.2
Inca Dove	2	181	2.8 *	1.3, 4.1	0.1	-5.2, 4.6	-13.1	-31.0, 7.6
Common Ground-Dove	1	304	-0.6	-1.4, 0.1	-0.5	-4.7, 2.4	1.6	-14.4, 16.9
Black-billed Cuckoo	3	1645	-3.0 *	-13.7, -1.6	-2.8	-6.8, 1.6	-11.8	-27.9, 8.3
Yellow-billed Cuckoo	1	2250	-1.4 *	-1.7, -1.2	-1.5 *	-2.7, -0.3	-0.2	-6.0, 5.9
Greater Roadrunner	2	462	0.6	-0.1, 1.4	1.1	-2.5, 4.9	1.9	-15.2, 21.4
Groove-billed Ani	2	22	-1.1	-5.2, 3.3	1.1	-17.3, 32.0	95.9	-26.3, 1308.8

APPENDIX 1. Continued.

		1966-2008			2003-2008		2007-2008	
Species	TQ	N	Trend	Credible Interval	Trend	Credible Interval	Trend	Credible Interval
Barn Owl	3	171	2.6	-1.4, 5.4	10.3	-10.1, 25.8	17.5	-37.1, 115.4
Western Screech-Owl	3	103	-1.9	-8.8, 2.3	3.6	-9.7, 19.8	9.1	-33.9, 129.9
Eastern Screech-Owl	3	607	-0.9	-3.6, 0.3	0.9	-8.4, 8.2	4.2	-26.0, 45.6
Great Horned Owl	2	2436	-0.8 *	-2.0, -0.1	0.8	-2.8, 4.8	-0.5	-19.0, 20.1
Northern Pygmy-Owl	3	222	0.8	-3.6, 3.0	6.3	-2.1, 16.4	5.5	-31.3, 58.8
Burrowing Owl	2	568	-1.0	-2.7, 0.0	-0.2	-4.6, 4.4	1.6	-14.3, 21.5
Barred Owl	2	1407	1.5 *	0.2, 2.1	2.5 *	0.2, 4.6	-2.3	-12.8, 7.9
Short-eared Owl	3	434	-2.6	-14.0, 0.0	6.8	-6.8, 23.9	42.9	-26.4, 208.6
Lesser Nighthawk	3	191	1.6	-0.2, 3.2	1.5	-1.7, 4.6	1.5	-11.9, 17.8
Common Nighthawk	3	2438	-1.9 *	-16.5, -1.4	-1.6 *	-3.2, -0.1	-3.9	-11.4, 3.1
Common Poorwill	2	327	-0.3	-2.2, 1.6	-1.6	-12.7, 6.3	4.6	-24.3, 56.1
Chuck-will's-widow	1	727	-2.0 *	-2.3, -1.6	-1.8 *	-3.2, -0.5	-3.2	-9.2, 3.1
Whip-poor-will	2	825	-2.2 *	-7.7, -1.4	-0.2	-2.8, 2.6	-1.4	-13.4, 13.0
Black Swift	2	119	-6.1 *	-9.8, -2.5	-4.3	-14.8, 11.0	-4.4	-50.1, 89.4
Chimney Swift	1	2451	-2.0 *	-2.2, -1.8	-2.3 *	-3.1, -1.6	1.2	-2.6, 4.9
Vaux's Swift	2	256	-1.0	-3.5, 0.5	-0.7	-6.2, 4.1	0.5	-19.7, 29.4
White-throated Swift	1	369	-1.2	-4.2, 1.7	1.2	-6.9, 14.7	-0.4	-35.9, 73.9
Ruby-throated Hummingbird	2	2195	1.9 *	1.6, 2.2	1.3 *	0.1, 2.4	-0.6	-6.2, 5.0
Black-chinned Hummingbird	2	408	0.9	-0.1, 1.9	3.1	-0.3, 7.1	9.1	-4.4, 30.4
Anna's Hummingbird	2	207	1.7 *	0.9, 2.5	1.1	-3.0, 4.0	-0.5	-15.4, 14.7
Costa's Hummingbird	2	94	-0.6	-5.3, 2.8	-0.9	-12.4, 10.7	6.9	-39.7, 96.8
Calliope Hummingbird	2	210	0.0	-1.2, 1.1	1.7	-2.3, 6.4	-10.4	-31.7, 7.5
Broad-tailed Hummingbird	1	286	-0.8 *	-1.5, -0.2	0.9	-1.2, 3.4	2.6	-6.8, 13.4
Rufous Hummingbird	1	338	-2.2 *	-2.8, -1.5	-2.0	-4.2, 0.4	0.5	-9.0, 14.0
Allen's Hummingbird	1	55	-4.0 *	-5.6, -2.4	-3.9	-9.2, 2.7	-6.6	-33.5, 20.2
Belted Kingfisher	2	2911	-1.4 *	-2.0, -1.0	-2.2 *	-3.5, -1.0	-2.1	-8.1, 3.9
Lewis's Woodpecker	3	191	-2.1	-9.8, 0.6	3.1	-3.4, 13.5	7.9	-26.2, 60.1
Red-headed Woodpecker	1	1746	-2.7 *	-3.2, -2.4	-2.0 *	-3.5, -0.6	-5.4	-12.3, 1.6
Acorn Woodpecker	1	197	0.2	-0.5, 1.0	-0.9	-4.1, 2.3	0.5	-13.5, 16.6
Gila Woodpecker	1	42	-1.3	-2.9, 0.2	-0.6	-4.0, 3.0	0.7	-14.8, 19.5
Golden-fronted Woodpecker	1	101	-0.8	-1.6, 0.1	-1.5	-4.8, 1.3	1.1	-10.7, 17.9
Red-bellied Woodpecker	1	1918	1.0 *	0.9, 1.2	0.3	-0.4, 0.9	-0.1	-3.0, 2.8
Yellow-bellied Sapsucker	1	988	0.2	-3.1, 1.5	3.3 *	1.0, 5.9	0.7	-9.0, 12.6
Yellow-bel/Red-npd/ Red-brst Sapsucker	1	1586	0.7	-1.0, 1.6	2.9 *	0.9, 5.0	0.2	-8.3, 10.2
Red-naped Sapsucker	1	375	1.7 *	0.7, 2.7	0.8	-3.7, 5.4	-5.8	-25.0, 17.8
Red-breasted Sapsucker	1	266	0.5	-1.5, 1.9	0.7	-4.6, 6.0	-1.4	-23.1, 27.7
Williamson's Sapsucker	2	171	0.1	-1.8, 1.9	-1.0	-8.2, 5.4	-5.2	-31.6, 27.5
Ladder-backed Woodpecker	1	304	-0.1	-0.7, 0.5	0.5	-1.7, 2.7	1.2	-8.9, 12.2
Nuttall's Woodpecker	1	123	1.2 *	0.4, 2.1	3.2	-0.6, 7.7	11.3	-7.7, 37.3
Downy Woodpecker	1	3284	0.3	0.0, 0.5	0.0	-0.8, 0.8	0.4	-3.4, 4.3
Hairy Woodpecker	2	3136	1.1 *	0.6, 1.5	1.4 *	0.2, 2.5	-0.4	-6.2, 5.3
Red-cockaded Woodpecker	2	61	-4.5 *	-7.7, -1.6	-3.6	-17.1, 7.3	0.5	-40.7, 86.2
White-headed Woodpecker	2	114	0.9	-0.3, 2.0	2.1	-1.5, 7.1	4.6	-12.8, 30.6
American Three-toed Woodpecker	3	138	2.6	-1.4, 5.8	5.3	-3.7, 13.1	4.0	-37.0, 42.3
Black-backed Woodpecker	3	247	-1.0	-4.4, 1.4	6.0	-2.2, 16.0	-2.1	-39.0, 45.1
Gilded Flicker	1	34	-1.7	-3.9, 0.4	-0.8	-5.3, 6.0	3.6	-15.3, 47.7
Northern Flicker	1	3909	-1.5 *	-1.7, -1.2	-1.2 *	-2.1, -0.4	-5.2 *	-9.2, -1.0

APPENDIX 1. Continued.

			1966-2008		2003-2008		2007-2008	
Species	TQ	N	Trend	Credible Interval	Trend	Credible Interval	Trend	Credible Interval
Pileated Woodpecker	2	2449	1.2 *	0.7, 1.6	1.4 *	0.3, 2.4	-2.6	-6.8, 1.8
Olive-sided Flycatcher	1	1184	-3.6 *	-4.8, -2.9	-2.0 *	-3.5, -0.2	-4.4	-12.0, 3.8
Western Wood-Pewee	1	1205	-1.7 *	-2.5, -1.2	0.0	-1.3, 1.4	-0.6	-6.1, 5.3
Eastern Wood-Pewee	1	2393	-1.4 *	-1.6, -1.3	-0.8 *	-1.4, -0.1	-2.0	-5.1, 1.2
Yellow-bellied Flycatcher	1	423	2.0	-0.3, 4.0	-0.4	-4.5, 3.9	0.9	-14.7, 23.3
Acadian Flycatcher	1	1246	-0.5 *	-0.8, -0.2	0.1	-0.9, 1.1	0.6	-4.1, 5.4
Alder Flycatcher	1	1248	-0.9	-1.7, 0.0	-1.6	-3.2, 0.0	-1.5	-8.3, 6.1
Willow Flycatcher	1	1739	-1.5 *	-2.1, -1.1	-1.4 *	-2.8, -0.1	-1.9	-8.9, 4.4
Willow/Alder Flycatcher	1	2371	-1.0 *	-1.8, -0.3	-1.8 *	-3.0, -0.6	-1.9	-7.2, 3.8
Least Flycatcher	1	1695	-1.5 *	-2.0, -1.0	-2.0 *	-3.5, -0.6	-3.8	-10.2, 2.6
Hammond's Flycatcher	1	460	1.2 *	0.3, 2.0	2.2	-0.6, 5.4	9.4	-4.5, 29.4
Gray Flycatcher	1	242	3.0 *	1.0, 4.3	3.5 *	0.3, 6.9	1.5	-14.1, 16.4
Dusky Flycatcher	1	561	-0.2	-1.4, 0.9	0.1	-3.3, 3.6	-1.3	-16.8, 16.7
Cordilleran/Pacific-slope Flycatcher	1	638	-0.8 *	-4.2, -0.2	-1.4	-4.2, 1.3	-8.5	-19.9, 3.9
Black Phoebe	2	241	2.4 *	1.2, 3.4	0.4	-3.5, 4.4	-5.8	-21.8, 12.7
Eastern Phoebe	1	2423	0.7	-0.4, 1.3	4.3 *	3.2, 5.6	6.7 *	1.6, 13.2
Say's Phoebe	2	956	1.1 *	0.5, 1.6	1.5	-0.4, 3.2	0.3	-7.3, 8.7
Vermilion Flycatcher	2	112	0.1	-1.6, 1.5	0.2	-4.6, 5.2	2.8	-15.4, 30.3
Ash-throated Flycatcher	1	672	1.0 *	0.4, 1.6	0.3	-1.6, 1.8	1.3	-5.9, 8.5
Great Crested Flycatcher	1	2508	0.1	-0.1, 0.2	0.1	-0.6, 0.8	-0.7	-4.1, 2.8
Brown-crested Flycatcher	1	89	4.0 *	2.5, 5.3	2.3	-3.3, 6.5	-0.6	-21.0, 19.5
Couch's Kingbird	2	36	12.6 *	9.0, 15.9	12.0 *	2.0, 20.7	0.7	-37.6, 34.4
Cassin's Kingbird	1	263	0.1	-1.1, 1.2	1.2	-1.6, 4.3	0.5	-12.8, 15.5
Western Kingbird	1	1543	0.7 *	0.3, 1.0	1.5 *	0.1, 3.0	3.4	-3.0, 10.5
Eastern Kingbird	1	3238	-1.0 *	-1.2, -0.8	-1.5 *	-2.3, -0.6	-4.6 *	-8.5, -0.5
Scissor-tailed Flycatcher	1	402	-0.6 *	-1.0, -0.2	-2.2 *	-3.8, -0.6	-6.6	-13.7, 0.7
Loggerhead Shrike	1	1961	-3.0 *	-3.4, -2.7	-3.0 *	-4.6, -1.6	-0.5	-7.2, 7.0
White-eyed Vireo	1	1402	0.8 *	0.6, 1.0	3.8 *	2.8, 4.9	7.5 *	3.0, 12.3
Bell's Vireo	1	489	0.0	-1.8, 0.9	4.2 *	1.3, 7.8	8.5	-4.7, 26.2
Gray Vireo	2	93	1.7	-1.4, 4.7	3.8	-2.3, 10.6	20.6	-6.7, 71.0
Yellow-throated Vireo	2	1736	1.0 *	0.7, 1.3	2.5 *	1.4, 3.8	2.5	-3.2, 8.5
Plumbeous Vireo	1	262	-2.7 *	-6.0, -0.1	2.2	-0.4, 5.6	3.5	-7.8, 18.5
Cassin's Vireo	1	440	1.4 *	0.7, 2.0	1.6	-1.2, 4.3	4.8	-7.9, 18.7
Blue-headed Vireo	1	1050	3.3 *	2.1, 4.3	4.7 *	2.5, 7.1	9.2	-0.4, 21.6
Hutton's Vireo	2	221	1.8 *	0.9, 2.8	0.3	-3.5, 3.9	5.0	-12.0, 25.4
Warbling Vireo	1	2692	0.9 *	0.4, 1.3	1.7 *	0.6, 3.0	3.6	-2.0, 9.8
Philadelphia Vireo	1	387	1.2	-1.7, 3.8	4.2 *	0.5, 8.4	-1.6	-26.4, 16.0
Red-eyed Vireo	1	2974	0.9 *	0.7, 1.2	0.7	0.0, 1.5	-0.2	-3.4, 3.3
Gray Jay	1	684	-0.7	-2.4, 0.6	-0.6	-3.7, 2.7	-6.9	-24.2, 6.2
Steller's Jay	1	612	0.0	-0.4, 0.4	-0.1	-1.5, 1.4	-4.4	-11.1, 2.5
Blue Jay	1	2869	-0.7	-0.8, -0.6	-1.2 *	-1.7, -0.7	-1.9	-4.1, 0.4
Green Jay	2	27	7.1 *	3.8, 11.0	7.8	-3.9, 18.4	5.7	-36.8, 59.1
Western Scrub-Jay	1	473	-0.4	-0.9, 0.1	-2.5 *	-4.8, -0.2	-5.9	-15.8, 4.7
Pinyon Jay	1	287	-3.9 *	-5.9, -2.1	-2.9	-7.2, 1.7	-2.6	-23.5, 21.5
Clark's Nutcracker	2	395	0.3	-1.5, 1.5	-2.7	-7.1, 1.9	-8.0	-25.2, 14.1
Black-billed Magpie	1	1021	-0.6 *	-1.0, -0.2	-1.8 *	-3.5, -0.3	-3.2	-9.6, 3.1
Yellow-billed Magpie	1	44	-1.3 *	-2.5, -0.1	-8.9 *	-14.8, -3.2	7.3	-19.4, 44.6
American Crow	1	3832	0.3 *	0.1, 0.5	-1.4 *	-1.8, -0.9	-0.9	-3.0, 1.3

APPENDIX 1. Continued.

		1966-2008			2003-2008		2007-2008	
Species	TQ	N	Trend	Credible Interval	Trend	Credible Interval	Trend	Credible Interval
Northwestern Crow	2	47	0.6	-4.5, 2.8	0.3	-5.5, 3.8	0.3	-19.2, 21.8
Fish Crow	1	750	0.7 *	0.2, 1.3	1.4	-1.0, 3.9	-0.4	-12.6, 11.7
Chihuahuan Raven	1	172	1.2	-0.2, 2.4	-0.1	-6.7, 4.0	-4.3	-27.8, 13.9
Common Raven	1	2255	2.7 *	1.9, 3.3	4.5 *	3.1, 6.0	3.9	-2.8, 10.8
Horned Lark	1	2494	-2.4 *	-2.8, -1.9	-1.2	-2.3, 0.0	0.1	-5.3, 5.8
Purple Martin	1	2227	-0.3	-3.2, 0.3	1.3 *	0.1, 2.6	1.1	-4.9, 7.3
Tree Swallow	1	2855	-0.9 *	-1.4, -0.4	1.1	0.0, 2.2	0.2	-4.5, 5.3
Violet-green Swallow	1	917	-0.1	-0.8, 0.4	0.0	-1.9, 1.8	-6.5	-17.1, 3.0
Northern Rough-winged Swallow	1	3045	-0.2	-0.9, 0.2	1.4	-0.3, 3.3	1.0	-7.1, 10.4
Bank Swallow	1	1781	-5.3 *	-7.2, -2.1	1.5	-24.3, 71.2	-1.4	-90.7, 1100.7
Cliff Swallow	1	2798	0.9 *	0.2, 1.5	5.4 *	3.4, 7.7	6.2	-3.3, 15.4
Cave Swallow	3	90	25.5 *	19.1, 31.8	27.3	-3.2, 51.7	70.1	-18.5, 292.7
Barn Swallow	1	4019	-1.2 *	-1.5, -1.1	-0.1	-0.7, 0.6	-4.4 *	-7.3, -1.5
Carolina Chickadee	1	1245	0.1	-0.1, 0.3	-0.3	-1.3, 0.7	1.1	-3.3, 5.8
Black-capped Chickadee	1	2198	0.9 *	0.5, 1.3	-1.4	-2.6, 0.1	-2.5	-9.0, 3.6
Mountain Chickadee	1	560	-1.0 *	-1.8, -0.5	-3.0 *	-5.0, -1.2	-9.4 *	-17.9, -0.8
Chestnut-backed Chickadee	1	228	-1.2 *	-2.3, -0.3	-2.9	-7.9, 1.1	4.0	-15.2, 27.6
Boreal Chickadee	2	335	-0.3	-3.1, 1.2	-1.7	-10.9, 4.9	-5.3	-32.6, 23.0
Tufted Titmouse	1	1913	1.1 *	0.9, 1.3	0.7	-0.1, 1.5	6.5 *	2.6, 10.6
Oak Titmouse	1	146	-1.5 *	-2.3, -0.7	-0.8	-4.4, 3.2	2.8	-13.8, 24.7
Juniper Titmouse	2	168	0.2	-1.3, 1.9	2.8	-2.1, 9.3	5.9	-22.1, 43.5
Verdin	1	188	-2.1 *	-3.4, -0.8	-0.4	-4.2, 3.6	1.1	-15.1, 21.0
Bushtit	1	460	-0.9	-2.5, 0.4	-3.2	-9.4, 3.0	-15.6	-39.2, 14.6
Red-breasted Nuthatch	1	1601	1.5 *	0.7, 2.2	-0.5	-4.0, 1.9	-2.9	-12.2, 8.3
White-breasted Nuthatch	2	2541	1.9 *	1.5, 2.2	1.9 *	0.6, 3.1	-6.8 *	-12.1, -1.4
Pygmy Nuthatch	1	244	-0.5	-2.4, 1.3	-0.1	-4.7, 6.9	-8.9	-29.7, 21.3
Brown-headed Nuthatch	1	458	-0.5	-1.1, 0.1	1.3	-0.9, 3.9	2.8	-7.5, 15.4
Brown Creeper	3	1042	0.9	0.0, 20.7	1.1	-4.7, 19.2	-0.6	-55.2, 91.9
Cactus Wren	1	239	-1.6 *	-2.6, -0.6	1.1	-2.0, 4.5	-5.6	-18.5, 9.4
Rock Wren	1	920	-0.9 *	-1.6, -0.3	-1.3	-8.4, 1.8	2.9	-9.2, 18.6
Canyon Wren	2	340	-0.4	-2.9, 1.1	2.4	-2.4, 9.0	-1.4	-25.1, 25.2
Carolina Wren	1	1661	1.4 *	1.2, 1.6	2.5 *	1.6, 3.4	-3.2	-6.9, 0.6
Bewick's Wren	1	921	-0.5	-1.1, 0.1	-1.5	-3.7, 0.6	-4.3	-13.4, 5.8
House Wren	1	2887	0.2	0.0, 0.4	0.9 *	0.1, 1.7	1.9	-1.6, 5.6
Winter Wren	1	1101	0.9	0.0, 1.8	-3.7 *	-5.9, -1.6	-8.4	-17.3, 0.8
Sedge Wren	1	635	1.5	-0.8, 2.5	4.0 *	0.5, 7.6	-9.1	-23.0, 6.6
Marsh Wren	1	703	2.0	-0.2, 3.2	4.6	-0.4, 9.6	5.6	-15.5, 32.0
American Dipper	3	210	-0.1	-1.8, 1.2	1.0	-3.3, 5.0	-1.4	-22.1, 16.6
Golden-crowned Kinglet	1	1007	-0.6	-2.9, 0.7	-0.9	-4.0, 2.4	2.0	-16.9, 19.8
Ruby-crowned Kinglet	1	1105	0.1	-1.1, 1.2	-3.1 *	-5.4, -0.8	-1.1	-11.6, 9.8
Blue-gray Gnatcatcher	1	2051	1.1 *	0.8, 2.3	0.9	-0.4, 2.8	3.0	-4.1, 13.0
Black-tailed Gnatcatcher	1	118	-0.6	-2.7, 1.4	-0.7	-8.1, 5.3	17.1	-11.3, 62.3
Eastern Bluebird	1	2405	1.9 *	1.7, 2.2	1.7 *	0.7, 2.8	0.2	-4.9, 5.3
Western Bluebird	1	446	0.8	-0.2, 1.5	1.7	-1.1, 4.6	2.2	-12.0, 16.1
Mountain Bluebird	1	821	-0.7 *	-1.5, -0.1	0.7	-1.2, 2.5	-1.1	-9.6, 8.1
Townsend's Solitaire	2	501	1.1	0.0, 1.9	2.9	-0.4, 5.7	6.0	-5.9, 21.6
Veery	1	1371	-0.8 *	-1.4, -0.1	-1.2	-2.3, 0.0	-6.8 *	-11.7, -1.8
Swainson's Thrush	1	1191	-0.9 *	-1.8, -0.3	-1.1	-2.3, 0.1	-4.8	-10.5, 1.0

APPENDIX 1. Continued.

			1966-2008		2003-2008		2007-2008	
Species	TQ	N	Trend	Credible Interval	Trend	Credible Interval	Trend	Credible Interval
Hermit Thrush	1	1497	0.9	0.0, 1.9	1.4	-0.1, 4.0	-5.0	-12.1, 4.5
Wood Thrush	1	2055	-1.8 *	-2.1, -1.5	0.3	-0.5, 1.1	-1.0	-4.7, 3.0
American Robin	1	3895	0.2 *	0.1, 0.3	-0.2	-0.6, 0.2	-1.9 *	-3.6, -0.1
Varied Thrush	1	279	-2.2 *	-3.3, -1.4	-2.9	-6.2, 0.3	-8.5	-22.8, 7.7
Wrentit	1	165	-0.8 *	-1.3, -0.2	-2.4	-5.1, 0.0	-7.7	-19.1, 4.7
Gray Catbird	1	2771	-0.2 *	-0.3, -0.1	0.8 *	0.3, 1.4	1.0	-1.7, 3.7
Northern Mockingbird	1	2576	-0.6 *	-0.7, -0.4	-1.4 *	-2.1, -0.7	-3.1 *	-6.1, -0.1
Sage Thrasher	1	440	-0.7	-1.7, 0.2	0.7	-2.2, 4.0	2.4	-10.6, 19.6
Brown Thrasher	1	2649	-1.1 *	-1.2, -0.9	-0.4	-1.0, 0.2	-0.8	-3.8, 2.3
Long-billed Thrasher	2	37	7.1 *	4.5, 9.6	8.6 *	1.8, 15.2	-0.8	-47.6, 31.6
Bendire's Thrasher	2	75	-4.8 *	-7.2, -2.7	-4.6	-12.1, 2.8	-4.6	-38.0, 34.9
Curve-billed Thrasher	1	215	-1.3 *	-2.4, -0.3	-1.2	-4.1, 1.5	-6.2	-17.2, 5.0
California Thrasher	1	100	-1.9 *	-2.9, -0.9	-2.5	-7.2, 0.9	0.4	-15.6, 26.1
Crissal Thrasher	2	85	0.9	-1.0, 2.8	2.0	-3.7, 8.7	2.4	-19.8, 35.3
Le Conte's Thrasher	2	54	-2.6 *	-4.9, -0.5	-1.3	-16.0, 12.8	5.7	-43.3, 113.6
European Starling	1	3965	-1.2 *	-1.5, -1.1	-1.1 *	-1.7, -0.5	0.1	-2.8, 2.9
Sprague's Pipit	1	223	-3.0 *	-4.5, -1.7	-3.9	-11.3, 3.2	-10.5	-34.0, 22.6
Cedar Waxwing	1	2571	0.1	-1.2, 0.8	-0.3	-1.8, 1.3	6.6	-0.9, 15.2
Phainopepla	1	187	-0.3	-1.9, 1.3	-0.3	-7.3, 7.1	-4.4	-31.6, 33.6
Blue-winged Warbler	2	695	0.1	-0.5, 0.8	0.1	-2.5, 3.0	1.5	-9.3, 14.9
Golden-winged Warbler	2	434	-2.4 *	-3.4, -1.5	0.2	-5.1, 5.7	-0.8	-25.0, 27.0
Tennessee Warbler	1	580	-0.3	-2.6, 1.6	4.1	-4.6, 12.1	-4.5	-33.5, 36.6
Orange-crowned Warbler	1	714	-0.9 *	-1.6, -0.1	-0.1	-3.0, 2.8	5.6	-7.5, 23.4
Nashville Warbler	1	1063	0.3	-0.5, 1.1	1.4	-0.7, 3.4	9.3	-0.5, 19.6
Virginia's Warbler	1	126	-0.4	-1.9, 0.8	-0.3	-3.3, 3.1	-0.2	-14.0, 16.4
Lucy's Warbler	1	61	0.0	-1.3, 1.4	0.8	-4.1, 6.1	12.1	-8.6, 50.1
Northern Parula	1	1542	1.0 *	0.6, 1.4	3.0 *	1.8, 4.3	2.2	-3.0, 7.8
Yellow Warbler	1	3196	-0.3	-0.6, 0.0	-0.2	-1.2, 0.6	-1.4	-5.5, 2.5
Chestnut-sided Warbler	1	1123	-1.6 *	-2.4, -0.9	0.4	-0.7, 1.5	-0.9	-6.6, 4.5
Magnolia Warbler	1	839	1.8	-0.6, 2.9	2.0 *	0.4, 3.8	4.0	-3.5, 12.6
Cape May Warbler	1	403	-3.2 *	-6.0, -0.7	4.4	-1.0, 11.2	1.1	-23.2, 32.4
Black-throated Blue Warbler	2	649	2.4 *	1.1, 3.6	4.2 *	1.8, 7.3	1.5	-8.4, 14.0
Yellow-rumped Warbler	1	1591	0.1	-0.5, 0.6	0.4	-0.8, 1.8	-0.3	-5.9, 5.9
Black-throated Gray Warbler	1	373	-1.0 *	-2.1, -0.2	-0.2	-3.6, 3.2	0.6	-13.9, 18.2
Black-throated Green Warbler	1	963	1.1 *	0.1, 2.0	-0.2	-2.3, 1.8	-3.8	-14.5, 5.1
Townsend's Warbler	1	261	0.1	-0.8, 0.9	-1.1	-4.2, 1.4	0.2	-10.4, 12.2
Hermit Warbler	1	158	0.0	-0.9, 0.8	-1.6	-5.1, 0.9	-0.1	-11.9, 14.5
Blackburnian Warbler	1	734	1.0 *	0.1, 2.1	1.2	-0.7, 3.0	-0.7	-8.7, 7.9
Yellow-throated Warbler	2	783	1.1 *	0.5, 1.7	1.5	-0.5, 3.4	-0.6	-9.5, 8.8
Grace's Warbler	1	63	-2.1 *	-3.9, -0.5	-0.7	-5.0, 3.7	5.7	-14.2, 34.4
Pine Warbler	1	1282	1.4 *	1.1, 1.8	3.2 *	1.7, 4.7	-2.2	-8.3, 4.2
Prairie Warbler	1	1076	-2.2 *	-2.5, -1.8	-1.0	-2.6, 0.5	-2.8	-10.8, 5.5
Palm Warbler	2	190	-2.6	-5.5, 0.0	2.2	-4.0, 10.3	-2.7	-31.4, 37.8
Bay-breasted Warbler	1	353	0.3	-1.9, 2.5	-2.7	-11.2, 5.1	-11.9	-51.8, 22.1
Blackpoll Warbler	3	227	-6.3 *	-17.1, -1.0	-5.5	-13.4, 1.0	-3.1	-32.4, 30.6
Cerulean Warbler	2	426	-3.2 *	-4.2, -2.3	-4.6 *	-9.4, -0.9	-8.9	-25.5, 7.8
Black-and-white Warbler	1	1662	0.0	-0.7, 0.6	1.2	-0.4, 2.7	0.1	-7.1, 7.5
American Redstart	1	1915	0.0	-0.5, 0.7	0.9	-0.6, 2.8	1.8	-5.9, 10.6

APPENDIX 1. Continued.

		1966-2008			2003-2008		2007-2008	
Species	TQ	N	Trend	Credible Interval	Trend	Credible Interval	Trend	Credible Interval
Prothonotary Warbler	1	680	-1.2 *	-1.7, -0.7	0.0	-2.3, 2.3	-5.5	-16.0, 5.1
Worm-eating Warbler	2	589	0.7	-0.2, 1.5	2.0	-0.9, 4.8	1.2	-10.8, 14.0
Swainson's Warbler	2	252	1.0	-0.6, 2.5	4.6	-0.6, 12.9	2.5	-23.3, 46.2
Ovenbird	1	1873	0.1	-0.3, 0.5	0.6	-0.2, 1.6	-0.4	-4.6, 3.9
Northern Waterthrush	1	954	1.1 *	0.2, 1.9	0.2	-2.6, 3.0	3.9	-7.8, 19.4
Louisiana Waterthrush	2	888	0.5	-0.1, 1.0	1.6	-0.5, 3.6	3.2	-5.4, 13.2
Kentucky Warbler	1	988	-0.7 *	-1.1, -0.2	0.3	-1.5, 2.2	-5.9	-14.5, 2.6
Connecticut Warbler	1	221	-1.0	-3.2, 2.2	-0.5	-7.3, 7.2	2.1	-24.4, 43.4
Mourning Warbler	1	813	-1.6 *	-2.7, -0.7	-1.0	-2.6, 0.8	-1.0	-8.2, 6.9
MacGillivray's Warbler	3	614	-0.8	-17.6, 0.0	0.3	-1.7, 2.5	0.7	-8.2, 11.7
Common Yellowthroat	1	3545	-0.9 *	-1.2, -0.7	-0.6 *	-1.0, -0.1	-1.4	-3.6, 0.9
Hooded Warbler	1	925	2.0 *	1.5, 2.5	4.6 *	2.5, 6.8	9.0	-0.4, 19.7
Wilson's Warbler	1	890	-2.6 *	-3.8, -1.8	-1.6	-3.7, 0.5	-2.7	-12.3, 8.0
Canada Warbler	2	717	-2.2 *	-3.4, -1.2	-0.8	-5.1, 4.4	0.9	-20.6, 29.1
Yellow-breasted Chat	1	1884	-1.3	-4.0, 1.5	0.8	-0.1, 1.6	1.6	-2.3, 5.5
Hepatic Tanager	2	49	3.4 *	1.6, 5.3	4.4	-1.1, 10.5	-6.2	-30.3, 19.4
Summer Tanager	1	1160	0.0	-0.2, 0.3	0.7	-0.2, 1.7	-1.0	-5.2, 3.4
Scarlet Tanager	1	1711	0.0	-0.2, 0.3	0.7	-0.3, 1.8	-0.1	-5.1, 4.9
Western Tanager	1	912	1.3 *	0.9, 1.7	2.1 *	0.9, 3.4	-0.1	-5.6, 6.1
Olive Sparrow	1	33	3.4 *	1.3, 5.5	15.4 *	6.0, 25.8	22.4	-10.5, 67.8
Green-tailed Towhee	1	434	-0.4	-1.2, 0.2	0.4	-2.0, 3.0	-1.9	-11.7, 10.8
Spotted Towhee	1	956	0.1	-0.3, 0.4	0.0	-1.3, 1.3	0.5	-5.4, 6.9
Eastern Towhee	1	1965	-1.4 *	-1.6, -1.3	-0.8 *	-1.4, -0.2	-3.2 *	-6.1, -0.4
Canyon Towhee	1	172	-1.0 *	-2.0, -0.1	-0.2	-3.3, 3.4	3.5	-10.1, 23.2
California Towhee	1	145	-0.2	-0.8, 0.3	-0.4	-2.9, 2.0	2.9	-8.3, 17.0
Abert's Towhee	1	34	2.2	-0.2, 4.6	2.8	-3.6, 10.7	2.2	-25.2, 39.3
Cassin's Sparrow	1	326	-1.1	-3.7, 0.1	2.9	-0.9, 7.4	-4.7	-22.3, 15.6
Bachman's Sparrow	2	258	-3.0 *	-4.3, -2.1	-2.5	-5.8, 1.2	-3.0	-18.8, 16.5
Rufous-crowned Sparrow	1	184	-0.8	-2.1, 0.6	-0.6	-5.6, 4.7	-1.9	-23.3, 25.1
Chipping Sparrow	1	3536	-0.2	-0.6, 0.0	0.6	-0.1, 1.3	-2.2	-5.2, 0.9
Clay-colored Sparrow	1	781	-1.3 *	-1.8, -0.9	0.6	-0.8, 2.0	0.5	-5.9, 7.0
Brewer's Sparrow	1	655	-0.6	-1.5, 0.3	0.2	-4.5, 5.0	-1.2	-21.8, 24.0
Field Sparrow	3	2118	-2.3 *	-14.8, -2.1	0.1	-0.8, 1.1	0.5	-4.0, 5.2
Black-chinned Sparrow	1	92	-2.5	-4.7, 0.0	0.6	-7.7, 12.0	-8.3	-43.0, 42.4
Vesper Sparrow	1	2170	-0.9 *	-1.3, -0.5	0.4	-0.8, 1.6	-0.2	-5.7, 5.7
Lark Sparrow	1	1532	-1.1 *	-1.6, -0.7	0.3	-1.1, 2.0	0.3	-6.4, 7.6
Black-throated Sparrow	1	425	-1.6 *	-2.6, -0.4	-1.3	-10.6, 4.8	-1.7	-16.6, 34.2
Sage Sparrow	1	367	0.2	-1.6, 2.1	0.2	-6.2, 4.1	0.9	-23.8, 22.7
Lark Bunting	1	524	-4.5 *	-6.8, -2.7	-12.3 *	-19.2, -3.3	-40.8 *	-59.7, -10.6
Savannah Sparrow	1	2192	-1.0 *	-1.4, -0.7	-0.2	-1.3, 1.0	1.5	-3.7, 7.3
Grasshopper Sparrow	1	2096	-2.7 *	-3.9, -2.1	-1.2	-3.0, 0.6	-2.5	-10.5, 6.2
Baird's Sparrow	1	199	-2.7 *	-4.3, -1.2	6.6	-2.2, 17.8	6.7	-30.8, 70.6
Le Conte's Sparrow	1	346	-1.0	-2.6, 0.7	3.8	-2.8, 11.1	-12.6	-42.4, 23.3
Henslow's Sparrow	3	354	-0.6	-2.3, 0.8	8.0	-0.9, 15.1	10.7	-15.4, 48.5
Nelson's Sharp-tailed Sparrow	2	183	1.6	-2.9, 3.8	3.1	-3.0, 8.6	-0.4	-26.2, 26.6
Seaside Sparrow	2	35	3.9	-1.7, 8.2	5.2	-13.5, 20.0	19.7	-40.1, 176.8
Fox Sparrow	1	416	1.4	-1.3, 4.4	0.6	-2.1, 3.5	2.2	-9.4, 16.9
Song Sparrow	1	3152	-0.5 *	-0.7, -0.4	0.2	-0.3, 0.8	-2.0	-4.3, 0.5

APPENDIX 1. Continued.

			1966-2008		2003-2008		2007-2008	
Species	TQ	N	Trend	Credible Interval	Trend	Credible Interval	Trend	Credible Interval
Lincoln's Sparrow	1	800	-1.4	-3.3, 0.2	0.9	-2.5, 4.6	-15.5 *	-29.3, -0.2
Swamp Sparrow	1	1153	0.9	-0.6, 2.0	0.8	-1.1, 2.6	-2.4	-10.6, 6.3
White-throated Sparrow	1	976	-0.3	-1.0, 0.2	-0.2	-1.3, 1.1	-11.6 *	-16.2, -6.4
White-crowned Sparrow	1	496	-1.0 *	-1.7, -0.3	0.2	-1.9, 2.7	2.7	-7.2, 15.7
Dark-eyed Junco	1	1514	-1.1 *	-1.7, -0.5	-1.3	-4.0, 1.2	-12.0	-23.6, 0.0
McCown's Longspur	1	106	-5.1 *	-8.1, -2.4	-2.2	-10.0, 5.3	-5.6	-47.3, 27.0
Chestnut-collared Longspur	1	207	-4.3 *	-5.3, -3.2	-2.9	-6.7, 1.7	-8.4	-26.2, 12.4
Northern Cardinal	1	2306	0.3 *	0.2, 0.4	0.2	-0.2, 0.6	-2.1 *	-4.0, -0.1
Pyrrhuloxia	1	127	-0.8	-1.8, 0.2	0.2	-3.1, 3.6	1.9	-11.5, 18.7
Rose-breasted Grosbeak	1	1641	-0.6 *	-1.0, -0.3	0.4	-1.1, 1.8	-0.3	-7.1, 6.8
Black-headed Grosbeak	1	929	0.9 *	0.6, 1.3	2.2 *	0.9, 3.6	3.2	-2.7, 9.7
Blue Grosbeak	1	1590	0.7 *	0.4, 0.9	1.8 *	0.9, 2.8	-0.6	-4.9, 4.0
Lazuli Bunting	1	743	-0.5	-1.2, 0.1	1.7	-0.3, 5.2	4.1	-5.7, 22.4
Indigo Bunting	1	2419	-0.5 *	-0.6, -0.4	-0.6 *	-1.1, -0.2	-1.1	-3.2, 1.0
Painted Bunting	1	448	-0.3	-0.9, 0.3	0.9	-1.1, 3.0	2.6	-7.1, 13.4
Dickcissel	1	1230	-0.8 *	-1.3, -0.3	-1.0	-2.8, 0.8	-11.8 *	-19.7, -3.4
Bobolink	1	1533	-2.1 *	-3.3, -1.7	-1.8 *	-3.4, -0.3	-2.8	-9.7, 4.2
Red-winged Blackbird	1	4094	-0.9 *	-1.1, -0.7	-0.7	-1.4, 0.0	1.2	-1.7, 4.5
Tricolored Blackbird	3	78	1.4	-5.5, 4.3	-2.1	-11.3, 12.0	-3.4	-51.2, 78.5
Eastern Meadowlark	1	2428	-3.2 *	-3.7, -3.0	-2.7 *	-3.5, -1.9	-2.0	-5.8, 1.8
Western Meadowlark	1	2001	-1.1 *	-1.3, -0.8	-1.1 *	-1.8, -0.3	0.4	-3.2, 4.1
Yellow-headed Blackbird	1	998	-0.1	-1.2, 0.8	0.6	-4.7, 6.2	3.4	-18.7, 33.4
Rusty Blackbird	3	219	-6.3 *	-11.7, -1.5	-2.0	-11.8, 13.2	-8.0	-57.1, 79.2
Brewer's Blackbird	1	1561	-2.1 *	-2.6, -1.7	-1.2	-2.2, 0.1	-0.8	-7.0, 5.0
Great-tailed Grackle	1	478	2.8 *	1.1, 4.0	4.6 *	0.1, 9.5	5.1	-14.3, 29.9
Boat-tailed Grackle	1	174	-0.2	-1.5, 1.2	0.3	-4.2, 4.8	-3.5	-22.8, 17.7
Common Grackle	1	3201	-1.6 *	-1.7, -1.4	-2.3 *	-3.0, -1.6	-3.9 *	-7.1, -0.6
Bronzed Cowbird	1	106	0.2	-1.9, 2.3	7.6	-1.3, 19.7	25.7	-12.3, 100.6
Brown-headed Cowbird	1	4159	-0.7 *	-0.9, -0.5	0.9	0.0, 1.8	0.1	-4.2, 4.6
Orchard Oriole	1	1925	-0.8 *	-1.1, -0.6	1.5 *	0.3, 2.7	3.2	-2.5, 9.1
Hooded Oriole	2	133	-0.6	-2.9, 1.4	1.8	-3.2, 7.1	-1.7	-24.6, 23.9
Bullock's Oriole	1	1025	-0.5	-1.0, 0.0	1.9 *	0.5, 3.5	3.3	-3.2, 10.5
Baltimore Oriole	1	2171	-1.1 *	-1.5, -0.7	0.6	-0.3, 1.5	2.4	-2.0, 7.1
Scott's Oriole	1	218	-0.3	-1.6, 0.8	0.1	-3.7, 3.5	-2.8	-17.8, 14.9
Pine Grosbeak	2	236	-2.1	-6.7, 0.0	0.3	-7.5, 9.1	-14.2	-48.2, 29.4
Purple Finch	1	1338	-1.1 *	-2.2, -0.4	0.7	-1.2, 2.7	3.9	-4.9, 13.7
Cassin's Finch	1	454	-2.5 *	-3.7, -1.3	0.5	-2.9, 4.1	-2.3	-17.1, 13.8
House Finch	1	2893	0.4	0.0, 0.9	-1.4	-3.4, 1.1	-5.5	-13.5, 6.4
Red Crossbill	2	782	-0.2	-7.3, 2.2	5.0	-4.7, 17.5	5.6	-39.1, 87.2
White-winged Crossbill	3	344	6.1	-2.1, 13.1	6.4	-27.1, 112.5	-72.2	-100.0, 253.4
Pine Siskin	1	1351	-2.8 *	-4.4, -1.6	3.2	-2.3, 8.9	-6.9	-28.1, 20.0
Lesser Goldfinch	1	519	0.4	-0.6, 2.4	0.3	-5.2, 20.2	-5.4	-26.9, 141.4
Lawrence's Goldfinch	1	82	-0.1	-3.0, 2.2	3.2	-5.3, 15.4	-1.5	-40.4, 54.8
American Goldfinch	1	3187	0.1	-0.1, 0.3	-1.1 *	-1.9, -0.3	-9.5 *	-12.7, -6.1
Evening Grosbeak	3	980	-5.2 *	-20.5, -3.2	0.3	-5.0, 6.2	14.1	-11.8, 49.0
House Sparrow	1	3613	-3.6 *	-3.9, -3.4	-4.6 *	-5.4, -3.9	-6.6 *	-10.1, -3.2
Eurasian Tree Sparrow	2	37	7.4 *	5.2, 9.7	7.2 *	0.1, 13.2	5.9	-25.2, 38.1

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THE 2007 AND 2008 NORTH AMERICAN BREEDING BIRD CENSUS[1]

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Abstract. The Breeding Bird Census (BBC) is the longest, continuously-run bird monitoring program in North America. Here we publish reports of Breeding Bird Censuses that were conducted at 22 and 20 sites during 2007 and 2008, respectively.

EL CENSO DE AVES REPRODUCTORAS DE NORTEAMÉRICA DE 2007 Y 2008
Resumen. El Censo de Aves Reproductoras (BBC) es el programa de monitoreo de aves contínuo más longevo de Norteamérica. Publicamos los informes del BBC que se llevaron a cabo a 22 y 20 sitios en 2007 y 2008, respectivamente.

INTRODUCTION

The Breeding Bird Census (BBC) is the breeding season component of the Resident Bird Counts (RBC), which also include the Winter Bird Population Study. The BBC uses the spot- or territory-mapping method to estimate densities of breeding birds. More information on methods, history, and uses of BBC data can be found in Lowe (2006).

A total of 22 and 20 BBC reports were submitted for 2007 and 2008, respectively, similar to the numbers of submissions from 2003 through 2006 (20-25 reports per year), but down considerably from submissions from 2001 and 2002 (38 and 30 reports, respectively). The length of effort among censuses during 2007 and 2008 ranged from 2 to 43 yr with half each year being ≥ 25 yr and the mean length of effort being 20.6 and 23.2 yr, respectively.

Please contact Tom Gardali (tgardali@prbo.org) for BBC instructions and data forms. To understand the layout of the reports, see Gardali and Lowe (2006).

THE 2007 BREEDING BIRD CENSUS

A total of 22 Breeding Bird Census reports are included for 2007 (Table 1). The counts come from 8 U.S. states, and 1 Canadian province. Except for New York which had 3 counts during 2007, the numbers of counts per state or

[1] Received: 18 October 2010. Revisions accepted 20 October 2010.

province during 2007 were similar to the numbers of counts per state or province during each of the years 2003-2006, with the highest numbers being in California (7 counts), Connecticut (5 counts), and Ontario (2 counts).

THE 2008 BREEDING BIRD CENSUS

A total of 20 Breeding Bird Census reports are included for 2008 (Table 2). The counts come from 7 U.S. states, and 1 Canadian province. Again, except for New York which had 2 counts during 2008, the numbers of counts per state or province during 2008 were similar to the numbers of counts per state or province during each of the years 2003-2007, with the highest numbers again being in California (7 counts), Connecticut (5 counts), and Ontario (2 counts).

LITERATURE CITED

GARDALI, T., AND J.D. LOWE. 2006. Reviving resident bird counts: the 2001 and 2002 Breeding Bird Census. Bird Populations 7: 90-95.

LOWE, J.D. 2006. An annotated bibliography of Breeding Bird Census publications. Bird Populations 7:128-135.

TABLE 1. Summary of Breeding Bird Census reports from 2007.

Habitat	State/ Prov.	Author(s)	Plot Size (ha)	Terr. per 40 ha	Num. spp.	Hrs. Obs.	Yrs. Study
Broadleaf Forests							
1. Mixed Hardwood Poletimber	CT	D. Rosgen	8.5	664	48	23.5	42
2. Second-Growth Hardwood Forest	CT	D. Rosgen	10.1	380	40	16.5	41
3. White Oak Savannah	ON	M.F.G. Clark	10.4	288	21	16.5	10
4. Oak-Maple-Poplar Hollow	PA	L. Ingram	11.3	117	13	15.1	15
5. Virgin Hardwood Swamp Forest	SC	M. Dawson	8.9	380	20	14.3	15
6. Mature Maple-Beech-Birch Forest	TN	L.M. Lewis	10.2	210	16	27.9	15
7. Mature Oak Woodland	WI	K. Kreitinger	46.0	108	16	49.6	5
Needleleaf Forests							
8. Upland Christmas Tree Farm	NY	E.W. Brooks	10.7	277	21	12.3	25
Broadleaf/Needleleaf Forests							
9. Climax Hemlock-White Pine Forest with Transition Hardwoods	CT	D. Rosgen	10.5	415	46	24.0	41
10. Young Mixed Hardwood-Conifer Stand	CT	D. Rosgen	8.5	325	41	16.0	30
11. Riparian Woodland	ID	S.R. Robinson	8.9	175	18	12.1	11
12. Upland Mixed Pine-Spruce-Hardwood Plantation	NY	E.W. Brooks	16.6	236	35	17.4	34
Mixed Habitats							
13. Riparian Scrub	CA	J. Coumoutso	14.6	214	21	18.4	2
14. Riparian Scrub Basin	CA	M. Aimar	12.7	348	24	22.8	4
15. Streamside Riparian Woodland I	CA	T. Reeser	17.8	266	26	30.7	4
16. Streamside Riparian Woodland III	CA	A. Beckman	12.3	501	35	24.2	4
17. Pitch Pine-Slabrock	NY	L. Bowdery, T. Sarro, L. Fagan, A. Bowdery, J. Chernek	15.8	135	36	30.6	4
18. Field, Ridge, Shrubby Trees, & Woods	ON	M.F.G. Clark	5.8	655	14	13.1	12
Non-forested Wetlands							
19. Shrubby Swamp & Sedge Hummocks	CT	D. Rosgen	8.1	1079	45	30.0	41
Shrublands							
20. Coastal Scrub	CA	J. Gunther, S. Jennings	8.1	195	20	168.9	33
21. Disturbed Coastal Scrub A	CA	S. Jennings, E. Porzig	4.7	323	28	216.0	33
22. Disturbed Coastal Scrub B	CA	I. Koulouris, S. Jennings	8.1	212	24	152.2	33

TABLE 2. Summary of Breeding Bird Census reports from 2008.

Habitat	State/ Prov.	Author(s)	Plot Size (ha)	Terr. per 40 ha	Num. spp.	Hrs. Obs.	Yrs. Study
Broadleaf Forests							
1. Mixed Hardwood Poletimber	CT	D. Rosgen	8.5	635	47	22.0	43
2. Second-Growth Hardwood Forest	CT	D. Rosgen	10.1	408	47	22.0	42
3. White Oak Savannah	ON	M.F.G. Clark	10.4	323	17	16.4	11
4. Oak-Maple-Poplar Hollow	PA	L. Ingram	11.3	142	11	14.8	16
5. Hardwood Swamp Forest	SC	M.R. Dawson	8.1	425	20	14.4	15
6. Mature Maple-Beech-Birch Forest	TN	L.M. Lewis	10.2	153	9	18.4	16
Needleleaf Forests							
7. Upland Christmas Tree Farm	NY	E.W. Brooks	10.7	254	17	13.6	26
Broadleaf/Needleleaf Forests							
5. Climax Hemlock-White Pine Forest with Transition Hardwoods	CT	D. Rosgen	10.5	507	46	28.0	42
9. Young Mixed Hardwood-Conifer Stand	CT	D. Rosgen	8.5	360	35	15.0	31
10. Riparian Woodland	ID	S.R. Robinson	8.9	173	20	10.7	12
11. Upland Mixed Pine-Spruce-Hardwood Plantation	NY	E.W. Brooks	16.6	208	28	12.9	35
Mixed Habitats							
12. Riparian Scrub	CA	J. Coumoutso	14.6	296	21	20.5	3
13. Riparian Scrub Basin	CA	M. Aimar	12.7	337	26	19.3	5
14. Streamside Riparian Woodland I	CA	T. Reeser	17.8	454	29	47.0	5
15. Streamside Riparian Woodland III	CA	A. Beckman	12.3	569	37	23.1	5
16. Field, Ridge, Shrubby Trees, & Woods	ON	M.F.G. Clark	5.8	548	17	16.4	13
Non-forested Wetlands							
17. Shrubby Swamp and Sedge Hummocks	CT	D. Rosgen	8.1	1148	52	28.0	42
Shrublands							
18. Coastal Scrub	CA	P. Valle, S. Jennings	8.1	289	25	279.0	34
19. Disturbed Coastal Scrub A	CA	M. Meitzelfeld, S. Jennings	4.7	319	30	125.8	34
20. Disturbed Coastal Scrub B	CA	W. Pett, S. Jennings	8.1	294	26	168.5	3 4

Bird Populations 10:114-124

BREEDING BIRD CENSUS: 2007

1. MIXED HARDWOOD POLETIMBER
BOSQUE MIXTO MADERERO

DAVID ROSGEN
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P.O. Box 368
Litchfield CT 06759

Site Number: CT1265009. **Location:** Connecticut; Litchfield Co.; Litchfield; White Memorial Foundation–Wheeler Hill; 41°42'N, 73°13'W; Litchfield Quadrangle, USGS. **Continuity:** Established 1965; 42 yr. **Size:** 8.5 ha. **Description of Plot:** See *Aud. Field Notes* 19:609–610 (1965), *J. Field Ornithol.* 64(Suppl.):36 (1993), and *Bird Populations* 8:125 (2007). The density of shrubs and vines is continuing to increase, and deer over-browsing of herbaceous vegetation is getting worse. **Weather:** Mean start temp., 24.4°C (range 18–32°C). Overall, the weather during May, June, and July was pretty nice in northwest Connecticut. It was very conducive to vegetation growth, and it helped produce an abundance of seeds, nuts, berries, and insects as the season progressed. Rainfall was below average in May, with 11 wet days producing a total of only 4.4 cm of rain. The number of wet days remained the same in June, but 8.6 cm of rain fell. That's a little below average. In July, there were 12 wet days that produced a total of 15.5 cm of rain. That's a little above average. May's mean temperature was 14.7°C, which is a little below average. The mean temperature in June was 18.6°C, which is close to average. In July, the mean temperature was 20.4°C, which is a little below average. **Source:** White Memorial Foundation's own weather station. **Coverage:** 23.5 h; 10 visits (1 sunrise, 7 sunset); 9, 16, 26 May; 5, 12, 19, 30 June; 9, 16, 26 July; 2007. Maximum number of observers/visit, 3. **Census:** Gray Catbird, 15.5 (73; 4N,29FL); Veery, 14.5 (68; 12FL); Ovenbird, 13.5 (64; 1N,15FL); Eastern Towhee, 12.5 (59; 2N,22FL); Red-eyed Vireo, 11.0 (52; 2N,11FL); Common Yellowthroat, 9.0 (42; 1N,16FL); American Redstart, 8.5 (40; 2N,15FL); Wood Thrush, 5.0 (24; 1N,6FL); Northern Cardinal, 4.5 (21; 10FL); Tufted Titmouse, 4.0 (19; 18FL); American Robin, 4.0 (2N,9FL); Chestnut-sided Warbler, 4.0 (6FL); Black-capped Chickadee, 3.5 (16; 1N,15FL); Yellow Warbler, 3.5 (1N,9FL); Scarlet Tanager, 2.5 (3FL); Baltimore Oriole, 2.0 (1N,5FL); American Goldfinch, 2.0 (2FL); Blue Jay, 1.5 (2FL); American Crow, 1.5 (1N,7FL); White-breasted Nuthatch, 1.5 (4FL); Cedar Waxwing, 1.5; Black-and-white Warbler, 1.5 (2FL); Wild Turkey, 1.0; Downy Woodpecker, 1.0 (3FL); Eastern Wood-Pewee, 1.0; House Wren, 1.0; Song Sparrow, 1.0 (1N,4FL); Red-winged Blackbird, 1.0 (2FL); Common Grackle, 1.0 (1N,4FL); Mourning Dove, 0.5 (1FL); Barred Owl, 0.5 (1FL); Ruby-throated Hummingbird, 0.5; Red-bellied Woodpecker, 0.5; Yellow-bellied Sapsucker, 0.5; Hairy Woodpecker, 0.5; Northern Flicker, 0.5; Pileated Woodpecker, 0.5; Yellow-throated Vireo, 0.5 (1N); Blue-winged Warbler, 0.5; Rose-breasted Grosbeak, 0.5; Brown-headed Cowbird, 0.5 (1FL); Purple Finch, 0.5; House Finch, 0.5; Eastern Phoebe, +; Great Crested Flycatcher, +; Eastern Kingbird, +; Warbling Vireo, +; Blue-gray Gnatcatcher, +. **Total:** 48 species; 141.0 territories (664/40 ha). **Visitors:** Cooper's Hawk, Yellow-billed Cuckoo, Chipping Sparrow. **Remarks:** The number of species found breeding in the plot decreased slightly this year to 48. Last year, 50 species were found here. The 10-year average is 46 species. Ruby-throated Hummingbird and Eastern Kingbird were found in the plot this year but not last year, when the latter species was just a visitor. Red-tailed Hawk, Fish Crow, and European Starling were lost as breeders; and Cooper's Hawk was reduced to visitor status this year. The total number of territories found here this year increased to a new record-high of 141.0 (from 132.0 last year). This is well above the 10-year average of 114.5 territories. The Gray Catbird population surged up to 15.5 territories this year, making it the most abundant species. Veery increased by 2.5 territories and remained the second most abundant species. Ovenbird remained the third most abundant species, even though it increased by 2.0 territories. Eastern Towhee moved up to fourth place this year. **Other Observers:** John Eykelhoff and John Grabowski.

2. SECOND-GROWTH HARDWOOD FOREST
BOSQUE SECUNDARIO DE MADERAS DURAS

DAVID ROSGEN
White Memorial Conservation Center
P.O. Box 368
Litchfield CT 06759

Site Number: CT2765006. **Location:** Connecticut;

Litchfield Co.; Morris; White Memorial Foundation–Van Winkle Road; 41°42'N, 73°12'W; Litchfield Quadrangle, USGS. **Continuity:** Established 1965; 41 yr. **Size:** 10.1 ha. **Description of Plot:** See *Aud. Field Notes* 19:590–591 (1965), *J. Field Ornithol.* 64(Suppl.): 37–38 (1993), and *Bird Populations* 8:126 (2007). **Weather:** Mean start temp., 23.8°C (range 19–32°C). Overall, the weather during May, June, and July was pretty nice in northwest Connecticut. It was very conducive to vegetation growth, and it helped produce an abundance of seeds, nuts, berries, and insects as the season progressed. Rainfall was below average in May, with 11 wet days producing a total of only 4.4 cm of rain. The number of wet days remained the same in June, but 8.6 cm of rain fell. That's a little below average. In July, there were 12 wet days that produced a total of 15.5 cm of rain. That's a little above average. May's mean temperature was 14.7°C, which is a little below average. The mean temperature in June was 18.6°C, which is close to average. In July, the mean temperature was 20.4°C, which is a little below average. **Source:** White Memorial Foundation's own weather station. **Coverage:** 16.5 h; 9 visits (0 sunrise, 9 sunset); 14, 25 May; 1, 8, 18, 29 June; 12, 21, 31 July; 2007. **Census:** Red-eyed Vireo, 15.5 (61; 2N,12FL); Veery, 15.0 (59; 1N,10FL); Ovenbird, 14.0 (55; 2N,16FL); Wood Thrush, 6.5 (26; 4FL); Gray Catbird, 4.5 (18; 1N,10FL); Eastern Wood-Pewee, 4.0 (16; 2FL); Yellow-bellied Sapsucker, 2.5 (1N,4FL); American Redstart, 2.5 (2FL); Scarlet Tanager, 2.5; Black-capped Chickadee, 2.0 (1N,5FL); Tufted Titmouse, 2.0 (9FL); American Robin, 2.0 (1N,8FL); Common Yellowthroat, 2.0 (3FL); Northern Cardinal, 2.0 (3FL); Blue Jay, 1.5 (3FL); White-breasted Nuthatch, 1.5 (6FL); Wild Turkey, 1.0; Red-bellied Woodpecker, 1.0; Downy Woodpecker, 1.0 (4FL); Eastern Phoebe, 1.0 (6FL); Great Crested Flycatcher, 1.0 (5FL); American Crow, 1.0 (1N,4FL); Hermit Thrush, 1.0; Chestnut-sided Warbler, 1.0 (3FL); Black-and-white Warbler, 1.0; Chipping Sparrow, 1.0 (5FL); Song Sparrow, 1.0 (2FL); Rose-breasted Grosbeak, 1.0 (2FL); American Goldfinch, 1.0; Mourning Dove, 0.5; Hairy Woodpecker, 0.5; Pileated Woodpecker, 0.5 (2FL); Yellow-throated Vireo, 0.5; Cedar Waxwing, 0.5; Brown-headed Cowbird, 0.5 (1FL); Brown Creeper, +; Blue-gray Gnatcatcher, +; Blue-winged Warbler, +; Black-throated Green Warbler, +; Louisiana Waterthrush, +. **Total:** 40 species; 96.0 territories (380/40 ha). **Visitors:** Wood Duck, Ruby-throated Hummingbird, Eastern Kingbird, Blue-headed Vireo, Fish Crow, Magnolia Warbler. **Remarks:** The number of species breeding in the plot increased slightly this year to 40. That is one more than last year and only two less than the previous 10-year average. Species found here this year but not last year included Mourning Dove, Yellow-throated Vireo, Brown Creeper, Blue-winged Warbler, and Chipping Sparrow. The latter four were just visitors last year. Red-tailed Hawk, Broad-winged Hawk, Northern Flicker, and Baltimore Oriole were found in the plot last year but not this year. This is the first year in a long time that no raptors have nested here. The number of territories found in the plot this year increased significantly to 96.0. That's far more than the 70.0 that were found here last year, and marks a rebound to above-average levels. The previous 10-year average is 91 territories. Red-eyed Vireo was the most abundant species this year, increasing by 6.0 territories over last year when it was in third place. Veery dropped to second place this year.

3. WHITE OAK SAVANNAH
SAVANA DE ROBLE BLANCO

MICHAEL F. G. CLARK
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Dundas ON L9H 6L7

Site Number: ON2893110. **Location:** Ontario; Municipality of Muskoka; Torrance; Southwood Shield Plateau; 44°56'N, 79°30'W. **Continuity:** Established 1993; 10 yr. **Size:** 10.4 ha. **Description of plot:** See *J. Field Ornithol.* 65(Suppl.):60–61 (1994) and *Bird Populations* 8:127–128 (2007). **Weather:** Mean start temp., 19.4°C (range 10–26°C). Temperatures were 5% above the 30-year norm for May–June of 13.8°C. Rainfall during May and June was 34% below their averaged mean. **Source:** Environment Canada. **Coverage:** 16.5 h; 8 visits (3 sunset); 5, 23 May; 2, 17, 18, 20, 21, 23 June; 2007. **Census:** Common Yellowthroat, 11.0 (42); Chestnut-sided Warbler, 10.0 (38); American Robin, 7.0 (27); Field Sparrow, 7.0; Chipping Sparrow, 6.0 (23); Red-eyed Vireo, 5.0 (19); Eastern Towhee, 5.0; Veery, 3.0 (12); Brown Thrasher, 3.0; Yellow-rumped Warbler, 3.0; Black-and-White Warbler, 3.0; American Redstart, 2.0; White-throated Sparrow, 2.0; Mourning Dove, 1.0; Northern Flicker, 1.0; Great Crested Flycatcher, 1.0; Blue Jay, 1.0; Black-capped Chickadee, 1.0; Ovenbird, 1.0; Red-winged Blackbird, 1.0; Purple Finch, 1.0. **Total:** 21 species; 75.0 territories (288/40 ha). **Visitors:** Turkey Vulture, Mourning Dove, Common Nighthawk, Ruby-throated Hummingbird, Downy Woodpecker, Hairy Woodpecker, House Wren, Eastern Bluebird, Hermit Thrush, Cedar Waxwing, Yellow Warbler, Rose-breasted Grosbeak, Common Grackle, Brown-headed Cowbird. **Remarks:** The lowest May–June rainfall over this plot's 10-year study period did not appear to adversely affect breeding outcomes. Both the 75 territorial males and 21 breeding species were the highest in four study years. Warblers in particular, were abundant with 30 territories (representing 40% of the overall total) and with six species that attained 10-year highs. Seedeaters (6 species) were 26% below the norm, but Purple Finch and Mourning Dove bred

on the plot for the first time in eight and six years, respectively. The one breeding flycatcher (Great Crested Flycatcher) underlines a continuing and severe decline of this group (81% below the mean). Many once-regular species have not bred on this plot for several years including Yellow Warbler and Warbling Vireo (five years), and Eastern Kingbird, House Wren, and Yellow-billed Cuckoo (four years). This suggests the plot's (as well as much of the surrounding area's) openness invites sporadic breeding by some species. To date, 46 species have bred on this plot.

4. OAK–MAPLE–POPLAR HOLLOW

BOSQUE DE ROBLE–ARCE–ALAMO HUECO

LINDA INGRAM
Nolde Forest Environmental Education Center
2910 New Holland Road
Reading PA 19607-9448

Site Number: PA1093123. **Location:** Pennsylvania; Berks Co.; Reading; Nolde Forest, Buck Hollow; 40°16'57"N, 75°57'30"W; Reading Quadrangle, USGS. **Continuity:** Established 1993; 15 yr. **Size:** 11.3 ha. **Description of Plot:** See *J. Field Ornithol.* 65(Suppl.):61 (1994). **Weather:** Mean start temp., 13.9°C (range 7–18°C). **Coverage:** 15.1 h; 9 visits (9 sunrise); 30 April; 4, 7, 8, 11, 14, 20, 21 May; 18 June; 2007. **Census:** Wood Thrush, 7.0 (25); Ovenbird, 5.0 (18); Veery, 4.0 (14); American Crow, 3.0 (11); Eastern Towhee, 3.0; Northern Cardinal, 2.5; Eastern Wood-Pewee, 2.0; Red-bellied Woodpecker, 1.5; Pileated Woodpecker, 1.0; Blue Jay, 1.0; chickadee sp.; 1.0; Tufted Titmouse, 1.0; Scarlet Tanager, 1.0. **Total:** 13 species; 33.0 territories (117/40 ha). **Visitors:** Great Crested Flycatcher, Blue-headed Vireo, Brown Creeper, Cedar Waxwing, Worm-eating Warbler, Rose-breasted Grosbeak, Indigo Bunting. **Other Observers:** Pat Mangas, Lynn Scheirer, David Reynolds, and Phyllis Reynolds.

5. VIRGIN HARDWOOD SWAMP FOREST

BOSQUE PANTANOSO VIRGEN DE MADERAS DURAS

MICHAEL DAWSON
Audubon Center at Beidler Forest
336 Sanctuary Road
Harleyville SC 29448

Location: South Carolina; Berkeley Co.; Harleyville; Francis Beidler Forest Sanctuary; 33°13'N, 80°20'W; Pringletown Quadrangle, USGS. **Continuity:** Established 1979; 15 yr. **Size:** 8.9 ha. **Description of Plot:** See *Am. Birds* 34:50 (1980) and *J. Field Ornithol.* 65(Suppl.):64 (1994). The plot is continuing to recover from the damage caused by hurricane Hugo in 1989. Scrubby areas have thinned greatly as saplings have increased in height and shaded the forest floor. **Weather:** Mean start temp., 13.4°C (range 9–16°C). May was a fairly dry month. **Coverage:** 14.3 h; 10 visits (10 sunrise, 0 sunset); 26 April; 2, 6, 10, 12, 15, 19, 23, 25, 29 May; 2007. **Census:** Blue-gray Gnatcatcher, 26.5 (119); Northern Parula, 7.5 (34); Carolina Wren, 6.5 (29); White-eyed Vireo, 6.0 (27); Tufted Titmouse, 5.5 (25); Red-eyed Vireo, 5.0 (22); Prothonotary Warbler, 4.0 (18); Northern Cardinal, 4.0; Pileated Woodpecker, 3.0 (13); Red-bellied Woodpecker, 2.5; Acadian Flycatcher, 2.5; Great Crested Flycatcher, 2.5; Hooded Warbler, 2.5; Red-shouldered Hawk, 1.0; Yellow-billed Cuckoo, 1.0; Barred Owl, 1.0; Yellow-throated Vireo, 1.0; Carolina Chickadee, 1.0; Yellow-throated Warbler, 1.0; Swainson's Warbler, 0.5. **Total:** 20 species; 84.5 territories (380/40 ha). **Visitors:** Wood Duck, Great Blue Heron, Yellow-crowned Night-Heron, Turkey Vulture, Chimney Swift, Red-headed Woodpecker, Downy Woodpecker, American Crow, Ovenbird, Northern Waterthrush, Louisiana Waterthrush, Kentucky Warbler, Summer Tanager. **Other Observer:** Norman Brunswig.

6. MATURE MAPLE–BEECH–BIRCH FOREST

BOSQUE MADURO DE ARCE–HAYA–ABEDUL

LAURA M. LEWIS
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Cleveland TN 37312

Site Number: TN2392102. **Location:** Tennessee; Monroe Co.; Whigg Ridge, Cherokee National Forest; 35°19'36"N, 84°2'30"W; Big Junction Quadrangle, USGS. **Continuity:** Established 1992; 15 yr. **Size:** 10.2 ha. **Description of Plot:** See *J. Field Ornithol.* 64(Suppl.):57–58 (1993) and 66(Suppl.):63 (1995). **Weather:** Mean start temp., 19.3°C (range 10–30°C). **Coverage:** 27.9 h; 9 visits (7 sunrise, 2 sunset); 9, 10, 12, 13, 21, 22, 23 June; 8, 9 July; 2007. **Census:** Blue-headed Vireo, 10.5 (41); Veery, 10.5; Dark-eyed Junco, 10.0 (39; 1N,12FL); Ovenbird, 8.0 (31); Blackburnian Warbler, 5.0 (20); Black-throated Blue Warbler, 2.0; Chestnut-sided Warbler, 1.5; Barred Owl, 1.0; Hairy Woodpecker, 1.0; Carolina Chickadee, 1.0; White-breasted Nuthatch, 1.0; Winter Wren, 1.0; Canada Warbler, 1.0 (2FL); Tufted Titmouse, +; Red-breasted Nuthatch, +; Rose-breasted Grosbeak, +. **Total:** 16 species; 53.5 territories (210/40 ha). **Visitors:** Ruffed Grouse, Downy Woodpecker, Blue Jay, Common Raven, Gray Catbird, Cedar Waxwing, Scarlet Tanager. **Remarks:** Flyovers: Turkey Vulture, Chimney Swift, and American Goldfinch. **Other Observers:** David F. Vogt and Hayden Wilson. **Acknowledgments:** We acknowledge the financial and logistical support of the Cherokee National Forest.

7. MATURE OAK WOODLAND
ARBOLADA DE ROBLE MADURO

KIM KREITINGER
419 Jean Street
Madison WI 53703

Location: Wisconsin; Dane Co.; Verona; Olson Oak Woods; 42°56'53"N, 89°35'2"W; Monroe and Verona Quadrangles, USGS. **Continuity:** Established 1998; 5 yr. **Size:** 46.0 ha. **Description of Plot:** See 1998 BBC report (unpublished). There were prescribed burns in 2004, 2005, and 2006. **Weather:** Mean start temp. 16.2°C (range 10–22°C). **Coverage:** 49.6 h; 16 visits; each visit covered half the plot making 8 complete surveys (16 sunrise, 0 sunset); 24, 25, 29 May; 1, 5, 6, 11, 12, 19, 20, 26, 27 June; 3, 5, 10, 11 July; 2007. **Census:** Eastern Wood-Pewee, 31.0 (27); Indigo Bunting, 26.0 (23); House Wren, 17.0 (15; 2FL); Red-eyed Vireo, 13.5 (12); Veery, 7.0 (6); Chestnut-sided Warbler, 7.0; Eastern Towhee, 5.0 (4; 1FL); Ovenbird, 4.0 (3); Scarlet Tanager, 4.0; Red-bellied Woodpecker, 2.0; Gray Catbird, 2.0; Chipping Sparrow, 2.0; Eastern Phoebe, 1.0; Yellow-throated Vireo, 1.0; Wood Thrush, 1.0; Mourning Warbler, 1.0. **Total:** 16 species; 124.5 territories (108/40 ha). **Visitors:** Wild Turkey, Mourning Dove, Yellow-billed Cuckoo, Barred Owl, Ruby-throated Hummingbird, Downy Woodpecker, Hairy Woodpecker, Northern Flicker, Pileated Woodpecker, Acadian Flycatcher, Great Crested Flycatcher, Blue Jay, Black-capped Chickadee, Tufted Titmouse, White-breasted Nuthatch, Blue-gray Gnatcatcher, American Robin, Cedar Waxwing, Common Yellowthroat, Hooded Warbler, Northern Cardinal, Rose-breasted Grosbeak, Baltimore Oriole. **Other Observer:** Nick Walton. **Acknowledgments:** Wisconsin Department of Natural Resources.

8. UPLAND CHRISTMAS TREE FARM
FINCAS DE ARBOLES DE NAVIDAD DE ALTURAS

ELIZABETH W. BROOKS
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Alfred Station NY 14803

Site Number: NY2483108. **Location:** New York, Allegany Co., Andover; Kent Christmas Tree Farm; 42°10'N, 77°50'W; Andover Quadrangle, USGS. **Continuity:** Established 1983; 25 yr. **Size:** 10.7 ha. **Description of Plot:** See *Am. Birds* 38:91(1984). **Weather:** Mean start temp. 16.1°C (range 12.2–22.2°C). Data collected by the Alfred Cooperative Weather Station indicated that June was warmer and drier than normal while July was warmer and wetter than normal. The average daily temperature in June was 19.7°C and in July it was 20.4°C, both well above average. The total precipitation in June was 6.4 cm (3 cm below average); in July, total precipitation was 16.4 cm (about 8 cm above the average). **Coverage:** 12.3 h; 9 visits plus 1 woodcock survey (1 sunset); 12 April; 29 May; 8, 14, 21, 30 June; 7, 13, 20, 29 July; 2007. **Census:** Chipping Sparrow, 19.0 (71; 2N,3FL); Song Sparrow, 16.0 (60; 2N); American Robin, 5.0 (19; 2N); Yellow-rumped Warbler, 5.0 (2N); Purple Finch, 5.0; Magnolia Warbler, 3.0 (11); Field Sparrow, 3.0 (1N); Mourning Dove, 2.0; Blue Jay, 2.0; Cedar Waxwing, 2.0; Eastern Towhee, 2.0; American Goldfinch, 2.0; Bobolink, 1.5; American Woodcock, 1.0; Savannah Sparrow, 1.0; Indigo Bunting, 1.0; Red-winged Blackbird, 1.0; Brown-headed Cowbird, 1.0; Red-breasted Nuthatch, 0.5; Common Yellowthroat, 0.5; Grasshopper Sparrow, 0.5. **Total:** 21 species; 74.0 territories (277/40 ha). **Visitors:** Black-billed Cuckoo, Ruby-throated Hummingbird, Yellow-bellied Sapsucker, Northern Flicker, Red-eyed Vireo, American Crow, Black-capped Chickadee, Gray Catbird, Brown Thrasher, Chestnut-sided Warbler. **Remarks:** The number of territories (74.0) was above the mean (67.1), but it was lower than in any of the previous eight years. Red-breasted Nuthatch was a new species for the study plot. Brown Thrasher was missing (except as a visitor) after having been recorded on the study plot in 15 of the past 20 years; and Prairie Warbler was missing after being present in 11 of the past 20 years. No nests were found parasitized by cowbirds. **Acknowledgments:** Appreciation to Rick Walker and Dennis Smith for weather data and to Tom and Kathy Kent for their continued interest and permission to conduct the study on their land.

9. CLIMAX HEMLOCK–WHITE PINE FOREST WITH TRANSITION HARDWOODS
BOSQUE CLIMAX DE PICEA–PINO BLANCO EN TRANSICION A MADERAS DURAS

DAVID ROSGEN
White Memorial Conservation Center
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Litchfield CT 06759

Site Number: CT2765008. **Location:** Connecticut; Litchfield Co.; Litchfield; White Memorial Foundation–Catlin Woods; 41°43'N, 73°12'W; Litchfield Quadrangle, USGS. **Continuity:** Established 1965; 41 yr. **Size:** 10.5 ha. **Description of Plot:** See *Aud. Field Notes* 19:594–595 (1965), *J. Field Ornithol.* 67(Suppl.):60 (1996), and *Bird Populations* 8:129–130 (2007). Succession is continuing in areas that experienced blow-downs in past years. **Weather:** Mean start temp., 24.4°C (range 18–32°C). Overall, the weather during May, June, and July was pretty nice in northwest Connecticut. It was very conducive to vegetation growth, and it helped produce an abundance of seeds, nuts, berries, and insects as the season progressed. Rainfall was below average in

May, with 11 wet days producing a total of only 4.4 cm of rain. The number of wet days remained the same in June, but 8.6 cm of rain fell. That's a little below average. In July, there were 12 wet days that produced a total of 15.5 cm of rain. That's a little above average. May's mean temperature was 14.7°C, which is a little below average. The mean temperature in June was 18.6°C, which is close to average. In July, the mean temperature was 20.4°C, which is a little below average. **Source:** White Memorial Foundation's own weather station. **Coverage:** 24.0 h; 12 visits (0 sunrise, 9 sunset); 7, 15, 24, 31 May; 7, 14, 21 June; 2, 10, 17, 24, 31 July; 2007. Maximum number of observers/visit, 3. **Census:** Veery, 14.5 (55; 1N,16FL); Ovenbird, 13.5 (51; 5N,24FL); Black-throated Green Warbler, 9.5 (36; 2N,15FL); Red-eyed Vireo, 8.5 (32; 1N,8FL); Hermit Thrush, 7.5 (29; 9FL); Blackburnian Warbler, 4.5 (17; 3FL); Wood Thrush, 4.0 (15; 6FL); Black-capped Chickadee, 3.5 (13; 21FL); Pine Warbler, 3.5 (5FL); Scarlet Tanager, 3.5 (4FL); Eastern Wood-Pewee, 2.5 (3FL); Blue-headed Vireo, 2.5 (2FL); Mourning Dove, 2.0 (4FL); Great Crested Flycatcher, 2.0 (1N,4FL); Blue Jay, 2.0 (3FL); American Robin, 2.0 (1N,9FL); Yellow-rumped Warbler, 2.0 (1N,7FL); Northern Cardinal, 2.0 (1N,8FL); Yellow-bellied Sapsucker, 1.5; American Crow, 1.5 (1N,6FL); Tufted Titmouse, 1.5 (7FL); Brown Creeper, 1.5 (4FL); Gray Catbird, 1.5 (1N,5FL); Purple Finch, 1.5 (1N,3FL); Downy Woodpecker, 1.0 (2FL); Pileated Woodpecker, 1.0 (1N,2FL); Eastern Phoebe, 1.0 (1N,5FL); White-breasted Nuthatch, 1.0 (5FL); Black-and-white Warbler, 1.0 (3FL); Chipping Sparrow, 1.0; Wild Turkey, 0.5; Great Horned Owl, 0.5 (2FL); Hairy Woodpecker, 0.5; Yellow Warbler, 0.5 (3FL); Common Yellowthroat, 0.5 (2FL); Song Sparrow, 0.5 (3FL); Rose-breasted Grosbeak, 0.5; Brown-headed Cowbird, 0.5 (2FL); American Goldfinch, 0.5; Eastern Kingbird, +; Red-breasted Nuthatch, +; Magnolia Warbler, +; American Redstart, +; Northern Waterthrush, +; Canada Warbler, +; Baltimore Oriole, +. **Total:** 46 species; 109.0 territories (415/40 ha). **Visitors:** Ruby-throated Hummingbird, Cedar Waxwing, House Finch. **Remarks:** The number of species found breeding in the plot increased to 46 this year (up from 42 last year and 36 the year before). The 10-year average is 42 species. Species found here this year but not last year included Eastern Kingbird, Yellow and Magnolia warblers, Song Sparrow, Rose-breasted Grosbeak, Baltimore Oriole, and American Goldfinch. It seems as if more edge species are finding their way into this plot. Red-tailed Hawk, Barred Owl, and Northern Flicker were found here last year but not this year. The number of territories found in the plot increased to 109.0 this year. Last year, 100.0 were counted here. The 10-year average is 120.0 territories. Veery remained the most abundant species in the plot this year, and its numbers were unchanged from last year. Ovenbird remained the second most abundant species even though it increased by 1.0 territory. Black-throated Green Warbler remained the third most abundant species even though it declined by 1.0 territory. **Other Observers:** John Eykelhoff, Mary Gendron, Lukas Hyder, Candace Kalmick, Caitlin MacGinitie, Russ Naylor, Margaret Sellers, and Bob Stanowski.

10. YOUNG MIXED HARDWOOD–CONIFER STAND

BOSQUE JOVEN–MIXTO DE MADERAS DURAS/RODAL DE CONIFEROS

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Site Number: CT2778262. **Location:** Connecticut; Litchfield Co.; Morris; White Memorial Foundation–Pitch Road; 41°42'N, 73°10'W; Litchfield Quadrangle, USGS. **Continuity:** Established 1978; 30 yr. **Size:** 8.5 ha. **Description of Plot:** See *Am. Birds* 33:72 (1979). ATVs, dirt bikes, and 4x4 trucks have destroyed even more of this plot despite our constant battle to keep them out. Erosion of the roads and trail surrounding the plot, and the resultant siltation of the brook that flows through it, are getting much worse. **Weather:** Mean start temp., 21.4°C (range 12–29°C). Overall, the weather during May, June, and July was pretty nice in northwest Connecticut. It was very conducive to vegetation growth, and it helped produce an abundance of seeds, nuts, berries, and insects as the season progressed. Rainfall was below average in May, with 11 wet days producing a total of only 4.4 cm of rain. The number of wet days remained the same in June, but 8.6 cm of rain fell. That's a little below average. In July, there were 12 wet days that produced a total of 15.5 cm of rain. That's a little above average. May's mean temperature was 14.7°C, which is a little below average. The mean temperature in June was 18.6°C, which is close to average. In July, the mean temperature was 20.4°C, which is a little below average. **Source:** White Memorial Foundation's own weather station. **Coverage:** 16.0 h; 8 visits (1 sunrise, 5 sunset); 21, 29 May; 10, 19, 30 June; 7, 20, 30 July; 2007. **Census:** Veery, 11.0 (52; 10FL); Ovenbird, 10.0 (47; 6FL); Red-eyed Vireo, 9.5 (45; 1N,6FL); Gray Catbird, 3.5 (16; 1N,8FL); Scarlet Tanager, 3.5 (6FL); Yellow-bellied Sapsucker, 2.5 (1N,6FL); Wood Thrush, 2.5 (3FL); Eastern Wood-Pewee, 2.0; Black-capped Chickadee, 2.0 (10FL); Tufted Titmouse, 2.0 (9FL); American Robin, 2.0 (4FL); Hermit Thrush, 1.5 (2FL); Mourning Dove, 1.0; Eastern Phoebe, 1.0 (1N,2FL); Great Crested Flycatcher, 1.0; White-breasted Nuthatch, 1.0 (3FL); Black-throated Blue

Warbler, 1.0; Black-and-white Warbler, 1.0; American Redstart, 1.0; Common Yellowthroat, 1.0; Chipping Sparrow, 1.0 (3FL); American Goldfinch, 1.0; Red-bellied Woodpecker, 0.5; Downy Woodpecker, 0.5; Hairy Woodpecker, 0.5; Pileated Woodpecker, 0.5; Blue-headed Vireo, 0.5; Blue Jay, 0.5; American Crow, 0.5; Black-throated Green Warbler, 0.5; Blackburnian Warbler, 0.5; Louisiana Waterthrush, 0.5; Northern Cardinal, 0.5; Rose-breasted Grosbeak, 0.5; Brown-headed Cowbird, 0.5; Purple Finch, 0.5 (1N); Cooper's Hawk, +; Barred Owl, +; Blue-gray Gnatcatcher, +; Chestnut-sided Warbler, +; Pine Warbler, +. **Total:** 41 species; 69.0 territories (325/40 ha). **Visitors:** Least Flycatcher, Yellow-throated Vireo, Yellow-rumped Warbler, Canada Warbler, Eastern Towhee, Baltimore Oriole. **Remarks:** It was another terrible year for birds attempting to breed in this plot. Frequent harassment from the above-mentioned vehicles, coupled with the resultant habitat destruction, was the primary problem. Amazingly, the number of species displaying breeding evidence rebounded to 41 this year. Last year, only 35 species were found here. The 10-year average is 43 species. Species found here this year but not last year included Cooper's Hawk, Barred Owl, Blue-headed Vireo, Chestnut-sided, Black-throated Green, and Pine warblers, Chipping Sparrow, Brown-headed Cowbird, and Purple Finch. Wild Turkey, Great Horned Owl, Cedar Waxwing, and Song Sparrow were found here last year but not this year. The number of territories found here this year increased very slightly to 69.0 (from 68.5 last year). The 10-year average is 82.0 territories. The most abundant species again this year was Veery. Ovenbird remained the second most abundant species. **Other Observers:** Russ Naylor and Susan Spencer.

11. RIPARIAN WOODLAND

ARBOLADO RIVEREÑO

SCOTT R. ROBINSON
Bureau of Land Management
3815 N. Schreiber Way
Coeur d'Alene ID 83815

Location: Idaho; Kootenai Co.; Coeur d'Alene; Blackwell Island; 47°41'N, 116°48'W; Coeur d'Alene Quadrangle, USGS. **Continuity:** Established 1997; 11 yr. **Size:** 8.9 ha. **Description of Plot:** See 1997 BBC report (unpublished) and *Bird Populations* 7:106 (2006) and 7:123 (2006). **Weather:** Mean start temp., 9.3°C (range 4–17°C). The weather was about normal. No flooding since last reported in 2002. **Coverage:** 12.1 h; 8 visits (8 sunrise); 3, 10 May; 4, 8, 13, 19, 26 June; 3 July; 2007. **Census:** American Robin, 6.5 (29); Red-winged Blackbird, 5.0 (22); Tree Swallow, 3.0 (13); Black-capped Chickadee, 3.0; Brown-headed Cowbird, 3.0; Gray Catbird, 2.0; European Starling, 2.0; Yellow Warbler, 2.0; Yellow-rumped Warbler, 2.0; Song Sparrow, 2.0; Mallard, 1.5 (1N,6FL); Wood Duck, 1.0; Rufous Hummingbird, 1.0; Downy Woodpecker, 1.0; Northern Flicker, 1.0; Western Wood-Pewee, 1.0; Cedar Waxwing, 1.0; Bullock's Oriole, 1.0. **Total:** 18 species; 39.0 territories (175/40 ha). **Visitors:** Canada Goose, California Quail, Ring-necked Pheasant, Great Blue Heron, Osprey, Bald Eagle, Spotted Sandpiper, Ring-billed Gull, Rock Pigeon, Cordilleran Flycatcher, American Crow, Violet-green Swallow, Red-breasted Nuthatch, Hermit Thrush, Nashville Warbler, Spotted Towhee, Chipping Sparrow, Black-headed Grosbeak, House Finch.

12. UPLAND MIXED PINE–SPRUCE–HARDWOOD PLANTATION

PLANTACION MIXTA DE PINO–ABETO–MADERAS DURAS EN ALTURAS

ELIZABETH W. BROOKS
5540 Jericho Hill Road
Alfred Station NY 14803

Site Number: NY2474107. **Location:** New York; Allegany Co., Ward; Phillips Creek State Reforestation Tract; 42°8'N, 77°45'W; Andover Quadrangle, USGS. **Continuity:** Established 1974; 34 yr. **Size:** 16.6 ha. **Description of Plot:** See *Am. Birds* 28:699–700 (1974), *J. Field Ornithol.* 63(Suppl.):79–80 (1992) and 66(Suppl.):79–80 (1995). **Weather:** Mean start temp., 15.9°C (range 10.0–24.4°C). See Upland Christmas Tree Farm BBC for additional weather details. **Coverage:** 17.4 h; 10 visits (1 sunrise, 2 sunset); 27 May; 3, 10, 17, 24 June; 1, 8, 15, 22, 29 July; 2007. **Census:** Dark-eyed Junco, 10.0 (24; 1N,4FL); Magnolia Warbler, 9.0 (22); Blackburnian Warbler, 9.0; Black-throated Green Warbler, 8.0 (19); Yellow-rumped Warbler, 5.5 (13); Golden-crowned Kinglet, 5.0 (12); Blue-headed Vireo, 4.0 (10); American Robin, 4.0; Blue Jay, 3.0 (7); Chestnut-sided Warbler, 3.0; Common Yellowthroat, 3.0; Purple Finch, 3.0; Chipping Sparrow, 2.5; Yellow-bellied Sapsucker, 2.0; Black-capped Chickadee, 2.0; Red-breasted Nuthatch, 2.0; Brown Creeper, 2.0; Mourning Warbler, 2.0; Red Crossbill, 2.0; Hermit Thrush, 1.5; Ovenbird, 1.5; Indigo Bunting, 1.5; Wild Turkey, 1.0; Cooper's Hawk, 1.0 (1N,2FL); Red-shouldered Hawk, 1.0 (1N); Ruby-throated Hummingbird, 1.0; Great Crested Flycatcher, 1.0; Winter Wren, 1.0; Wood Thrush, 1.0; Eastern Towhee, 1.0; Song Sparrow, 1.0; White-throated Sparrow, 1.0; Brown-headed Cowbird, 1.0; American Goldfinch, 1.0; American Crow, 0.5. **Total:** 35 species; 98.0 territories, (236/40 ha). **Visitors:** Mourning Dove, Barred Owl, Eastern Kingbird, Red-eyed Vireo, Common Raven, Gray Catbird, Cedar Waxwing, Pine Warbler, Hooded Warbler, Common Grackle.

Remarks: The total number of territories (98.0) was well above the 33-year average (86.4). There were two new species recorded on the study plot (Ruby-throated Hummingbird and American Goldfinch). Chestnut-sided Warbler had the highest number of territorial males ever; Broad-winged Hawk was missing after being reported in 11 of the past 17 years. **Acknowledgments:** Appreciation to Rick Walker and Dennis Smith for weather data.

13. RIPARIAN SCRUB
MATORRAL RIBEREÑO

JILL COUMOUTSO
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Chino CA 91708

Location: California; Riverside Co.; Norco; Norco Burn; 33°57'29"N, 117°31'56"W; Corona North Quadrangle, USGS. **Continuity:** Established 2006; 2 yr. **Size:** 14.6 ha. **Description of Plot:** See *Bird Populations* 9:192 (2009). **Weather:** Mean start temp., 18.2°C (range 13.5–29°C). Temperatures were mild, as typical for southern California's Mediterranean climate. **Source:** a Kestrel 3000 was used to measure temperature and wind speed. **Coverage:** 18.4 h; 8 visits (0 sunrise, 0 sunset); 16 March; 4, 10, 18 April; 10, 18 May; 15 June; 12 July; 2007. **Census:** Song Sparrow, 11.0 (30); Anna's Hummingbird, 9.0 (25; 5N); House Wren, 8.0 (22; 2N); Spotted Towhee, 8.0; Mourning Dove, 7.0 (19); Least Bell's Vireo, 7.0 (5N,10FL); Black-headed Grosbeak, 6.0 (16; 3N); Lesser Goldfinch, 4.0 (11); Yellow-breasted Chat, 3.0 (8; 1FL); Cooper's Hawk, 2.0; Northern Flicker, 2.0; Common Yellowthroat, 2.0; Red-tailed Hawk, 1.0; Black-chinned Hummingbird, 1.0; Nuttall's Woodpecker, 1.0; Downy Woodpecker, 1.0; Bushtit, 1.0; Bewick's Wren, 1.0; Yellow Warbler, 1.0; California Towhee, 1.0; Brown-headed Cowbird, 1.0. **Total:** 21 species; 78.0 territories (214/40 ha). **Visitors:** Mallard, Osprey, White-tailed Kite, Common Ground-Dove, Western Wood-Pewee, Willow Flycatcher, Pacific-slope Flycatcher, Black Phoebe, Ash-throated Flycatcher, Cassin's Kingbird, Western Kingbird, Western Scrub-Jay, Western Bluebird, Phainopepla, Orange-crowned Warbler, Blue Grosbeak, Hooded Oriole, Bullock's Oriole, House Finch, American Goldfinch. **Remarks:** Song Sparrows were the most abundant breeders on site due to the presence of a dense understory. Anna's Hummingbirds were the second most abundant breeders. In addition to winter and breeding bird surveys, this site is currently being monitored for the nests of the endangered Least Bell's Vireo. Other species of concern that bred on the plot include Yellow-breasted Chat. Species of concern that held territories on the plot include Yellow Warbler and Downy Woodpecker. This site continues to be treated for Arundo re-growth on a yearly basis. A Brown-headed Cowbird trap was present adjacent to the plot for the entire breeding season.

14. RIPARIAN SCRUB BASIN
CUENCA CON MATORRAL RIBEREÑO

MELODY AIMAR
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Chino CA 91708

Location: California; Riverside Co.; Riverside; Mockingbird Canyon; 33°53'33"N, 117°24'47"W; Riverside West Quadrangle, USGS. **Continuity:** Established 2004; 4 yr. **Size:** 12.7 ha. **Description of Plot:** See *Bird Populations* 8:142–143 (2007). **Weather:** Mean start temp., 18.3°C (range 14–22°C). Temperatures were mild, as is typical for southern California's Mediterranean climate. There was no precipitation during, or within 24 hours of, survey visits. One day was foggy. **Coverage:** 22.8 h; 8 visits (0 sunrise, 0 sunset); 3, 9, 16, 29 May; 6, 14, 19 June; 9 July; 2007. **Census:** Bewick's Wren, 12.0 (38); Spotted Towhee, 12.0 (1FL); Song Sparrow, 12.0; Anna's Hummingbird, 11.5 (36); California Towhee, 11.0 (35); House Finch, 9.0 (28; 3FL); Black-headed Grosbeak, 6.0 (19; 2FL); Phainopepla, 5.0 (16; 3FL); Hooded Oriole, 5.0; California Quail, 4.0 (13); Bushtit, 3.0 (9; 1N,4FL); Lesser Goldfinch, 3.0; California Thrasher, 2.5; Black-chinned Hummingbird, 2.0; Nuttall's Woodpecker, 2.0; Least Bell's Vireo, 2.0 (2FL); Western Scrub-Jay, 2.0; Yellow Warbler, 2.0; Mourning Dove, 1.0; Black Phoebe, 1.0 (1N,3FL); Common Yellowthroat, 1.0; Cooper's Hawk, 0.5; Red-tailed Hawk, 0.5; Barn Swallow, 0.5 (1N). **Total:** 24 species; 110.5 territories (348/40 ha). **Visitors:** Allen's Hummingbird, Northern Flicker, Pacific-slope Flycatcher, Western Kingbird, American Crow, House Wren, California Gnatcatcher, Wrentit, Orange-crowned Warbler, Yellow-breasted Chat, American Goldfinch. **Remarks:** Overall, numbers were much lower than in previous years. This area is suffering from severe drought; precipitation was lower in 2006–2007 than in recorded history. As a result, many birds may not have nested or were less active, reducing detectability. Last year's most abundant species, Song Sparrow (26.5 territories), was tied with Spotted Towhee and Bewick's Wren with 12.0 territories. This is the first year that the endangered Least Bell's Vireo occurred on-site. This population has increased from 9 to 22 in this canyon since 2002, probably due to intensive management by the Santa Ana Watershed Association. The Red-tailed Hawk pair did not reuse their nest this year, and a Cooper's Hawk nested just off-site. **Other Observers:** Nicole Peltier and Sue Hoffman. **Acknowledgments:** We would like to thank Gage Canal for site access.

15. STREAMSIDE RIPARIAN WOODLAND I

BOSQUE RIBEREÑO I

TERRY REESER
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Location: California; Orange Co.; Yorba Linda; Featherly Regional Park; 33°52'24"N, 117°42'23"W; Black Star Canyon and Prado Dam Quadrangles, USGS. **Continuity:** Established 2004; 4 yr. **Size:** 17.8 ha. **Description of Plot:** See *Bird Populations* 8:143–144 (2007). **Weather:** Mean start temp., 19.9°C (range 15–23°C). Temperatures were mild, as typical for southern California's Mediterranean climate. **Source:** weather data were obtained by using a Kestrel 3000 weather meter. **Coverage:** 30.7 h; 6 visits (0 sunrise, 0 sunset); 26 March; 4, 18 April; 31 May; 21 June; 12 July; 2007. **Census:** Song Sparrow, 22.0 (49); Least Bell's Vireo, 9.5 (21; 6N,5FL); Bewick's Wren, 9.5; Common Yellowthroat, 9.5; Spotted Towhee, 9.5; Yellow Warbler, 9.0 (20); Anna's Hummingbird, 8.0 (18); House Wren, 6.0 (13); Black Phoebe, 4.0 (9); California Towhee, 4.0; Nuttall's Woodpecker, 3.5 (8); Black-headed Grosbeak, 3.5; Yellow-breasted Chat, 3.0 (7; 1FL); Mallard, 2.0; Red-shouldered Hawk, 2.0; Mourning Dove, 2.0; Wrentit, 2.0; House Finch, 2.0 (1N,1FL); Cooper's Hawk, 1.5; Wood Duck, 1.0 (3FL); Ash-throated Flycatcher, 1.0; American Crow, 1.0; Hooded Oriole, 1.0; Lesser Goldfinch, 1.0 (1N); Wilson's Warbler, 0.5; Bullock's Oriole, 0.5. **Total:** 26 species; 118.5 territories (266/40 ha). **Visitors:** California Quail, Great Blue Heron, Great Egret, Snowy Egret, Black-crowned Night-Heron, White-tailed Kite, American Kestrel, American Coot, Black-chinned Hummingbird, Downy Woodpecker, Western Scrub-Jay, Northern Rough-winged Swallow, Bushtit, Northern Mockingbird, California Thrasher, Phainopepla, Orange-crowned Warbler, Red-winged Blackbird, American Goldfinch. **Remarks:** The breeding bird community includes riparian, coastal sage, and chaparral species. The endangered Least Bell's Vireo and California species of concern Yellow Warbler and Yellow-breasted Chat bred on the plot along with other species of concern such as Downy Woodpecker. The mature stands of cottonwood and black willow throughout the plot benefit many species observed including Yellow Warbler, Nuttall's Woodpecker, and Downy Woodpecker. I possibly over counted some species due to surveying only one side of the river, but I took this into account for some species. Nest monitoring for Least Bell's Vireo and winter bird surveys take place on the plot. **Acknowledgments:** I thank Harbors, Beaches, and Parks Resources and Development Department, County of Orange, for site access and its continuing logistical support.

16. STREAMSIDE RIPARIAN WOODLAND III

BOSQUE RIBEREÑO III

ALLYSON BECKMAN
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Location: California; Riverside Co.; Redlands; San Timoteo Canyon; 33°59'5"N, 117°7'45"W; Sunnymead Quadrangle, USGS. **Continuity:** Established 2004; 4 yr. **Size:** 12.3 ha. **Description of Plot:** See *Bird Populations* 8:144–145 (2007)) and 9:182–183 (2009). **Weather:** Mean start temp., 20.2°C (range 12–31°C). Temperatures were warm, as typical for southern California's Mediterranean climate. There was no precipitation during, or within 24 hours of, any survey visit. **Source:** weather data were obtained by using a Kestrel 3000 weather meter. **Coverage:** 24.2 h; 8 visits (2 sunrise, 0 sunset); 22 March; 13 April; 17 May; 6, 18, 22 June; 2, 6 July; 2007. **Census:** Song Sparrow, 15.0 (49); Bewick's Wren, 14.0 (46); Spotted Towhee, 13.0 (42); Northern Rough-winged Swallow, 12.0 (39); Mourning Dove, 11.0 (36); California Towhee, 11.0; Lesser Goldfinch, 9.0 (29); Bushtit, 7.0 (23); Common Yellowthroat, 6.0 (20); American Goldfinch, 6.0; Anna's Hummingbird, 5.0 (16); Least Bell's Vireo, 5.0 (6N,7FL); House Wren, 4.0 (13); Black-chinned Hummingbird, 3.0 (10); Nuttall's Woodpecker, 3.0; Black Phoebe, 3.0; Ash-throated Flycatcher, 3.0; Oak Titmouse, 3.0; Barn Owl, 2.0; Northern Flicker, 2.0; Phainopepla, 2.0; Yellow Warbler, 2.0; Yellow-breasted Chat, 2.0; House Finch, 2.0; Red-shouldered Hawk, 1.0; Downy Woodpecker, 1.0; American Crow, 1.0; Common Raven, 1.0; European Starling, 1.0; Black-headed Grosbeak, 1.0; Brown-headed Cowbird, 1.0; Red-tailed Hawk, 0.5; California Thrasher, 0.5; Blue Grosbeak, 0.5; Bullock's Oriole, 0.5. **Total:** 35 species; 154.0 territories (501/40 ha). **Visitors:** California Quail, White-tailed Kite, Cooper's Hawk, American Kestrel, Western Scrub-Jay, Northern Mockingbird, Red-winged Blackbird. **Remarks:** Thirty-five species bred on this plot. The plot has been undergoing passive restoration over the last six years after the removal of over 80 ha of invasive Arundo donax that choked the entire canyon. One endangered species, Least Bell's Vireo, bred on the plot. Nest monitoring for the Least Bell's Vireo and winter bird surveys are also done on this plot. **Acknowledgments:** Special thanks to the U.S. Army Corps of Engineers for providing funding for the surveys.

17. PITCH PINE–SLABROCK

AREA DE PINO RESINA

LYNN BOWDERY, TOM SARRO, LIN FAGAN, ALLAN BOWDERY & JOE CHERNEK

Daniel Smiley Research Center
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New Paltz NY 12561

Site Number: NY1392063. **Location:** New York; Ulster Co.; Gardiner; The Near Trapps; 41°44'0"N, 74°12'30"W; Gardiner Quadrangle, USGS. **Continuity:** Established 1992; 4 yr. **Size:** 15.8 ha. **Description of Plot:** See *J. Field Ornithol.* 64 (Suppl.):86–87 (1993) and *Bird Populations* 7:124 (2006). At the southern end of the plot, the hardwood overstory has grown older, and more red maples are getting tall. There are also some white pines attaining considerable size, possibly as a result of fire suppression and the impact of gypsy moth larvae on chestnut oaks. **Weather:** Mean start temp., 14.0°C (range 5–29°C). The average temperature for May was 2.3°C above the 111-year average, and the precipitation was 1.8 cm (the driest May on record). The average temperature for June was 2.1°C above the 111-year average (the sixth warmest June on record), and the precipitation was 7.6 cm (25% below average). **Source:** Mohonk Lake Cooperative Weather Station. **Coverage:** 30.6 h; 13 visits (12 sunrise, 1 sunset); 15, 22, 25, 28, 31 May; 5, 7, 11, 14, 18, 22, 26, 29 June; 2007. Maximum number of observers/visit, 8. **Census:** Chipping Sparrow, 12.0 (30); Prairie Warbler, 8.5 (22; 1FL); Black-and-white Warbler, 6.0 (15); Eastern Towhee, 4.5 (11); Indigo Bunting, 3.5 (9); Black-capped Chickadee, 3.0 (8); Pine Warbler, 3.0; Mourning Dove, 2.0; Red-eyed Vireo, 2.0; American Robin, 1.5; Great Crested Flycatcher, 1.0; Tufted Titmouse, 1.0; Cedar Waxwing, 1.0; Common Yellowthroat, 1.0; Dark-eyed Junco, 1.0; Scarlet Tanager, 1.0; Eastern Phoebe, 0.5; Blue Jay, 0.5; Worm-eating Warbler, 0.5; Yellow-billed Cuckoo, +; Black-billed Cuckoo, +; Barred Owl, +; Ruby-throated Hummingbird, +; Downy Woodpecker, +; Hairy Woodpecker, + (1FL); Northern Flicker, +; Blue-headed Vireo, +; Hermit Thrush, +; Wood Thrush, +; Yellow-rumped Warbler, +; Ovenbird, +; Hooded Warbler, +; Northern Cardinal, +; Baltimore Oriole, +; Purple Finch, +; American Goldfinch, +. **Total:** 36 species; 53.5 territories (135/40 ha). **Visitors:** Sharp-shinned Hawk, American Crow, Red-breasted Nuthatch, Winter Wren, Magnolia Warbler, Black-throated Green Warbler. **Remarks:** Compared to the 2002 census of this plot, we have been more liberal in giving infrequently sighted species "+" designations rather than listing them as visitors. **Other Observers:** John Thompson, Flo LaValle, Charlotte Gabrielsen, and Shanan Smiley. **Acknowledgments:** Thanks to the Mohonk Preserve for its cooperation.

18. FIELD, RIDGE, SHRUBBY TREES, AND WOODS

CAMPOS, COLINAS, ARBUSTOS Y BOSQUES

MICHAEL F. G. CLARK
101 Governor's Road, #708
Dundas ON L9H 6L7

Location: Ontario; Municipality of Hamilton-Wentworth; Dundas; Dundas Valley Plot #1; 43°15'N, 79°54'W. **Continuity:** Established 1994; 12 yr. **Size:** 5.8 ha. **Description of Plot:** See *J. Field Ornithol.* 60(Suppl.):14 (1989), 66(Suppl.):27–28 (1995), and 67(Suppl.):73–74 (1996). **Weather:** Mean start temp., 19.9°C (range 14–24°C). Precipitation was 12.8 cm below the norm over the study period. This marks the least rainfall for the last ten years for which there are records. Temperatures from May through July were at the 30-year norm. **Source:** Environment Canada. **Coverage:** 13.1 h; 8 visits (0 sunrise, 3 sunset); 2, 15 May; 9, 12, 30 June; 1, 7, 12 July; 2007. **Census:** Yellow Warbler, 27.0 (186); Gray Catbird, 22.0 (152); Song Sparrow, 8.0 (55; 1FL); Northern Cardinal, 8.0; Field Sparrow, 6.0 (41); American Goldfinch, 5.0 (34); Blue-winged Warbler, 4.0 (28); Indigo Bunting, 4.0; American Robin, 3.0 (21); Rose-breasted Grosbeak, 3.0; Great Crested Flycatcher, 2.0 (2FL); Blue Jay, 1.0; Black-capped Chickadee, 1.0; House Wren, 1.0. **Total:** 14 species; 95.0 territories (655/40 ha). **Visitors:** Cooper's Hawk, Mourning Dove, Yellow-billed Cuckoo, Downy Woodpecker, Northern Flicker, Red-eyed Vireo, White-breasted Nuthatch, Wood Thrush, Common Yellowthroat, Scarlet Tanager, Common Grackle, Brown-headed Cowbird. **Remarks:** Fewer insects, resulting from this year's excessive dryness, may have been responsible for the second lowest territorial males total recorded over 12 years on this revised plot. While the typically low numbers of breeding thrushes, mimids, and flycatchers were at or near their 12-year means, the two warbler species were 30% below the mean, there were no icterids, and the three top species (Yellow Warbler, Gray Catbird, and Song Sparrow) were 24% under average. Seedeaters (six species), at just 8% below the mean, likely took advantage of the rich herbal variety in open areas. The increased bushiness of hawthorns, dogwoods, etc., and increasing canopy in some areas may be contributing to the ongoing decline of breeding numbers for some species. The 14 breeding species were four species below the mean.

19. SHRUBBY SWAMP AND SEDGE HUMMOCKS

PANTANO ARBUSTIVO–MOGOTE

DAVID ROSGEN
White Memorial Conservation Center
P.O. Box 368
Litchfield CT 06759

Location: Connecticut; Litchfield Co.; Litchfield; White Memorial Foundation–North Shore Marsh; 41°43'N, 73°13'W; Litchfield Quadrangle, USGS. **Continuity:** Established 1965; 41 yr. **Size:** 8.1 ha. **Description of Plot:** See *Aud. Field Notes* 19:625–627 (1965) and *Bird Populations* 7:125–126 (2006). Three severe flooding events in the past year altered the vegetation in this wetland by killing or otherwise damaging some of the trees and reducing the amount of the herbaceous layer. The shrub cover, which continues to increase in surface area and density, was unaffected by the flooding. **Weather:** Mean start temp., 24.5°C (range 18–29°C). Overall, the weather during May, June, and July was pretty nice in northwest Connecticut. It was very conducive to vegetation growth, and it helped produce an abundance of seeds, nuts, berries, and insects as the season progressed. Rainfall was below average in May, with 11 wet days producing a total of only 4.4 cm of rain. The number of wet days remained the same in June, but 8.6 cm of rain fell. That's a little below average. In July, there were 12 wet days that produced a total of 15.5 cm of rain. That's a little above average. May's mean temperature was 14.7°C, which is a little below average. The mean temperature in June was 18.6°C, which is close to average. In July, the mean temperature was 20.4°C, which is a little below average. **Source:** White Memorial Foundation's own weather station. **Coverage:** 30.0 h; 12 visits (0 sunrise, 9 sunset); 3, 10, 22 May; 2, 9, 16, 28 June; 6, 12, 20, 26, 31 July; 2007. Maximum number of observers/ visit, 5. **Census:** Swamp Sparrow, 34.0 (168; 3N,61FL); Red-winged Blackbird, 31.0 (153; 3N,55FL); Yellow Warbler, 26.5 (131; 6N,54FL); Gray Catbird, 21.0 (104; 5N,45FL); Common Yellowthroat, 20.5 (101; 1N,27FL); Song Sparrow, 8.5 (42; 2N,17FL); American Goldfinch, 7.5 (37; 1N,9FL); Common Grackle, 6.5 (32; 2N,20FL); Veery, 6.0 (30; 12FL); Tree Swallow, 5.5 (27; 5N,28FL); Eastern Kingbird, 4.0 (20; 3N,10FL); Cedar Waxwing, 4.0 (1N,9FL); Warbling Vireo, 3.5 (17; 1N,6FL); Black-capped Chickadee, 3.5 (2N,18FL); Tufted Titmouse, 3.5 (16FL); American Robin, 3.5 (2N,15FL); Baltimore Oriole, 3.0 (15; 1N,7FL); Blue-gray Gnatcatcher, 2.5 (2N,6FL); Northern Cardinal, 2.5 (8FL); Willow Flycatcher, 2.0 (2FL); Least Flycatcher, 2.0 (1N,5FL); Downy Woodpecker, 1.5 (1N,6FL); Eastern Wood-Pewee, 1.5 (2FL); Northern Waterthrush, 1.5 (2FL); Mourning Dove, 1.0 (1FL); Northern Flicker, 1.0 (2FL); Great Crested Flycatcher, 1.0; Yellow-throated Vireo, 1.0; Red-eyed Vireo, 1.0; White-breasted Nuthatch, 1.0 (6FL); Black-and-white Warbler, 1.0 (3FL); American Redstart, 1.0 (3FL); Canada Goose, 0.5 (4FL); Wood Duck, 0.5 (4FL); Great Blue Heron, 0.5; Spotted Sandpiper, 0.5 (2FL); Red-bellied Woodpecker, 0.5; Hairy Woodpecker, 0.5 (3FL); Alder Flycatcher, 0.5; Chestnut-sided Warbler, 0.5; Rose-breasted Grosbeak, 0.5; Brown-headed Cowbird, 0.5 (1FL); Yellow-bellied Sapsucker, +; Ovenbird, +; Purple Finch, +. **Total:** 45 species; 218.5 territories (1079/40 ha). **Visitors:** Mallard, Osprey, American Woodcock, Ruby-throated Hummingbird, House Wren, Scarlet Tanager. **Remarks:** Despite a few cold nights in May, most of this year's breeding season was characterized by nearly ideal weather conditions. Consequently, most birds did very well in fledging young (a total of 469 in this plot). The number of species recorded this year decreased to 45 (from 52 last year). This may have been due to habitat damaged by earlier floods. The previous 10-year average was 43 species. The only species found this year but not last year were Wood Duck and Ovenbird. The number of territories found here this year increased to 218.5. That's the second highest total ever, and it is well above the 10-year average of 189.5. It is 14.5 territories more than were tallied here last year. Swamp Sparrow was the most abundant species here this year, with Red-winged Blackbird in second place. **Other Observers:** Lorraine Amalavage, John Eykelhoff, Mary Gendron, Lukas Hyder, Daren Jacklin, Caitlin MacGinitie, Bill O'Day, John Shugrue, Bob Stanowski, and Terry Weaver.

20. COASTAL SCRUB

MATORRAL COSTANERO

JONATHAN GUNTHER & SCOTT JENNINGS
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Petaluma CA 94954

Location: California; Marin Co.; Bolinas; Palomarin Field Station; 37°55'N, 122°45'W; Bolinas Quadrangle, USGS. **Continuity:** Established 1971; 33 yr. **Size:** 8.1 ha. **Description of Plot:** See *Am. Birds* 25:1003–1004 (1971). Succession from coastal scrub to Douglas-fir (Pseudotsuga menziesii) forest continues on the plot. This process occurs relatively uniformly across the entire plot. **Weather:** Mean start temp., 13.0°C (range 8–23°C). The bioyear rainfall total (1 July 2006–30 June 2007) was 595.7 mm. The 1976–2007 mean bioyear rainfall was 869.2 mm. The breeding season rainfall (1 April–31 July) was 79.5 mm. **Coverage:** 168.9 h; 57 visits (12 sunrise, 0 sunset). 2007. **Census:** Wrentit, 9.5 (47; 9N,28FL); Bewick's Wren, 6.0 (30); Wilson's Warbler, 4.5 (22); Spotted Towhee, 3.5 (17; 4N,7FL); Orange-crowned Warbler, 3.0 (15); Anna's Hummingbird, 2.5; Swainson's Thrush, 2.5; Bushtit, 2.0; Purple Finch, 1.5; Hutton's Vireo, 1.0; Chestnut-backed Chickadee, 1.0; White-crowned Sparrow, 1.0 (1N,4FL); Steller's Jay, 0.5; American Robin, 0.5; Dark-eyed Junco, 0.5; Red-tailed Hawk, +; Northern Flicker,

+; Western Scrub-Jay, + (1N,3FL); Golden-crowned Kinglet, +; Song Sparrow, +. **Total:** 20 species; 39.5 territories (195/40 ha). **Visitors:** None listed. **Remarks:** The total number of territories (39.5) was down 8% from 2006 (43.0). Minor declines in the densities of several species were responsible for the overall decline, which was observed despite some notable increases in a couple of species. Wilson's Warbler increased from 1.5 to 4.5 territories, and Swainson's Thrush increased from 1.0 to 2.5 territories. Band-tailed Pigeon and Mourning Dove were present in 2006 but not in 2007. **Acknowledgments:** We thank the Point Reyes National Seashore for their cooperation. This is PRBO contribution No. 1758.

21. DISTURBED COASTAL SCRUB A

MATORRAL PERTURBADO A

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Location: California; Marin Co.; Bolinas; Palomarin Field Station; 37°55'N, 122°45'W; Bolinas Quadrangle, USGS. **Continuity:** Established 1972; 33 yr. **Size:** 4.7 ha. **Description of Plot:** See *Am. Birds* 26:987–988 (1972). Succession from coastal scrub to Douglas-fir (Pseudotsuga menziesii) forest continues across most areas of the plot. Forest is progressing across the plot roughly from northeast to southwest. **Weather:** Mean start temp., 13.0°C (range 8–23°C). The bioyear rainfall total (1 July 2006–30 June 2007) was 595.7 mm. The 1976–2007 mean bioyear rainfall was 869.2 mm. The breeding season rainfall (1 April–31 July) was 79.5 mm. **Coverage:** 216.0 h; 80 visits (32 sunrise, 0 sunset). 2007. **Census:** Wrentit, 7.5 (64; 11N,28FL); Song Sparrow, 4.0 (34; 5N,12FL); Bewick's Wren, 3.0 (26); Wilson's Warbler, 3.0; Spotted Towhee, 3.0 (3N,4FL); Anna's Hummingbird, 2.5; Swainson's Thrush, 2.0; California Quail, 1.5; Orange-crowned Warbler, 1.5; Purple Finch, 1.5; American Goldfinch, 1.5 (1N); Allen's Hummingbird, 1.0; Steller's Jay, 1.0; Chestnut-backed Chickadee, 1.0; Golden-crowned Kinglet, 1.0; Band-tailed Pigeon, 0.5; Mourning Dove, 0.5; Northern Flicker, 0.5; Hutton's Vireo, 0.5; Bushtit, 0.5; American Robin, 0.5; Red-tailed Hawk, +; Downy Woodpecker, +; Pacific-slope Flycatcher, +; Warbling Vireo, +; Western Scrub-Jay, +; Dark-eyed Junco, +; Brown-headed Cowbird, +. **Total:** 28 species; 38.0 territories (323/40 ha). **Visitors:** None listed. **Remarks:** Two observers worked separately to monitor the plot this year. Total visits and number of hours spent censusing were summed for both observers, thus these numbers are higher than in recent years. The total number of territories increased 17% from 32.5 in 2006 to 38.0 this year. This increase appears to be the result of minor increases in the densities of the majority of species present on the plot; no species showed a large change in density. European Starling, California Towhee, and House Finch were observed in 2006 but not in 2007. None of these species showed numbers greater than 0.5 territories in 2006, however. **Acknowledgments:** We thank the Point Reyes National Seashore for their cooperation. This is PRBO contribution No. 1756.

22. DISTURBED COASTAL SCRUB B

MATORRAL PERTURBADO B

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Location: California; Marin Co.; Bolinas; Palomarin Field Station; 37°55'N, 122°46'W; Bolinas Quadrangle, USGS. **Continuity:** Established 1971; 33 yr. **Size:** 8.1 ha. **Description of Plot:** See *Am. Birds* 25:1002–1003 (1971) and *J. Field Ornithol.* 66(Suppl.):104 (1995). The plant community continues to change from coastal scrub to Douglas-fir (Pseudotsuga menziesii) forest. This succession is progressing generally from east to west across the plot. The western portion of the plot is largely coastal scrub with isolated stands of trees; the eastern portion is primarily dense fir forest ranging from 6–10 m high with scattered patches of grass and coastal scrub. **Weather:** Mean start temp., 13.0°C (range 8–23°C). The bioyear rainfall total (1 July 2006–30 June 2007) was 595.7 mm. The 1976–2007 mean bioyear rainfall was 869.2 mm. The breeding season rainfall (1 April–31 July) was 79.5 mm. **Coverage:** 152.2 h; 64 visits (16 sunrise, 0 sunset). 2007. **Census:** Wrentit, 8.0 (40; 5N,5FL); Song Sparrow, 7.5 (37; 7N,21FL); Swainson's Thrush, 4.5 (22); Winter Wren, 4.0 (20); Wilson's Warbler, 4.0; Bewick's Wren, 2.5; American Goldfinch, 2.5 (7N); Anna's Hummingbird, 2.0; Orange-crowned Warbler, 2.0; Purple Finch, 2.0; Spotted Towhee, 1.5; Hutton's Vireo, 0.5; Western Scrub-Jay, 0.5; Chestnut-backed Chickadee, 0.5; Bushtit, 0.5; American Robin, 0.5; Red-tailed Hawk, +; Mourning Dove, +; Northern Flicker, +; Warbling Vireo, +; Steller's Jay, +; Golden-crowned Kinglet, +; California Towhee, +; Brown-headed Cowbird, +. **Total:** 24 species; 43.0 territories (212/40 ha). **Visitors:** None listed. **Remarks:** The total number of territories decreased 18% from 52.5 in 2006 to 43.0 this year. The majority of species showed moderate decreases in density of 20–50%. Wilson's Warbler and Swainson's Thrush both increased in density, however, and Western Scrub-Jay and Anna's Hummingbird remained constant. California Quail, Olive-sided Flycatcher, and Allen's Hummingbird were present in 2006 but not in 2007. **Acknowledgments:** We thank the Point Reyes National Seashore for their cooperation. This is PRBO contribution No. 1757.

Bird Populations 10:125-135

BREEDING BIRD CENSUS: 2008

1. MIXED HARDWOOD POLETIMBER
BOSQUE MIXTO MADERERO

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P.O. Box 368
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Site Number: CT1265009. **Location:** Connecticut; Litchfield Co.; Litchfield; White Memorial Foundation–Wheeler Hill; 41°42'N, 73°13'W; Litchfield Quadrangle, USGS. **Continuity:** Established 1965; 43 yr. **Size:** 8.5 ha. **Description of Plot:** See *Aud. Field Notes* 19:609–610 (1965), *J. Field Ornithol.* 64(Suppl.):36 (1993), and *Bird Populations* 8:125 (2007). Non-native shrubs and vines are continuing to take over this plot, and over-browsing of native vegetation by white-tailed deer was very evident again this year. **Weather:** Mean start temp., 22.0°C (range 17–27°C). The weather throughout all of 2008 was much wetter than normal in Connecticut. The months of May and June saw more wet days than dry ones. It was very conducive to vegetation growth, and it helped produce an abundance of seeds, berries, and insects as the season progressed. Rainfall was above average in May with 17 wet days producing a total of 8.4 cm of rain. The number of wet days decreased slightly in June to 16, but the amount of precipitation increased significantly to 14.3 cm. That's well-above average. In July, there were 13 wet days that produced a total of 15.4 cm of rain. That's a little above average. May's mean temperature was 12.3°C, which is a little below average. The mean temperature in June was 19.3°C, which is close to average. In July, the mean temperature was 21.9°C, which is close to average. **Source:** White Memorial Foundation's weather station. **Coverage:** 22.0 h; 10 visits (0 sunrise, 4 sunset); 8, 21, 30 May; 12, 19, 30 June; 11, 18, 25, 31 July; 2008. Maximum number of observers/visit, 3. **Census:** Veery, 14.0 (66; 6FL); Gray Catbird, 13.5 (64; 5N,21FL); Ovenbird, 13.0 (61; 1N,11FL); Red-eyed Vireo, 12.5 (59; 1N,7FL); Common Yellowthroat, 10.0 (47; 10FL); American Redstart, 9.0 (42; 3N,19FL); Eastern Towhee, 9.0 (11FL); Wood Thrush, 4.5 (21; 2FL); Northern Cardinal, 4.5 (1N,10FL); Chestnut-sided Warbler, 4.0 (19; 8FL); Black-capped Chickadee, 3.5 (16; 1N,10FL); Tufted Titmouse, 3.5 (16FL); Yellow Warbler, 3.5 (2N,9FL); American Robin, 3.0 (14; 2N,9FL); Black-and-white Warbler, 2.5 (3FL); Scarlet Tanager, 2.0; Common Grackle, 2.0 (2N,8FL); Baltimore Oriole, 2.0 (1N,5FL); American Goldfinch, 2.0 (2FL); Eastern Wood-Pewee, 1.5; Blue Jay, 1.5 (1FL); American Crow, 1.5 (2FL); Cedar Waxwing, 1.5 (2FL); Mourning Dove, 1.0 (2FL); Downy Woodpecker, 1.0 (3FL); White-breasted Nuthatch, 1.0 (5FL); House Wren, 1.0 (1N,4FL); Chipping Sparrow, 1.0 (3FL); Song Sparrow, 1.0 (1N,4FL); Rose-breasted Grosbeak, 1.0 (1FL); House Finch, 1.0 (2FL); Wild Turkey, 0.5; Ruby-throated Hummingbird, 0.5; Red-bellied Woodpecker, 0.5 (2FL); Great Crested Flycatcher, 0.5; Blue-winged Warbler, 0.5; Red-winged Blackbird, 0.5; Barred Owl, +; Yellow-bellied Sapsucker, +; Hairy Woodpecker, +; Northern Flicker, +; Least Flycatcher, +; Eastern Kingbird, +; Yellow-throated Vireo, +; Warbling Vireo, +; Brown-headed Cowbird, +; Purple Finch, +. **Total:** 47 species; 135.0 territories (635/40 ha). **Visitors:** Pileated Woodpecker. **Remarks:** The number of species exhibiting breeding evidence in this plot decreased to 47 this year, from 48 last year, 50 in 2006, and 51 in 2005. This year's number, however, is on par with the average of the previous 10 years. The total number of territories decreased to 135.0 this year. Last year, 141.0 were tallied here. The year before we found 132.0, and in 2005 we found 124.5. The average of the previous 10 years is 119.5 territories, so 2008 remained well-above average. Every year since 2000 has produced more than 108 territories. The most abundant species this year was Veery with 14.0 territories. Last year, they were the second most abundant species but had 14.5 territories. In 2006, they were also in second place with 12.0 territories. The second most abundant species this year was Gray Catbird with 13.5 territories. Last year, they were the most abundant species with 15.5 territories. In 2006, they were the fourth most abundant species with 11.0 territories. Ovenbird has been the third most abundant species here for the past few years, and this year was no exception with 13.0 territories. Last year, it had 13.5, and in 2006, it had 11.5 territories. The recent population fluctuations of these three species are not significant, and they can be considered relatively stable. Least Flycatcher and Chipping Sparrow were found this year but not last year. Species found last year but not this year included Pileated Woodpecker (one-time visitor this year), Eastern Phoebe, and Blue-

gray Gnatcatcher. Nesting success wasn't as good this year as it was last year or the year before. This year, we observed at least 198 fledglings from 30 different species. Last year, we counted 234 fledglings from 28 species. In 2006, we tallied 207 fledglings from 24 species. The most productive species this year were Gray Catbird, American Redstart, and Tufted Titmouse. **Other Observers:** Nathan Cyrus, John Eykelhoff and John Grabowski.

2. SECOND-GROWTH HARDWOOD FOREST
BOSQUE SECUNDARIO DE MADERAS DURAS

DAVID ROSGEN
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Site Number: CT2765006. **Location:** Connecticut; Litchfield Co.; Morris; White Memorial Foundation–Van Winkle Road; 41°42'N, 73°12'W; Litchfield Quadrangle, USGS. **Continuity:** Established 1965; 42 yr. **Size:** 10.1 ha. **Description of Plot:** See *Aud. Field Notes* 19:590–591 (1965), *J. Field Ornithol.* 64(Suppl.):37–38 (1993), and *Bird Populations* 8:126 (2007). **Weather:** Mean start temp., 21.9°C (range 17–26°C). The weather throughout all of 2008 was much wetter than normal in Connecticut. The months of May and June saw more wet days than dry ones. It was very conducive to vegetation growth, and it helped produce an abundance of seeds, berries, and insects as the season progressed. Rainfall was above average in May with 17 wet days producing a total of 8.4 cm of rain. The number of wet days decreased slightly in June to 16, but the amount of precipitation increased significantly to 14.3 cm. That's well-above average. In July, there were 13 wet days that produced a total of 15.4 cm of rain. That's a little above average. May's mean temperature was 12.3°C, which is a little below average. The mean temperature in June was 19.3°C, which is close to average. In July, the mean temperature was 21.9°C, which is close to average. **Source:** White Memorial Foundation's weather station. **Coverage:** 22.0 h; 10 visits (0 sunrise, 6 sunset); 15, 22, 29 May; 9, 17, 25 June; 5, 15, 25, 31 July; 2008. **Census:** Veery, 17.5 (69; 8FL); Ovenbird, 15.5 (61; 13FL); Red-eyed Vireo, 15.0 (59; 3N,13FL); Wood Thrush, 5.0 (20; 4FL); Scarlet Tanager, 4.0 (16; 1N,1FL); Eastern Wood-Pewee, 3.5 (14; 4FL); American Robin, 3.5 (3N,12FL); Gray Catbird, 3.5 (1N,8FL); Yellow-bellied Sapsucker, 3.0 (12; 1N,7FL); Black-capped Chickadee, 3.0 (1N,18FL); Tufted Titmouse, 2.5 (12FL); Red-bellied Woodpecker, 1.5 (2FL); Eastern Phoebe, 1.5 (6FL); Great Crested Flycatcher, 1.5 (4FL); Blue-headed Vireo, 1.5 (1FL); American Redstart, 1.5 (5FL); Common Yellowthroat, 1.5 (5FL); Northern Cardinal, 1.5 (3FL); American Goldfinch, 1.5; Downy Woodpecker, 1.0 (1N,4FL); Northern Flicker, 1.0 (1N,2FL); Blue Jay, 1.0 (1N,4FL); American Crow, 1.0 (1N,4FL); White-breasted Nuthatch, 1.0 (1N,6FL); Hermit Thrush, 1.0; Cedar Waxwing, 1.0; Song Sparrow, 1.0 (4FL); Wild Turkey, 0.5; Red-tailed Hawk, 0.5; Mourning Dove, 0.5; Hairy Woodpecker, 0.5; Eastern Kingbird, 0.5; Chestnut-sided Warbler, 0.5 (2FL); Pine Warbler, 0.5; Black-and-white Warbler, 0.5; Northern Waterthrush, 0.5 (2FL); Louisiana Waterthrush, 0.5; Chipping Sparrow, 0.5 (4FL); Rose-breasted Grosbeak, 0.5; Brown-headed Cowbird, 0.5 (1FL); Baltimore Oriole, 0.5; Pileated Woodpecker, +; Yellow-throated Vireo, +; Magnolia Warbler, +; Yellow-rumped Warbler, +; Black-throated Green Warbler, +; Eastern Towhee, +. **Total:** 47 species; 103.0 territories (408/40 ha). **Visitors:** Brown Creeper, Blue-winged Warbler, Canada Warbler. **Remarks:** The number of species showing territoriality in the plot surged up to 47 this year. That is far more than the 40 found last year, the 39 found in 2006, and the 10-year average of 42 species. What caused this increase is a mystery, but it could be related to food sources. The number of territories increased to 103.0 this year, from 96.0 last year, and a dismal 69.0 in 2006. The 10-year average is 91 territories. The most abundant species this year was Veery with 17.5 territories. Last year, they were in second place with 15.0, and in 2006, they were the most abundant species but with only 11.0 territories. The second most abundant species this year was Ovenbird with 15.5 territories. Last year, they were the third most abundant species with 14.0, and in 2006, they were in second place with only 10.0 territories. The third most abundant species this year was Red-eyed Vireo with 15.0 territories. Last year, they were the most abundant species with 15.0, and in 2006, they were the third most abundant species with only 9.5 territories. These three species are almost always the top three most abundant species in this plot, even though their order switches around. It is good to see that they seem to have recovered from whatever was causing their low numbers in 2004, 2005, and 2006. Species found exhibiting territoriality this year but not last year included Red-tailed Hawk, Northern Flicker, Eastern Kingbird, Blue-headed Vireo, Magnolia Warbler, Yellow-rumped Warbler, Pine Warbler, Northern Waterthrush, Eastern Towhee, and Baltimore Oriole. Some of these were non-breeding visitors last year. The only species found on territory last year, but not this year, were Brown Creeper, Blue-gray Gnatcatcher, and Blue-winged Warbler. The creeper and warbler were one-time visitors this year. Breeding success was pretty good this year with 28 species fledging a total of at least 159 young. Last year, 131 fledglings of 25 species were observed. In 2006, 107 fledglings from 17 species were seen. This is a positive upward trend. This year, the most productive species were Black-capped Chickadee, Red-eyed Vireo, Ovenbird, Tufted Titmouse, and American Robin.

3. WHITE OAK SAVANNAH
SAVANA DE ROBLE BLANCO

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Site Number: ON2893110. **Location:** Ontario; Municipality of Muskoka; Torrance; Southwood Shield Plateau; 44°56'N, 79°30'W. **Continuity:** Established 1993; 11 yr. **Size:** 10.4 ha. **Description of Plot:** See *J. Field Ornithol.* 65(Suppl.):60–61 (1994) and *Bird Populations* 8:127–128 (2007). **Weather:** Mean start temp., 17.4°C (range 15–19°C). Temperatures were 2.5°C below the 30-year (1971–2000) norm in May but at the norm for the three-month study period. Precipitation totals averaged 35% over the norm from May through July. **Source:** Environment Canada. **Coverage:** 16.4 h; 8 visits (0 sunrise, 2 sunset); 16, 31 May; 21, 23, 24, 25, 26 June; 15 July; 2008. **Census:** Chestnut-sided Warbler, 14.5 (56); American Robin, 12.0 (46); Eastern Towhee, 8.0 (31); Field Sparrow, 7.5 (29); Brown Thrasher, 7.0 (27); Yellow-rumped Warbler, 7.0; Red-eyed Vireo, 6.0 (23); Chipping Sparrow, 6.0; Common Yellowthroat, 5.0 (19); American Redstart, 3.0 (12); Black-and-White Warbler, 2.0; Red-winged Blackbird, 1.5; Northern Flicker, 1.0; Blue Jay, 1.0; Black-capped Chickadee, 1.0; Veery, 1.0; Song Sparrow, 0.5. **Total:** 17 species; 84.0 territories (323/40 ha). **Visitors:** American Woodcock, Mourning Dove, Hairy Woodpecker, Eastern Phoebe, Great Crested Flycatcher, Common Raven, White-breasted Nuthatch, Ovenbird, Purple Finch, American Goldfinch. **Remarks:** Rain abundance may have contributed to the highest number of breeding warblers to date (31.5 territories). Four of the five warbler species set new plot highs. Chestnut-sided Warbler, which supplanted Yellow Warbler in 1998, almost tripled its 11-year breeding territory average this year. For the second year running, breeding warblers have reversed the seedeater dominance on this plot. Flycatchers, in steady decline since their high of 10.5 territories in 1993, were absent for the first time. Overall breeding pairs, however, have gradually increased from the plot low of 56.0 (in 2000) to this year's 84.0, the 11-year average. Of the 47 plot breeding species overall, 10 have bred at least nine years, and six have bred for all 11 years.

4. OAK–MAPLE–POPLAR HOLLOW
BOSQUE DE ROBLE–ARCE–ALAMO HUECO

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2910 New Holland Road
Reading PA 19607-9448

Site Number: PA1093123. **Location:** Pennsylvania; Berks Co.; Reading; Nolde Forest, Buck Hollow; 40°16'57"N, 75°57'30"W; Reading Quadrangle, USGS. **Continuity:** Established 1993; 16 yr. **Size:** 11.3 ha. **Description of Plot:** See *J. Field Ornithol.* 65(Suppl.):61 (1994). **Weather:** Mean start temp., 12.6°C (range 4–21°C). **Coverage:** 14.8 h; 9 visits (8 sunrise); 24, 26, 27 April; 3, 11, 18, 25, 27 May; 22 June; 2008. **Census:** Wood Thrush, 8.0 (28); Ovenbird, 8.0; Tufted Titmouse, 5.0 (18); Blue Jay, 4.0 (14); Veery, 4.0; Red-bellied Woodpecker, 2.0; Hairy Woodpecker, 2.0; American Crow, 2.0; Eastern Towhee, 2.0; Northern Cardinal, 2.0; chickadee sp.; 1.0. **Total:** 11 species; 40.0 territories (142/40 ha). **Visitors:** Great Crested Flycatcher, Blue-headed Vireo, Brown Creeper, Worm-eating Warbler, Rose-breasted Grosbeak. **Other Observers:** Keith Lutz, Kevin Lutz, Pat Mangas, Phyllis Reynolds, and David Reynolds.

5. HARDWOOD SWAMP FOREST
BOSQUE DE MADERAS DURAS PANTANOSO

MICHAEL R. DAWSON
Francis Beidler Forest
336 Sanctuary Road
Harleyville SC 29448

Location: South Carolina; Dorchester Co.; Harleyville; Francis Beidler Forest Sanctuary, Four Holes Swamp; 33°11'N, 80°19'W; Pringletown Quadrangle, USGS. **Continuity:** Established 1979; 15 yr. **Size:** 8.1 ha. **Description of Plot:** See *Am. Birds* 34:50 (1980) and *J. Field Ornithol.* 64 (Suppl.):56 (1993). The plot is continuing to recover from the effects of hurricane Hugo in 1989. The post-hurricane brushiness continues to thin as the understory trees grow up and once again shade the forest floor. The coarse woody debris is mostly broken down and rotting, further opening the forest floor. The plot's vegetation was resurveyed in 1996 (unpublished). **Weather:** Mean start temp., 12.2°C (range 7–18°C). Temperatures and water levels were normal. The 9 May visit was aborted due to a thunderstorm. **Coverage:** 14.4 h; 11 visits (11 sunrise); 21, 29, 30 April; 2, 6, 9, 13, 14, 21, 23, 30 May; 2008. **Census:** Blue-gray Gnatcatcher, 30.0 (148); Red-eyed Vireo, 7.0 (35); Tufted Titmouse, 6.5 (32); Northern Parula, 6.0 (30); White-eyed Vireo, 5.0 (25); Great Crested Flycatcher, 4.0 (20); Northern Cardinal, 4.0; Prothonotary Warbler, 3.5 (17); Pileated Woodpecker, 3.0 (15); Acadian Flycatcher, 3.0; Yellow-billed Cuckoo, 2.5; Red-bellied Woodpecker, 2.0; Carolina Wren, 2.0; Hooded Warbler, 2.0; Red-shouldered Hawk, 1.0; Yellow-throated Vireo, 1.0; American Crow, 1.0; Carolina Chickadee, 1.0; Gray Catbird, 1.0; Swainson's Warbler, 0.5. **Total:** 20 species; 86.0 territories (425/40 ha). **Visitors:** White Ibis, Barred Owl, Downy Woodpecker, White-breasted Nuthatch, Wood Thrush, Black-throated Blue Warbler, Black-throated Green Warbler, Yellow-throated Warbler, Ovenbird, Northern Waterthrush, Kentucky

Warbler, Common Yellowthroat, Summer Tanager. **Other Observer:** Norman Brunswig.

6. MATURE MAPLE–BEECH–BIRCH FOREST
BOSQUE MADURO DE ARCE–HAYA–ABEDUL

LAURA M. LEWIS
Cherokee National Forest
2800 N. Ocoee Street
Cleveland TN 37312

Site Number: TN2392102. **Location:** Tennessee; Monroe Co.; Whigg Ridge, Cherokee National Forest; 35°19'36"N, 84°2'30"W; Big Junction Quadrangle, USGS. **Continuity:** Established 1992; 16 yr. **Size:** 10.2 ha. **Description of Plot:** See *J. Field Ornithol.* 64(Suppl.):57–58 (1993) and 66(Suppl.):63 (1995). Hemlock mortality (due to woolly adelgid infestation) continues. **Weather:** Mean start temp., 21.3°C (range 12–36°C). **Coverage:** 18.4 h; 8 visits (4 sunrise, 4 sunset); 29, 30 May; 4, 5, 25, 26 June; 6, 7 July; 2008. **Census:** Veery, 13.0 (51); Blue-headed Vireo, 9.5 (37); Ovenbird, 7.0 (27); Dark-eyed Junco, 6.0 (24); Tufted Titmouse, 1.5; White-breasted Nuthatch, 1.0; Blackburnian Warbler, 1.0; Downy Woodpecker, +; Carolina Chickadee, +. **Total:** 9 species; 39.0 territories (153/40 ha). **Visitors:** Common Raven, Winter Wren, Eastern Towhee. **Remarks:** Flyovers: Chimney Swift, Purple Martin, and Cedar Waxwing. **Other Observers:** David F. Vogt and Hayden Wilson. **Acknowledgments:** We wish to acknowledge the financial and logistical support of the Cherokee National Forest.

7. UPLAND CHRISTMAS TREE FARM
FINCAS DE ARBOLES DE NAVIDAD DE ALTURAS

ELIZABETH W. BROOKS
5540 Jericho Hill Road
Alfred Station NY 14803

Site Number: NY2483108. **Location:** New York, Allegany Co., Andover; Kent Christmas Tree Farm; 42°10'N, 77°50'W; Andover Quadrangle, USGS. **Continuity:** Established 1983; 26 yr. **Size:** 10.7 ha. **Description of Plot:** See *Am. Birds* 38:91(1984). During the previous two years, all the Scotch pine trees in the study area were removed. **Weather:** Mean start temp. 18.6°C (range 12.2–22.2°C). **Coverage:** 13.6 h; 8 visits plus 1 woodcock survey (0 sunrise, 1 sunset); 12 April; 2, 9, 16, 23, 30 June; 14, 23, 29 July; 2008. **Census:** Chipping Sparrow, 14.0 (52; 1N); Song Sparrow, 13.0 (49; 6N,5FL); American Robin, 9.0 (34; 1N,2FL); Yellow-rumped Warbler, 6.0 (22); Field Sparrow, 4.0 (15; 1N); Purple Finch, 4.0; Cedar Waxwing, 3.5 (13; 1N); Eastern Towhee, 2.5 (1N); Mourning Dove, 2.0; Magnolia Warbler, 2.0; Brown-headed Cowbird, 2.0 (females); American Goldfinch, 2.0; Prairie Warbler, 1.0; Savannah Sparrow, 1.0; Indigo Bunting, 1.0; Bobolink, 0.5; Red-winged Blackbird, 0.5. **Total:** 17 species; 68.0 territories (254/40 ha). **Visitors:** Sharp-shinned Hawk, Black-billed Cuckoo, Blue-headed Vireo, Red-eyed Vireo, Black-capped Chickadee, Red-breasted Nuthatch, House Wren, Gray Catbird, Brown Thrasher, Chestnut-sided Warbler, Common Yellowthroat. **Remarks:** The number of territories (68.0) was about average, but lower than in any of the previous eight years. There were no new species recorded on the study area. American Woodcock was missing after being recorded in 21 of the past 24 years. No nests were found parasitized by cowbirds. **Acknowledgments:** Appreciation to Rick Walker and Dennis Smith for weather data and to Tom and Kathy Kent for their continued interest and permission to conduct the study on their land.

8. CLIMAX HEMLOCK–WHITE PINE FOREST WITH TRANSITION HARDWOODS
BOSQUE CLIMAX DE PICEA–PINO BLANCO EN TRANSICION A MADERAS DURAS

DAVID ROSGEN
White Memorial Conservation Center
P.O. Box 368
Litchfield CT 06759

Site Number: CT2765008. **Location:** Connecticut; Litchfield Co.; Litchfield; White Memorial Foundation–Catlin Woods; 41°43'N, 73°12'W; Litchfield Quadrangle, USGS. **Continuity:** Established 1965; 42 yr. **Size:** 10.5 ha. **Description of Plot:** See *Aud. Field Notes* 19:594–595 (1965), *J. Field Ornithol.* 67(Suppl.):60 (1996), and *Bird Populations* 8:129–130 (2007). The vegetation was resurveyed in 1990 and 2004, but the results have not been published. **Weather:** Mean start temp., 20.7°C (range 11–28°C). The weather throughout all of 2008 was much wetter than normal in Connecticut. The months of May and June saw more wet days than dry ones. It was very conducive to vegetation growth, and it helped produce an abundance of seeds, berries, and insects as the season progressed. Rainfall was above average in May with 17 wet days producing a total of 8.4 cm of rain. The number of wet days decreased slightly in June to 16, but the amount of precipitation increased significantly to 14.3 cm. That's well-above average. In July, there were 13 wet days that produced a total of 15.4 cm of rain. That's a little above average. May's mean temperature was 12.3°C, which is a little below average. The mean temperature in June was 19.3°C, which is close to average. In July, the mean temperature was 21.9°C, which is close to average. **Source:** White Memorial Foundation's weather station. **Coverage:** 28.0 h; 11 visits (0 sunrise, 4 sunset); 7, 14, 21, 28 May; 5, 13, 25 June; 3, 10, 18, 28

July; 2008. Maximum number of observers/visit, 3. **Census:** Veery, 17.0 (65; 13FL); Black-throated Green Warbler, 16.5 (63; 4N,24FL); Ovenbird, 16.0 (61; 23FL); Red-eyed Vireo, 10.0 (38; 7FL); Hermit Thrush, 8.0 (30; 2N,14FL); Blackburnian Warbler, 7.5 (29; 1N,11FL); Great Crested Flycatcher, 5.0 (19; 1N,7FL); Wood Thrush, 5.0 (1N,6FL); Pine Warbler, 5.0 (1N,12FL); Black-capped Chickadee, 3.5 (13; 27FL); Scarlet Tanager, 3.5 (5FL); Blue-headed Vireo, 3.0 (11; 3FL); Blue Jay, 3.0 (5FL); Eastern Wood-Pewee, 2.5 (4FL); Mourning Dove, 2.0 (2N,2FL); Yellow-bellied Sapsucker, 2.0; White-breasted Nuthatch, 2.0 (13FL); American Robin, 2.0 (1N,11FL); Hairy Woodpecker, 1.5 (3FL); American Crow, 1.5 (3FL); Yellow-rumped Warbler, 1.5 (1N,4FL); Black-and-white Warbler, 1.5 (3FL); Northern Cardinal, 1.5 (1N,5FL); Purple Finch, 1.5 (1N,3FL); Downy Woodpecker, 1.0 (2FL); Pileated Woodpecker, 1.0 (1N,2FL); Tufted Titmouse, 1.0 (8FL); Brown Creeper, 1.0 (4FL); Gray Catbird, 1.0 (1FL); Wild Turkey, 0.5 (6FL); Red-tailed Hawk, 0.5 (2FL); Great Horned Owl, 0.5 (1N,4FL); Red-bellied Woodpecker, 0.5 (1FL); Yellow Warbler, 0.5; Worm-eating Warbler, 0.5; Common Yellowthroat, 0.5 (2FL); Chipping Sparrow, 0.5 (4FL); Rose-breasted Grosbeak, 0.5 (1FL); Brown-headed Cowbird, 0.5 (1FL); American Goldfinch, 0.5; Barred Owl, +; Least Flycatcher, +; Cedar Waxwing, +; Chestnut-sided Warbler, +; American Redstart, +; Northern Waterthrush, +. **Total:** 46 species; 133.0 territories (507/40 ha). **Visitors:** Cooper's Hawk, Eastern Kingbird, Red-breasted Nuthatch, Dark-eyed Junco, Baltimore Oriole. **Remarks:** A total of 133 birds of 46 species exhibited evidence of territoriality in this plot in 2008. That's the same number of species as were present last year and four more than the 10-year average. There were 24 more individuals found this year than last year. That's 19 more than the 10-year average. The most abundant species this year was Veery, as was the case last year and in 2006. With 17.0 territories this year, it was more abundant than ever before. Last year, and in 2006, there were 14.5 Veery territories. Black-throated Green Warbler with 16.5 territories barely edged-out Ovenbird, with 16.0, as the second most abundant species. Ovenbird, now in third place, had been in second place in 2007 and 2006 and was the most abundant species in 2005. This doesn't mean that they've declined in number, however. In fact, they have steadily increased in number since 2005, just not at the same pace as Veery. Black-throated Green Warbler numbers have fluctuated widely over the past 40 years, and 2008 was an up year. Red-eyed Vireo increased to 10.0 territories this year, but remained in fourth place. The Hermit Thrush population continued its long, steady increase this year to a new record high of 8.0 territories. Blackburnian Warbler numbers rebounded quite nicely this year to 7.5 territories from only 4.5 last year and in 2006. Species found exhibiting territoriality this year but not last year included Red-tailed Hawk, Barred Owl, Red-bellied Woodpecker (first time ever in this plot), Least Flycatcher, Cedar Waxwing, Chestnut-sided Warbler, and Worm-eating Warbler. Species being territorial here last year but not this year included Eastern Phoebe, Eastern Kingbird, Red-breasted Nuthatch, Magnolia Warbler, Canada Warbler, Song Sparrow, and Baltimore Oriole. This is the first time in many years that Eastern Phoebes haven't nested on the map board at the main entrance to the trail leading into the plot. Breeding success for most birds was excellent this year with 246 fledglings being counted over the course of the season. Last year, 205 fledglings were counted. Black-capped Chickadee, Black-throated Green Warbler, and Ovenbird seemed to be the most productive species this year. **Other Observers:** John Eykelhoff, Russ Naylor, Margaret Sellers, and Thomas Sellers.

9. YOUNG MIXED HARDWOOD–CONIFER STAND

BOSQUE JOVEN–MIXTO DE MADERAS DURAS/RODAL DE CONIFEROS

DAVID ROSGEN
White Memorial Conservation Center
P.O. Box 368
Litchfield CT 06759

Site Number: CT2778262. **Location:** Connecticut; Litchfield Co.; Morris; White Memorial Foundation–Pitch Road; 41°42'N, 73°10'W; Litchfield Quadrangle, USGS. **Continuity:** Established 1978; 31 yr. **Size:** 8.5 ha. **Description of Plot:** See *Am. Birds* 33:72 (1979). Degradation of the plot's habitats by ATVs, dirt bikes, and other off-road vehicles continued this year, to the detriment of the birds. Law enforcement efforts were sporadic and futile. Erosion of the land and roads, with resultant siltation of the brook and wetland has become a major problem. **Weather:** Mean start temp., 20.5°C (range 16–25°C). The weather throughout all of 2008 was much wetter than normal in Connecticut. The months of May and June saw more wet days than dry ones. It was very conducive to vegetation growth, and it helped produce an abundance of seeds, berries, and insects as the season progressed. Rainfall was above average in May with 17 wet days producing a total of 8.4 cm of rain. The number of wet days decreased slightly in June to 16, but the amount of precipitation increased significantly to 14.3 cm. That's well-above average. In July, there were 13 wet days that produced a total of 15.4 cm of rain. That's a little above average. May's mean temperature was 12.3°C, which is a little below average. The mean temperature in June was 19.3°C, which is close to average. In July, the mean temperature was 21.9°C, which is close to average.

Source: White Memorial Foundation's weather station. **Coverage:** 15.0 h; 8 visits (1 sunrise, 5 sunset); 23, 30 May; 7, 17, 25 June; 5, 16, 29 July; 2008. **Census:** Red-eyed Vireo, 12.0 (56); Ovenbird, 11.5 (54; 2FL); Veery, 11.0 (52; 1FL); Wood Thrush, 4.0 (19); Black-capped Chickadee, 3.5 (16; 1N,16FL); Tufted Titmouse, 3.0 (14; 14FL); Gray Catbird, 3.0 (3FL); Common Yellowthroat, 2.5; Scarlet Tanager, 2.5; Yellow-bellied Sapsucker, 2.0; Eastern Wood-Pewee, 2.0; Hermit Thrush, 2.0; American Robin, 2.0 (4FL); Downy Woodpecker, 1.5; White-breasted Nuthatch, 1.5 (4FL); Black-throated Green Warbler, 1.5; Red-bellied Woodpecker, 1.0; Eastern Phoebe, 1.0; Blue-headed Vireo, 1.0; Blue Jay, 1.0; American Crow, 1.0; Black-throated Blue Warbler, 1.0; American Redstart, 1.0; Louisiana Waterthrush, 1.0; Northern Cardinal, 1.0; Mourning Dove, 0.5; Great Crested Flycatcher, 0.5; Black-and-white Warbler, 0.5; Chipping Sparrow, 0.5 (3FL); Barred Owl, +; Hairy Woodpecker, +; Blackburnian Warbler, +; Pine Warbler, +; Brown-headed Cowbird, +; American Goldfinch, +. **Total:** 35 species; 76.5 territories (360/40 ha). **Visitors:** Broad-winged Hawk, Northern Flicker, Rose-breasted Grosbeak. **Remarks:** The number of species exhibiting breeding evidence in this plot dropped back down to 35 this year, which is the same as in 2006. Otherwise, not since 1984 was the number of species this low. Last year, 41 species were found. The average of the previous 10 years is 43. Surprisingly, the total number of territorial males increased somewhat to 76.5. Last year, this plot produced 69.0 territories, and in 2006 it had 68.5. The average of the previous 10 years is 80.5 territories. The most abundant species this year was Red-eyed Vireo with 12.0 territories. Last year, they were the third most abundant species with 9.5 territories. In 2006, they were also in third place but with only 7.0 territories. They have clearly rebounded. The second most abundant species this year was Ovenbird with 11.5 territories. They were also in second place last year with 10.0 and in 2006 with 9.5 territories. The third most abundant species this year was Veery with 11.0 territories. Last year, they were the most abundant species with the same number of territories, and in 2006, they were also the most abundant species but with 11.5 territories. These three species have consistently been the top three most abundant in this plot for many years, even though their order flip-flops. Overall, Veery numbers have been the most stable. No species were found this year which weren't found here last year. Six species, however, were found here last year but not this year, or at least they weren't exhibiting any breeding evidence this year. They were Cooper's Hawk, Pileated Woodpecker, Blue-gray Gnatcatcher, Chestnut-sided Warbler, Rose-breasted Grosbeak, and Purple Finch. Breeding success seemed to be very low this year. Only 47 fledglings representing only eight species were detected. Last year, 78 fledglings from 14 species were observed. In 2006, 76 fledglings from 14 species were counted. This year, the only really productive species were Black-capped Chickadee and Tufted Titmouse. Together they accounted for 30 of the fledglings. **Other Observer:** Russ Naylor.

10. RIPARIAN WOODLAND

ARBOLADO RIVEREÑO

SCOTT R. ROBINSON
Bureau of Land Management
3815 N. Schreiber Way
Coeur d'Alene ID 83815

Location: Idaho; Kootenai Co.; Coeur d'Alene; Blackwell Island; 47°41'N, 116°48'W; Coeur d'Alene Quadrangle, USGS. **Continuity:** Established 1997; 12 yr. **Size:** 8.9 ha. **Description of Plot:** See 1997 BBC report (unpublished) and *Bird Populations* 7:106 (2006) and 7:123 (2006). **Weather:** Mean start temp., 10.1°C (range 5–16°C). The plot flooded for the first time since 2002 (from 17 May to 26 June). The water level peaked about 2 m above summer normal pool level. Flood stage is 1.5 m above summer normal pool level of Coeur d'Alene Lake. Approximately 70% of the plot was inundated at the peak of the flood. **Coverage:** 10.7 h; 8 visits (8 sunrise); 5, 19, 28 May; 2, 9, 16, 23, 30 June; 2008. **Census:** Canada Goose, 5.0 (22; 31FL); Tree Swallow, 4.0 (18); American Robin, 3.5 (16); Mallard, 3.0 (13); Red-winged Blackbird, 3.0; Yellow Warbler, 2.5; Wood Duck, 2.0; Violet-green Swallow, 2.0; Song Sparrow, 2.0; Brown-headed Cowbird, 2.0; Gray Catbird, 1.5; Blue-winged Teal, 1.0; Downy Woodpecker, 1.0; Northern Flicker, 1.0; American Crow, 1.0; European Starling, 1.0; Cedar Waxwing, 1.0; Yellow-rumped Warbler, 1.0; Black-headed Grosbeak, 1.0; Osprey, +. **Total:** 20 species; 38.5 territories (173/40 ha). **Visitors:** domestic goose, Double-crested Cormorant, Great Blue Heron, Cooper's Hawk, Spotted Sandpiper, Ring-billed Gull, Calliope Hummingbird, Western Wood-Pewee, Black-capped Chickadee, Veery, House Finch, American Goldfinch.

11. UPLAND MIXED PINE–SPRUCE–HARDWOOD PLANTATION

PLANTACION MIXTA DE PINO–ABETO–MADERAS DURAS EN ALTURAS

ELIZABETH W. BROOKS
5540 Jericho Hill Road
Alfred Station NY 14803

Site Number: NY2474107. **Location:** New York; Allegany Co., Ward; Phillips Creek State Reforestation Tract; 42°8'N, 77°45'W; Andover Quadrangle, USGS. **Continuity:** Established 1974; 35 yr. **Size:** 16.6 ha.

Description of Plot: See *Am. Birds* 28:699–700 (1974), *J. Field Ornithol.* 63(Suppl.):79–80 (1992) and 66(Suppl.):79–80 (1995). Mature red pines (n=381) were harvested from a 1.2-ha section planted in 1935. **Weather:** Mean start temp., 18.3°C (range 12.2–23.9°C). **Coverage:** 12.9 h; 9 visits (0 sunrise, 1 sunset); 1, 8, 15, 22, 29 June; 13, 20, 27 July; 5 August; 2008. **Census:** Black-throated Green Warbler, 9.0 (22); Blackburnian Warbler, 9.0; Magnolia Warbler, 8.0 (19); Dark-eyed Junco, 7.0 (17); Golden-crowned Kinglet, 5.0 (12); Blue-headed Vireo, 4.0 (10); Black-capped Chickadee, 4.0; Hermit Thrush, 4.0; American Robin, 4.0; Purple Finch, 4.0; Brown Creeper, 3.0 (7); Yellow-rumped Warbler, 3.0; Red-breasted Nuthatch, 2.5; Blue Jay, 2.0; Chestnut-sided Warbler, 2.0; Chipping Sparrow, 2.0; Indigo Bunting, 2.0; Brown-headed Cowbird, 2.0 (female); Cedar Waxwing, 1.5; Red-shouldered Hawk, 1.0; Red-eyed Vireo, 1.0; American Crow, 1.0; Winter Wren, 1.0; Ovenbird, 1.0; Mourning Warbler, 1.0; White-throated Sparrow, 1.0; American Goldfinch, 1.0; Song Sparrow, 0.5. **Total:** 28 species; 86.5 territories (208/40 ha). **Visitors:** Broad-winged Hawk, Red-tailed Hawk, Ruby-throated Hummingbird, Yellow-bellied Sapsucker, Hairy Woodpecker, Eastern Wood-Pewee, Great Crested Flycatcher, Common Raven, Hooded Warbler, Canada Warbler, Red Crossbill. **Remarks:** The total number of territories (87.5) was slightly above the 34-year average (84.3). There were no new species recorded on the plot. Wood Thrush was missing after being reported in 30 of the past 34 years; Purple Finch had the highest number of territorial males (4) ever recorded. There was considerable disruption in a portion of the plot due to the selective logging activity conducted during the breeding season. **Acknowledgments:** Appreciation to Rick Walker and Dennis Smith for weather data.

12. RIPARIAN SCRUB
MATORRAL RIBEREÑO

JILL COUMOUTSO
Santa Ana Watershed Association
P.O. Box 219
Chino CA 91708

Location: California; Riverside Co.; Norco; Norco Burn; 33°57'29"N, 117°31'56"W; Corona North Quadrangle, USGS. **Continuity:** Established 2006; 3 yr. **Size:** 14.6 ha. **Description of Plot:** See *Bird Populations* 9:192 (2009). **Weather:** Mean start temp., 16.1°C (range 10.2–23.8°C). Temperatures were mild, as typical for southern California's Mediterranean climate. **Source:** a Kestrel 3000 was used to measure temperature and wind speed. **Coverage:** 20.5 h; 8 visits (0 sunrise, 0 sunset); 18 March; 7, 21 April; 8, 22 May; 10, 23 June; 11 July; 2008. **Census:** Anna's Hummingbird, 13.0 (36; 4N,6FL); Song Sparrow, 13.0; Spotted Towhee, 10.0 (27); Least Bell's Vireo, 8.5 (23; 7N,28FL); Common Yellowthroat, 8.0 (22; 2FL); Black-headed Grosbeak, 8.0; House Wren, 7.0 (19; 1N); Yellow-breasted Chat, 7.0 (3FL); Mourning Dove, 6.0 (16; 2N); Yellow Warbler, 5.0 (14; 2N,3FL); Lesser Goldfinch, 5.0; Bewick's Wren, 3.0 (8); California Towhee, 3.0 (1FL); House Finch, 3.0; Cooper's Hawk, 2.0 (1N,3FL); Bushtit, 2.0; Black-chinned Hummingbird, 1.0; Northern Flicker, 1.0; Ash-throated Flycatcher, 1.0; Western Bluebird, 1.0 (1FL); Nuttall's Woodpecker, 0.5. **Total:** 21 species; 108.0 territories (296/40 ha). **Visitors:** Mallard, American Bittern, Red-tailed Hawk, American Kestrel, Common Ground-Dove, Downy Woodpecker, Willow Flycatcher, Pacific-slope Flycatcher, Black Phoebe, Say's Phoebe, Western Scrub-Jay, Barn Swallow, Northern Mockingbird, California Thrasher, European Starling, Orange-crowned Warbler, Fox Sparrow, Lincoln's Sparrow, Blue Grosbeak, Red-winged Blackbird, Brown-headed Cowbird, Hooded Oriole, Bullock's Oriole, American Goldfinch. **Remarks:** Song Sparrows were the most abundant breeders on the site due to the presence of a dense understory. Anna's Hummingbird was the second most abundant species. In addition to winter and breeding bird surveys, this site is currently being monitored for the nests of the endangered Least Bell's Vireo. Other species of concern that bred on the plot included Yellow-breasted Chat and Yellow Warbler. A Cooper's Hawk nest was found at the building stage and monitored throughout the season. It was successful and fledged three young. This site continues to be treated for Arundo re-growth on a yearly basis. A Brown-headed Cowbird trap was present adjacent to the plot for the entire breeding season.

13. RIPARIAN SCRUB BASIN
CUENCA CON MATORRAL RIBEREÑO

MELODY AIMAR
Santa Ana Watershed Association
P.O. Box 219
Chino CA 91708

Location: California; Riverside Co.; Riverside; Mockingbird Canyon; 33°53'33"N, 117°24'47"W; Riverside West Quadrangle, USGS. **Continuity:** Established 2004; 5 yr. **Size:** 12.7 ha. **Description of Plot:** See *Bird Populations* 8:142–143 (2007). **Weather:** Mean start temp., 18.5°C (range 8–26°C). Temperatures were mild, as is typical for southern California's Mediterranean climate. There was no precipitation within 24 hours of survey visits. Drought conditions continue. **Coverage:** 19.3 h; 8 visits (0 sunrise, 0 sunset); 14, 18, 28 March; 14 April; 16, 22 May; 9, 30 June; 2008. **Census:** Song Sparrow, 12.0 (38; 2FL); California Towhee, 11.0 (35; 1FL);

Spotted Towhee, 10.5 (33); Bewick's Wren, 10.0 (31; 1FL); California Quail, 9.5 (30); Anna's Hummingbird, 8.0 (25); Lesser Goldfinch, 7.0 (22; 2FL); Bushtit, 5.0 (16; 1N); Black-headed Grosbeak, 5.0; House Finch, 4.0 (13; 1FL); California Thrasher, 3.5 (11); Common Yellowthroat, 3.0 (9); Hooded Oriole, 3.0 (1FL); Nuttall's Woodpecker, 2.5; Mourning Dove, 2.0; Northern Flicker, 2.0; Western Scrub-Jay, 2.0 (2FL); Black-chinned Hummingbird, 1.0; Downy Woodpecker, 1.0 (1FL); Black Phoebe, 1.0 (2N); House Wren, 1.0; Yellow Warbler, 1.0; American Goldfinch, 1.0; Cooper's Hawk, 0.5; Red-tailed Hawk, 0.5 (1FL); Least Bell's Vireo, + (1FL). **Total:** 26 species; 107.0 territories (337/40 ha). **Visitors:** Greater Roadrunner, Ash-throated Flycatcher, Cassin's Kingbird, California Gnatcatcher, Wrentit. **Remarks:** As in previous years, Song Sparrow, Bewick's Wren, California Towhee, and Spotted Towhee remain as the most abundant species. Absent from this year's census was Phainopepla which had 5.0 territories in 2007. Also, the Barn Swallow pair that nested on-site in previous years was absent. Last year, their nest was vandalized by taggers. Sadly, the two Least Bell's Vireo pairs that nested on-site in 2007 did not return this year. Vireo territory numbers throughout the canyon, however, increased from 23 in 2007 to 27 in 2008. The Red-tailed Hawk pair returned to nest successfully on-site. Overall, territory numbers were down slightly from 2007. **Acknowledgments:** We would like to thank Gage Canal for site access.

14. STREAMSIDE RIPARIAN WOODLAND I

BOSQUE RIBEREÑO I

TERRY REESER
Santa Ana Watershed Association
P.O. Box 219
Chino CA 91708

Location: California; Orange Co.; Yorba Linda; Featherly Regional Park; 33°52'24"N, 117°42'23"W; Black Star Canyon and Prado Dam Quadrangles, USGS. **Continuity:** Established 2004; 5 yr. **Size:** 17.8 ha. **Description of Plot:** See *Bird Populations* 8:143–144 (2007) and 9:182 (2009). **Weather:** Mean start temp., 20.6°C (range 14–27°C). Temperatures were mild, as typical for southern California's Mediterranean climate. **Source:** weather data were obtained with a Kestrel 2000 weather meter. **Coverage:** 47.0 h; 8 visits (0 sunrise, 0 sunset); 26 March; 22 April; 8, 19, 29 May; 13, 26 June; 16 July; 2008. **Census:** Song Sparrow, 32.0 (72; 1N); Common Yellowthroat, 28.0 (63; 2FL); Yellow Warbler, 20.5 (46); Spotted Towhee, 15.5 (35); House Wren, 13.0 (29; 1N,3FL); Bewick's Wren, 12.0 (27; 6FL); Least Bell's Vireo, 11.0 (25; 3N,7FL); Anna's Hummingbird, 10.0 (22; 1N,1FL); Nuttall's Woodpecker, 9.0 (20); Yellow-breasted Chat, 7.5 (17); Black-headed Grosbeak, 6.5 (15); Wrentit, 6.0 (13; 1FL); California Towhee, 5.0 (11); Wood Duck, 4.0 (9; 2FL); Downy Woodpecker, 3.0 (7); Black Phoebe, 3.0; Western Scrub-Jay, 2.0; Bushtit, 2.0; House Finch, 2.0 (4FL); Mallard, 1.0; Cooper's Hawk, 1.0; Red-shouldered Hawk, 1.0; Acorn Woodpecker, 1.0; Ash-throated Flycatcher, 1.0 (1N); Tree Swallow, 1.0 (1N,2FL); Western Bluebird, 1.0 (1FL); California Thrasher, 1.0; Hooded Oriole, 1.0; Lesser Goldfinch, 1.0 (1FL). **Total:** 29 species; 202.0 territories (454/40 ha). **Visitors:** Double-crested Cormorant, Great Blue Heron, Great Egret, Snowy Egret, American Coot, Mourning Dove, Belted Kingfisher, Western Kingbird, Warbling Vireo, American Crow, Northern Rough-winged Swallow, Northern Mockingbird, Wilson's Warbler, Blue Grosbeak, Red-winged Blackbird, Bullock's Oriole, American Goldfinch. **Remarks:** The breeding bird community includes riparian, coastal sage, and chaparral species. The endangered Least Bell's Vireo and California species of concern Yellow Warbler and Yellow-breasted Chat bred on the plot along with other species of concern such as Downy Woodpecker. The mature stands of cottonwood and black willow throughout the plot benefit many species observed including Yellow Warbler, Nuttall's Woodpecker, and Downy Woodpecker. I possibly over counted some species due to surveying only one side of the river, but I took this into account for some species. Nest monitoring for Least Bell's Vireo and winter bird surveys take place on the plot. **Acknowledgments:** I thank Harbors, Beaches, and Parks Resources and Development Department, County of Orange, for site access and its continuing logistical support.

15. STREAMSIDE RIPARIAN WOODLAND III

BOSQUE RIBEREÑO III

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Location: California; Riverside Co.; Redlands; San Timoteo Canyon; 33°59'5"N, 117°7'45"W; Sunnymead Quadrangle, USGS. **Continuity:** Established 2004; 5 yr. **Size:** 12.3 ha. **Description of Plot:** See *Bird Populations* 8:144–145 (2007) and 9:182–183 (2009). **Weather:** Mean start temp., 19.5°C (range 13–32°C). Temperatures were warm, as typical for southern California's Mediterranean climate. There was no precipitation during, or within 24 hours of, any survey visit. **Source:** weather data were obtained by using a Kestrel 3000 weather meter. **Coverage:** 23.1 h; 8 visits (4 sunrise, 0 sunset); 17, 27 March; 10, 23 April; 13, 28 May; 24 June; 2 July; 2008. **Census:** Song Sparrow, 19.0 (62); Bewick's Wren, 16.0 (52); Spotted Towhee, 15.0 (49); California Towhee, 12.0 (39); Lesser Goldfinch, 11.0 (36); Mourning Dove, 10.0 (33);

Northern Rough-winged Swallow, 9.0 (29); Bushtit, 9.0; Anna's Hummingbird, 7.0 (23); Common Yellowthroat, 7.0; Least Bell's Vireo, 5.5 (18; 6N,19FL); American Goldfinch, 5.0 (16); Oak Titmouse, 4.0 (13); Yellow Warbler, 4.0; Black-chinned Hummingbird, 3.0 (10); Nuttall's Woodpecker, 3.0; Black Phoebe, 3.0; American Crow, 3.0; House Wren, 3.0; Yellow-breasted Chat, 3.0; House Finch, 3.0; Ash-throated Flycatcher, 2.0; Common Raven, 2.0; European Starling, 2.0; Phainopepla, 2.0; Black-headed Grosbeak, 2.0; Bullock's Oriole, 2.0; Red-shouldered Hawk, 1.5; California Quail, 1.0; Barn Owl, 1.0; Downy Woodpecker, 1.0; Northern Flicker, 1.0; California Thrasher, 1.0; Cooper's Hawk, 0.5; Red-tailed Hawk, 0.5; Western Bluebird, 0.5; Blue Grosbeak, 0.5. **Total:** 37 species; 175.0 territories (569/40 ha). **Visitors:** White-tailed Kite, American Kestrel, Western Scrub-Jay, Red-winged Blackbird. **Remarks:** Thirty-seven species bred on this plot. The plot has been undergoing passive restoration over the last seven years after the removal of over 80 ha of invasive Arundo donax. One endangered species, Least Bell's Vireo, bred on the plot. Nest monitoring for the Least Bell's Vireo and winter bird surveys are also conducted on this plot. **Acknowledgments:** Special thanks to the U.S. Army Corps of Engineers for providing funding for the surveys.

16. FIELD, RIDGE, SHRUBBY TREES, AND WOODS

CAMPOS, COLINAS, ARBUSTOS Y BOSQUES

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Location: Ontario; Municipality of Hamilton-Wentworth; Dundas; Dundas Valley Plot #1; 43°15'N, 79°54'W. **Continuity:** Established 1994; 13 yr. **Size:** 5.8 ha. **Description of Plot:** See *J. Field Ornithol.* 60(Suppl.):14 (1989), 66(Suppl.):27–28 (1995), and 67(Suppl.):73–74 (1996). Ongoing succession or "thickening up" continues. Jerusalem artichoke invasion appears to have affected breeding numbers. **Weather:** Mean start temp., 17.4°C (range 15–19°C). Temperatures were 2.5°C below the 30-year (1971–2000) norm in May but at the norm for the three-month study period. Precipitation totals averaged 35% over the norm from May through July. **Source:** Environment Canada. **Coverage:** 16.4 h; 8 visits (0 sunrise, 2 sunset); 16, 31 May; 21, 23, 24, 25, 26 June; 15 July; 2008. **Census:** Yellow Warbler, 20.5 (141); Gray Catbird, 9.5 (66); Northern Cardinal, 9.5; American Robin, 6.0 (41); American Goldfinch, 5.0 (34); Blue Jay, 4.0 (28); Blue-winged Warbler, 4.0; Field Sparrow, 4.0; Indigo Bunting, 4.0 (2FL); Black-capped Chickadee, 3.0 (21); Rose-breasted Grosbeak, 2.0; Brown-headed Cowbird, 2.0; Baltimore Oriole, 2.0; Yellow-billed Cuckoo, 1.0; Brown Thrasher, 1.0; Eastern Towhee, 1.0; Common Grackle, 1.0. **Total:** 17 species; 79.5 territories (548/40 ha). **Visitors:** Northern Flicker, Great Crested Flycatcher, Red-eyed Vireo, American Crow, House Wren, Cedar Waxwing, American Redstart, Song Sparrow, Scarlet Tanager. **Remarks:** This year's 79.5 breeding pairs are 13.5 below the next lowest total (in 2006) and 39 pairs under the 13-year average for this revised plot. There has been a steady decline on this plot since the highest total (158 pairs) in 2000. The top three breeders (Yellow Warbler, Gray Catbird, and Song Sparrow) over 18 years of both versions of this plot declined this year to 42% of the 13-year average of 72 breeding pairs. Breeding Song Sparrows were absent for the first time. Yellow Warbler and Gray Catbird were 19 pairs below their 2007 total. Vegetative succession is likely playing a role in this steep decline. Also, there is a possible correspondence between the recent invasion of Jerusalem artichoke in the open low-lying areas of the northwest and north-central sectors and the notable declines of Yellow Warbler and catbird in these sectors.

17. SHRUBBY SWAMP AND SEDGE HUMMOCKS

PANTANO ARBUSTIVO–MOGOTE

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Location: Connecticut; Litchfield Co.; Litchfield; White Memorial Foundation–North Shore Marsh; 41°43'N, 73°13'W; Litchfield Quadrangle, USGS. **Continuity:** Established 1965; 42 yr. **Size:** 8.1 ha. **Description of Plot:** See *Aud. Field Notes* 19:625–627 (1965) and *Bird Populations* 7:125–126 (2006). Habitat succession continued this year despite several severe flooding events. Floods last year killed several more trees so that there is an abundance of this microhabitat for cavity-nesting birds. Shrubs (especially silky and red-twigged dogwoods, arrowwood viburnum, and buttonbush) continued to increase in the area that they covered while herbaceous vegetation continued to decrease. The entire plot was much wetter than average throughout the entire breeding season, but it didn't seem to adversely affect the birds. **Weather:** Mean start temp., 23.9°C (range 19–32°C). The weather throughout all of 2008 was much wetter than normal in Connecticut. The months of May and June saw more wet days than dry ones. It was very conducive to vegetation growth, and it helped produce an abundance of seeds, berries, and insects as the season progressed. Rainfall was above average in May with 17 wet days producing a total of 8.4 cm of rain. The number of wet days decreased slightly in June to 16, but the amount of

precipitation increased significantly to 14.3 cm. That's well-above average. In July, there were 13 wet days that produced a total of 15.4 cm of rain. That's a little above average. May's mean temperature was 12.3°C, which is a little below average. The mean temperature in June was 19.3°C, which is close to average. In July, the mean temperature was 21.9°C, which is close to average. **Source:** White Memorial Foundation's weather station. **Coverage:** 28.0 h; 12 visits (0 sunrise, 5 sunset); 5, 13, 20, 27 May; 3, 10, 17, 24 June; 3, 10, 18, 28 July; 2008. Maximum number of observers/visit, 3. **Census:** Red-winged Blackbird, 36.0 (178; 4N,64FL); Swamp Sparrow, 30.0 (148; 3N,47FL); Yellow Warbler, 29.0 (143; 8N,47FL); Common Yellowthroat, 25.5 (126; 2N,39FL); Gray Catbird, 20.0 (99; 3N,34FL); Common Grackle, 8.5 (42; 2N,26FL); Song Sparrow, 8.0 (40; 14FL); Veery, 7.5 (37; 10FL); American Goldfinch, 6.0 (30; 1N,6FL); Tree Swallow, 5.5 (27; 4N,26FL); American Robin, 4.5 (22; 2N,19FL); Cedar Waxwing, 4.5 (2N,8FL); Eastern Kingbird, 3.5 (17; 1N,4FL); Yellow-bellied Sapsucker, 3.0 (15; 3N,12FL); Warbling Vireo, 3.0 (1N,7FL); Black-capped Chickadee, 3.0 (20FL); Baltimore Oriole, 3.0 (1N,7FL); Least Flycatcher, 2.5 (4FL); Blue-gray Gnatcatcher, 2.5 (6FL); Alder Flycatcher, 2.0; Willow Flycatcher, 2.0; Mourning Dove, 1.5 (3FL); Great Crested Flycatcher, 1.5; Yellow-throated Vireo, 1.5 (1FL); Tufted Titmouse, 1.5 (9FL); Black-and-white Warbler, 1.5 (1FL); Northern Cardinal, 1.5 (5FL); Red-bellied Woodpecker, 1.0 (1N,3FL); Northern Flicker, 1.0; Eastern Wood-Pewee, 1.0 (2FL); Red-eyed Vireo, 1.0; Blue Jay, 1.0 (1FL); Chestnut-sided Warbler, 1.0; American Redstart, 1.0 (1FL); Northern Waterthrush, 1.0; Mute Swan, 0.5 (1N,4FL); Wood Duck, 0.5; Great Blue Heron, 0.5; Spotted Sandpiper, 0.5 (2FL); Downy Woodpecker, 0.5 (3FL); Hairy Woodpecker, 0.5 (3FL); Pileated Woodpecker, 0.5; White-breasted Nuthatch, 0.5 (4FL); Wood Thrush, 0.5; Ovenbird, 0.5; Scarlet Tanager, 0.5; Brown-headed Cowbird, 0.5 (1FL); Canada Goose, +; Mallard, +; Osprey, +; American Woodcock, +; Rose-breasted Grosbeak, +. **Total:** 52 species; 232.5 territories (1148/40 ha). **Visitors:** Ruby-throated Hummingbird, Blue-winged Warbler. **Remarks:** The number of species exhibiting breeding evidence in this plot increased to 52 this year, which ties the record high set in 2006. Last year, 45 species were found. The average of the previous 10 years is 44 species. The total number of territories increased to a new record high of 232.5 this year. The previous record high was 220.0 in 2002. Last year, 218.5 territories were recorded here. The average of the previous 10 years is 195, with all years from 2002 through the present producing greater than 200 territories each year. The most abundant species this year was Red-winged Blackbird with 36.0 territories. Last year, they were in second place with 31.0. In 2006, they were the most abundant species with 34.0 territories. The second most abundant species this year was Swamp Sparrow with 30.0 territories. Last year, they were the most abundant species with 34.0. In 2006, they were the second most abundant species with 32.5 territories. These two species have been number one or two every year for at least the last 10 years, and their number of territories is always in the 30s. Yellow Warbler has been the third most abundant species every year for at least the last 10 years, and that was the case again this year when 29.0 territories were recorded. Last year, there were 26.5, and in 2006, there were 25.5 territories. They are responding favorably to the increase in shrub cover. Species found this year but not last year included Mute Swan, Mallard, Osprey, American Woodcock, Pileated Woodpecker, Blue Jay, Wood Thrush, and Scarlet Tanager. The last four species are representative of the transition of the northern portion of this wetland into a hardwood swamp. The only species found here last year but not this year was Purple Finch. Nesting success was good this year despite the wet conditions. At least 443 fledglings from 34 species were tallied this year. Last year, 469 fledglings were counted. Red-winged Blackbird, Swamp Sparrow, and Yellow Warbler were the most productive species. **Other Observers:** John Eykelhoff, Mary Gendron, Daren Jacklin, Caitlin MacGinitie, and Margaret Sellers.

18. COASTAL SCRUB

MATORRAL COSTANERO

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Location: California; Marin Co.; Bolinas; Palomarin Field Station; 37°55'N, 122°45'W; Bolinas Quadrangle, USGS. **Continuity:** Established 1971; 34 yr. **Size:** 8.1 ha. **Description of Plot:** See *Am. Birds* 25:1003–1004 (1971). The vegetation continues to gradually transition from coastal scrub to Douglas-fir (Pseudotsuga menziesii) forest. **Weather:** Mean start temp., 12.9°C (range 8–30°C). The bioyear (1 July 2007–30 June 2008) rainfall was 703.4 mm. The 1976–2008 mean bioyear rainfall was 864.2 mm. The breeding season rainfall (1 April–31 July) was 17.4 mm. The 1975–2008 mean breeding season rainfall was 97.2 mm. **Coverage:** 279.0 h; 80 visits (72 sunrise, 0 sunset). 2008. **Census:** Wrentit, 13.0 (64; 8N,14FL); Bewick's Wren, 6.0 (30; 2N,4FL); Wilson's Warbler, 5.0 (25; 1N,2FL); Spotted Towhee, 4.5 (22; 3N,4FL); Hutton's Vireo, 3.5 (17); Chestnut-backed Chickadee, 3.5; Golden-crowned Kinglet, 3.5; Orange-crowned Warbler, 3.5; Bushtit, 3.0 (15; 1N); Swainson's Thrush, 3.0; Purple Finch, 2.5; Mourning Dove, 1.5; Allen's Hummingbird, 1.5; Anna's Hummingbird, 1.0; White-crowned Sparrow, 1.0 (1N,2FL); Band-tailed Pigeon,

0.5; Northern Flicker, 0.5; Steller's Jay, 0.5; Western Scrub-Jay, 0.5; Dark-eyed Junco, 0.5; Red-tailed Hawk, +; Red-breasted Nuthatch, +; Winter Wren, +; American Robin, +; Song Sparrow, +. **Total:** 25 species; 58.5 territories (289/40 ha). **Visitors:** None listed. **Remarks:** The total number of territories on the plot increased 48% from 39.5 in 2007 to 58.5 this year. Wrentit territories increased from 9.5 to 13.0, and Chestnut-backed Chickadee and Hutton's Vireo both increased from 1.0 to 3.5 territories. In 2007, a small portion of one Golden-crowned Kinglet territory fell within the plot; in 2008, there were 3.5 territories in the plot. Most other species showed increases of 0.5 to 1.0 territory each. Band-tailed Pigeon, Mourning Dove, Allen's Hummingbird, Red-breasted Nuthatch, and Winter Wren were present in 2008 but not in 2007. **Acknowledgments:** We thank the Point Reyes National Seashore for their cooperation. This is PRBO contribution No. 1761.

19. DISTURBED COASTAL SCRUB A

MATORRAL PERTURBADO A

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Location: California; Marin Co.; Bolinas; Palomarin Field Station; 37°55'N, 122°45'W; Bolinas Quadrangle, USGS. **Continuity:** Established 1972; 34 yr. **Size:** 4.7 ha. **Description of Plot:** See *Am. Birds* 26:987–988 (1972). The vegetation continues to gradually transition from coastal scrub to Douglas-fir (Pseudotsuga menziesii) forest. **Weather:** Mean start temp., 12.9°C (range 8–30°C). The bioyear (1 July 2007–30 June 2008) rainfall was 703.4 mm. The 1976–2008 mean bioyear rainfall was 864.2 mm. The breeding season rainfall (1 April–31 July) was 17.4 mm. The 1975–2008 mean breeding season rainfall was 97.2 mm. **Coverage:** 125.8 h; 55 visits (33 sunrise, 0 sunset). 2008. **Census:** Wrentit, 7.5 (64; 9N,11FL); Spotted Towhee, 3.0 (26; 3N,1FL); Song Sparrow, 3.0 (4N,9FL); Anna's Hummingbird, 2.5; Hutton's Vireo, 2.0; Bushtit, 2.0; California Quail, 1.5; Bewick's Wren, 1.5; Golden-crowned Kinglet, 1.5; Orange-crowned Warbler, 1.5; Wilson's Warbler, 1.5 (2N); Purple Finch, 1.5; Allen's Hummingbird, 1.0; Chestnut-backed Chickadee, 1.0; Swainson's Thrush, 1.0; American Goldfinch, 1.0; Red-tailed Hawk, 0.5; Band-tailed Pigeon, 0.5; Mourning Dove, 0.5; Northern Flicker, 0.5; Olive-sided Flycatcher, 0.5; Red-breasted Nuthatch, 0.5; Winter Wren, 0.5; White-crowned Sparrow, 0.5; Dark-eyed Junco, 0.5; Steller's Jay, +; Western Scrub-Jay, +; American Robin, +; California Towhee, +; Brown-headed Cowbird, +. **Total:** 30 species; 37.5 territories (319/40 ha). **Visitors:** None listed. **Remarks:** The total number of territories showed a minor decline from 38.0 in 2007 to 37.5 this year (-1.3%). Steller's Jay, Bewick's Wren, and Wilson's Warbler declined by 50% from small numbers in 2007. A remarkable number of species showed the same (or very similar) densities between the two years. Winter Wren, Red-breasted Nuthatch, Olive-sided Flycatcher, California Towhee, and White-crowned Sparrow were present in 2008 but not in 2007. Downy Woodpecker, Warbling Vireo, and Pacific-slope Flycatcher were present in 2007 but not in 2008. **Acknowledgments:** We thank the Point Reyes National Seashore for their cooperation. This is PRBO contribution No. 1759.

20. DISTURBED COASTAL SCRUB B

MATORRAL PERTURBADO B

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Location: California; Marin Co.; Bolinas; Palomarin Field Station; 37°55'N, 122°46'W; Bolinas Quadrangle, USGS. **Continuity:** Established 1971; 34 yr. **Size:** 8.1 ha. **Description of Plot:** See *Am. Birds* 25:1002–1003 (1971) and *J. Field Ornithol.* 66(Suppl.):104 (1995). The vegetation continues to gradually transition from coastal scrub to Douglas-fir (Pseudotsuga menziesii) forest. **Weather:** Mean start temp., 12.9°C (range 8–30°C). The bioyear (1 July 2007–30 June 2008) rainfall was 703.4 mm. The 1976–2008 mean bioyear rainfall was 864.2 mm. The breeding season rainfall (1 April–31 July) was 17.4 mm. The 1975–2008 mean breeding season rainfall was 97.2 mm. **Coverage:** 168.5 h; 58 visits (33 sunrise, 0 sunset). 2008. **Census:** Wrentit, 13.0 (64; 10N,12FL); Swainson's Thrush, 7.0 (35); Bewick's Wren, 5.5 (27); Song Sparrow, 5.0 (25); Winter Wren, 4.0 (20); American Goldfinch, 4.0; Anna's Hummingbird, 3.0 (15; 1N,1FL); Allen's Hummingbird, 3.0; Wilson's Warbler, 3.0; Spotted Towhee, 2.5 (2N); Golden-crowned Kinglet, 2.0; Purple Finch, 1.5; Band-tailed Pigeon, 1.0; Chestnut-backed Chickadee, 1.0; Orange-crowned Warbler, 1.0; Red-tailed Hawk, 0.5; Mourning Dove, 0.5; Hutton's Vireo, 0.5; Steller's Jay, 0.5; White-crowned Sparrow, 0.5; Brown-headed Cowbird, 0.5; California Quail, +; Northern Flicker, +; Western Scrub-Jay, +; Bushtit, +; American Robin, +. **Total:** 26 species; 59.5 territories (294/40 ha). **Visitors:** None listed. **Remarks:** The total number of territories increased dramatically from 2007 to 2008, rising 38% from 43.0 to 59.5. Wrentit increased from 8.0 to 13.0 territories, Swainson's Thrush increased from 4.5 to 7.0, and Bewick's Wren increased from 2.5 to 5.5. Allen's Hummingbird was not present in 2007 but had 3.0 territories in 2008. **Acknowledgments:** We thank the Point Reyes National Seashore for their cooperation. This is PRBO contribution No. 1760.

Bird Populations 10

LINKS TO REPORTS OF AVIAN MONITORING PROGRAMS

BREEDING BIRDS IN THE WIDER COUNTRYSIDE: THEIR CONSERVATION STATUS 2009. Trends in numbers and breeding performance for UK birds. (2010) BTO Research Report No. 541. British Trust for Ornithology, Thetford.

Stephen Baillie, John Marchant, David Leech, Andrew Joys, David Noble, Carl Barimore, Iain Downie, Mark Grantham, Kate Risely and Rob Robinson

Link: http://www.bto.org/birdtrends2009/

All of the Breeding Birds in the Wider Countryside reports can be downloaded from here

Link: http://www.bto.org/birdtrends2009/previous-reports.htm

THE (BRITISH) BREEDING BIRD SURVEY – 2007. (2008) BTO Research Report No. 508. British Trust for Ornithology, Thetford.

K. Risely, D.G. Noble and S.R. Baillie

Link: http://www.bto.org/bbs/results/BBSreport07.pdf

THE (BRITISH) BREEDING BIRD SURVEY – 2008. (2009) BTO Research Report No. 537. British Trust for Ornithology, Thetford.

K. Risely, D.G. Noble and S.R. Baillie

Link: http://www.bto.org/bbs/results/BBSreport08.pdf

All of the (British) Breeding Bird Survey reports can be downloaded from here

Link: http://www.bto.org/bbs/results/bbsreport.htm

CES (CONSTANT EFFORT SITES) NEWS – 2007. Number 21 (June 2008)

Mark Grantham and Rob Robinson (Eds.)

Link: http://blx1.bto.org/pdf/ces/cesnews21_2008.pdf

CES (CONSTANT EFFORT SITES) NEWS – 2008. Number 22 (June 2009)

Mark Grantham and Dave Leech (Eds.)

Link: http://blx1.bto.org/pdf/ces/cesnews22_2009.pdf

All issues of the CES (Constant Effort Sites) News can be downloaded from here

Link: http://www.bto.org/ringing/ringinfo/ces/ces_new_index.htm

WATERBIRDS IN THE UK 2007-08: THE WETLAND BIRD SURVEY. (2009) BTO/WWT/RSPB/JNCC, Thetford

Chas Holt, Graham Austin, Neil Calbrade, Heidi Mellan, Richard Thewlis, Colette Hall, David Stroud, Simon Wotton and Andy Musgrove

Link: http://www.bto.org/webs/news/AR07_08/index.htm

WATERBIRDS IN THE UK 2008-09: THE WETLAND BIRD SURVEY. (2010) BTO/RSPB/JNCC in association with WWT, Thetford

Neil Calbrade, Chas Holt, Graham Austin, Heidi Mellan, Richard Hearn, David Stroud, Simon Wotton and Andy Musgrove

Link: http://www.bto.org/webs/news/AR08_09/index.htm

All of the WeBS (Wetland Bird Survey) reports can be downloaded from here

Link: http://www.bto.org/webs/news/websdownloads.htm

Bird Populations 10:136-139
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BTO News 279:19-20

IS AVIAN BREEDING SUCCESS WEATHERING THE STORMS?

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Dave Leech and *Carl Barimore* report on the latest Nest Record Scheme productivity trends and find out how the birds fared during a 2007 breeding season that was characterised by unseasonably heavy rain and flooding.

¿RESISTE LAS TORMENTAS EL ÉXITO REPRODUCTIVO DE LAS AVES?
Dave Leech y *Carl Barimore* informan sobre las últimas tendencias del programa de monitoreo de nidos y descubren cómo les fue a las aves durante la temporada reproductiva de 2007, caracterizada por fuertes lluvias e inundaciones inusuales.

The three- to five-year population cycle of rodents in the UK hit a peak in 2007, meaning the most successful group of birds were those predating small mammals. Kestrel brood sizes were 14% larger than predicted from long-term trends.

For the second year in a row we appear to have come to the end of a summer that never really felt like it had started in the first place, characterised once more by heavy rain and strong winds. For many Nest Record Scheme (NRS) participants, weather such as this evokes much the same feelings as those experienced by parents whose children have gone to school/summer camp/university for the first time. After all the love and attention invested in finding the nest and following the breeding attempt, every shower brings new fears of catastrophe and premonitions of disaster. We feel compelled to keep checking that the offspring are OK and to interfere if we suspect that things may be about to take a turn for the worse, but we must restrain ourselves and let them fend for themselves. The poor weather in 2007 certainly didn't dampen the enthusiasm of nest recorders, however, and an amazing effort by all concerned saw submissions top the 35,000 mark for the first time since 1999.

IT NEVER RAINS …

…but it certainly poured in 2007, with several months achieving the unwelcome status of 'wettest since records began.' In terms of productivity, the most successful group of species were those predating small mammals; the three- to five-year population cycle of rodents in the UK hit a peak in 2007. Brood sizes of Tawny Owl, Barn Owl and Kestrel were 8%, 18% and 14% larger respectively than predicted from long-tterm trends. Little Owl and Starling were also more successful than might be predicted, both possibly having benefited from increased accessibility to soil invertebrates, on which they primarily feed, in the wet weather conditions. Nuthatch also demonstrated above-average breeding success – researchers in europe have previously identified a counter-intuitive positive correlation between the breeding success of this species and spring rainfall, although the reason for this relationship remains unclear.

In contrast, many resident open-nesting species showed levels of productivity that were

FIG 1. NEST RECORD SCHEME CONCERN LIST

SPECIES	YEARS ON LIST	SIGNIFICANT DECLINE IN:	BREEDING POPULATION TREND
Kestrel (A)	3	Brood size	>25% decline
Moorhen	16	Clutch size, Nest survival (E)	Fluctuating
Ringed Plover (A)	12	Nest survival (E)	Uncertain
Lapwing (R)	2	Nest survival (E)	>25% decline
Nightjar (R)	2	Clutch size*, Brood size*, Nest survival (E)*	Uncertain
Tree Pipit (R)	3	Nest survival (E & C)*	>50% decline
Yellow Wagtail (R)	9	Brood size*	>50% decline
Grey Wagtail (A)	6	Clutch size, Brood size	Probable decline
Pied Wagtail	5	Clutch size, Brood size	Uncertain
Dunnock (A)	6	Nest survival (E)	>25% decline
Whinchat (A)	3	Nest survival (E & C)*	Probable decline
Willow Warbler (A)	10	Nest survival (E)	>50% decline
Spotted Flycatcher (R)	4	Clutch size, Brood size, Nest survival (E & C)	>50% decline
House Sparrow (R)	5	Brood size	>50% decline
Linnet (R)	17	Clutch size, Brood size, Nest survival (C)	>50% decline
Bullfinch (A)	3	Brood size, Nest survival (E & C)	>50% decline
Yellowhammer (R)	6	Clutch size, Brood size, Nest survival (E & C)	>50% decline
Reed Bunting (A)	17	Nest survival (E)	>50% decline
Corn Bunting (R)	3	Brood size*, Nest survival (C)*	>50% decline

E indicates nest survival at the egg stage. **C** indicates nest survival at the chick stage. * indicates that the average annual sample size is small (between 10 and 30 records per year). Breeding population trends are taken from www.bto.org/birdtrends.
The inclusion of each species on the Red and Amber Lists of Conservation Concern is indicated by **R** or **A**, respectively (see www.bto.org/psob).

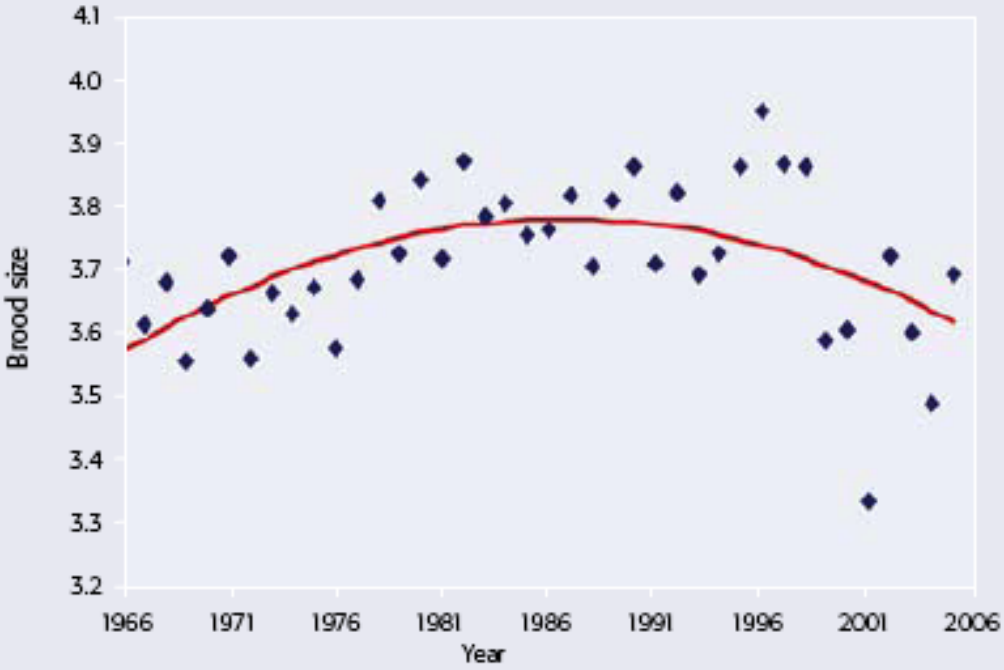
lower than predictions made using data from previous years. Robin, Dunnock and Wren, appeared to be particularly badly affected, exhibiting reduced clutch and brood sizes and increased failure rates, as did Reed Warbler. It is interesting to note that ringers participating in the Constant Effort Site scheme (CES, www.bto.org/goto/cesnews.htm) also reported lower proportions of juveniles of these species in their catches in 2007. CES and NRS results were not in agreement across the board. Nest recorders found little evidence for the reduction in productivity of Blue Tit and Great Tit apparent from the former data set. This discrepancy suggests that weather conditions may also have influenced post-fledging survival and illustrates the importance of combining a range of techniques when investigating trends in avian demography.

THE IMPORTANCE OF BEING TREND-Y

While the annual fluctuations in breeding success provide a fascinating insight into the processes that determine the number of offspring that birds are able to produce, it is the long-term trends in productivity that are of greatest use to conservationists. The NRS Concern List highlights those species that have demonstrated recent declines in both abundance and some aspect of productivity (Fig 1). While no new species have been added as a result of the latest analyses, a recent increase in mean brood sizes

FIG 2. MEAN SPOTTED FLYCATCHER BROOD SIZES

Mean Spotted Flycatcher brood sizes have been falling since the mid 1980s, during which period the population has continued to decline. Graphs such as this one are produced and updated for over 90 species each year and can be found on-line at **www.bto.org/birdtrends.**



has led to the removal of Starling, leaving a revised total of 19. The species of greatest concern are Yellowhammer and Spotted Flycatcher, which currently exhibit statistically significant declines in all four breeding parameters derived from the NRS data set (clutch size, brood size, egg survival rates and nestling survival rates) (Fig 1). The trends for Linnet, Bullfinch and Nightjar are also worrying, with three of the four breeding parameters calculated for each species indicating a significant reduction in productivity. Equivalent

NRS DATA ANALYSIS

- NRS data for 94 species were analysed using the methods outlined in a recent review paper in *Bird Study* 50:254 –270. Trends in laying date, clutch and brood sizes, and in daily nest failure rates over the egg and chick periods are described by linear or quadratic regression, as appropriate. Trends were not calculated for those species having a mean annual sample size of fewer than 10 records and species with a mean annual sample size of between 10 and 30 records were given the caveat of 'small sample size.'
- Species are placed on the NRS Concern List (Fig. 1) if a) they demonstrate significant declines in some aspect of breeding performance over at least the last 15 years and b) they have been placed on the Red or Amber Birds of conservation concern list due to population declines or if there is some uncertainty over their population status.

trends are calculated for over 90 species and published on-line each year in the Breeding Birds in the Wider Countryside Report – take a look at the latest results at www.bto.org/birdtrends.

LOOKING TO THE FUTURE

We're keen to receive more records of all species, as long as you are able to count the eggs and/or chicks inside the nest. So whether it's a Blackbird or Robin in your garden, or a Moorhen in your local park, why not help us to help them by filling in a nest record.

It simply wouldn't be possible for us to produce this article, without the amazing contribution of our dedicated volunteers. There are currently over 500 nest recorders in the UK, but there is always plenty of room for more, so please phone us or e-mail nest.records@bto.org if you 'd like to join in.

We are also extremely grateful for the support given under the JNCC/BTO partnership that the JNCC undertakes on behalf of Natural England, Scottish Natural Heritage, Countryside Council for Wales and the Environment and Heritage Service in Northern Ireland.

Bird Populations 10:140-142
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BTO News 285:10-11

PUTTING THE PIED FLYCATCHER INTO THE EQUATION

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Much has been written about the BTO's drive to recruit more nest recorders, but we're also working hard to develop the methods that we use to analyse the data and present the results. The latest trends in breeding success are therefore easier to interpret than ever before, as *Dave Leech* and *Carl Barimore* explain.

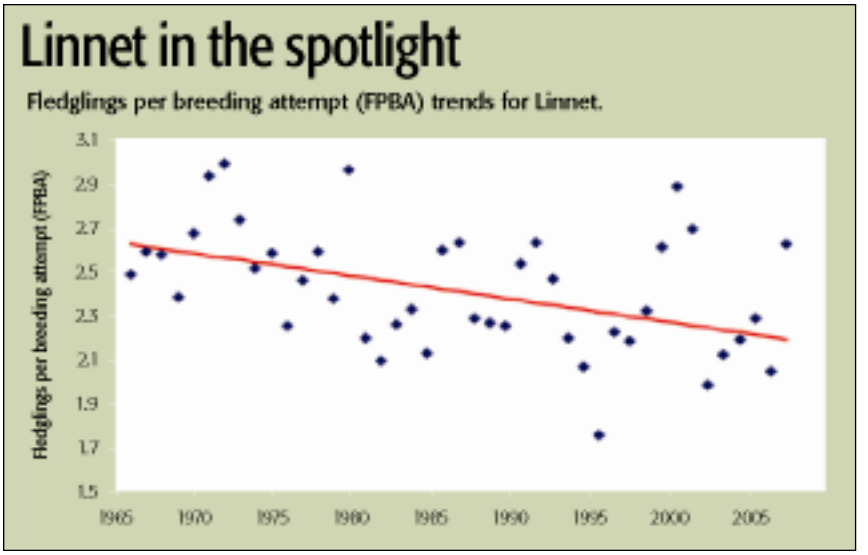
METIENDO AL PAPAMOSCAS CERROJILLO EN LA ECUACION
Mucho se ha escrito sobre la campaña del BTO de reclutamiento de más buscadores de nidos, pero también estamos trabajando duro para desarrollar métodos de análisis datos y presentación de resultados. Las últimas tendencias en éxito reproductivo son por tanto más fáciles de interpretar que nunca, como explican *Dave Leech* y *Carl Barimore*.

MAKING RECORDING SIMPLER

For the Nest Record Scheme (NRS), 2009 has been all about development. Much of the work that we've undertaken since January has focused on making things easier for those of you reading this article who have yet to submit your first nest record. An illustrated Quickstart Guide leads newcomers through the nest recording process, outlining what information to collect and how to record it for us, while our programme of training courses teaches new recorders to locate nests of the trickier species. We have also been working on novel ways to present the results of our annual analyses. Falling numbers of Afro-Palearctic migrants, such as Whinchat, Spotted Flycatcher and Wood Warbler, are a cause for increasing concern. In order to conserve these species effectively, we need to determine whether declines in the number of offspring being produced are responsible and each year NRS data are used to produce trends in clutch size, brood size and nest failure rates. The combined effect of these parameters on a species' annual productivity, however, can be difficult to interpret, so this year, for the first time, we have used these data to produce an overall estimate of the average number of chicks fledging from each nest.

PRODUCTIVITY DECLINES IN LONG-DISTANCE MIGRANTS

Trends in the number of fledglings produced per breeding attempt (FPBA) from 1966 to the present day are published for over 80 species in the latest Wider Countryside Report and those showing significant declines are listed in the Table. Of these 11 species, nine are Red- or Amber-listed Birds of Conservation Concern due to falling population sizes and/or range contractions, including three long-distance migrants: Nightjar, Tree Pipit and Spotted



Flycatcher. Smaller brood sizes and increasing failure rates at the egg and chick stages have meant that both Nightjar and Spotted Flycatcher are producing fewer fledglings, while Tree Pipit breeding success has suffered due to an increase in nestling mortality. While falling productivity may be due to factors such as habitat destruction, disturbance and predation on the breeding grounds, work on North American migrant passerines has shown that conditions experienced on the wintering grounds can also influence breeding success during the following season.

FOCUSING ON THE PIED FLYCATCHER

One migrant receiving a lot more attention from the NRS in 2009 is the Pied Flycatcher. Thanks to the efforts of volunteer data-inputters Michael Palles-Clark and Mike Reed, who have been working their way through our historic data sets, we have been able to include productivity trends for this species in the Wider Countryside Report for the first time. This is a significant advance, as Pied Flycatcher is the model species for much of the cutting-edge climate change research across Europe, to which we are now in an even better position to contribute. Several BTO research projects using these data are already under way, focusing on relationships between breeding success and climatic conditions on both the breeding and wintering grounds, so look out for the results in future editions of BTO News. Larger data sets permit much more powerful analyses so, if you're currently monitoring Pied Flycatchers or have historic data sets that have not yet been submitted to the NRS, please get in touch with us.

FARMLAND BIRDS STILL LISTED

Previous analyses of the NRS data set for Linnet have implicated increasing egg-stage failure rates in the species' decline, while falling productivity is thought to be preventing recovery of the Reed Bunting population, and both species show long-term declines in FPBA. More recent reductions in FPBA have been identified for Yellowhammer, a species producing progressively smaller clutches and broods while experiencing higher failure rates at both the egg and nestling stages, and Bullfinch, which now has smaller brood sizes and increasing failure rates at both the egg and nestling stage. Changing agricultural practices may have influenced breeding success directly, by reducing food availability during the spring and summer, but resources available to adults in winter may also impact on their condition and therefore the effort that they are able to invest in their brood during the following season.

Nests in trouble

Species demonstrating significant negative trends in the number of fledglings produced per breeding attempt (FPBA).

SPECIES	FPBA DECLINE		DECLINING BREEDING PARAMETERS
	Duration (years)	Magnitude	
Nightjar* (R)	43	56%	Clutch size, Brood size, Nest survival (E & C)
Tree Pipit* (R)	20	47%	Nest survival (C)
Dunnock (A)	20	14%	Nest survival (E & C)
Spotted Flycatcher (R)	24	15%	Brood size, Nest survival (E & C)
Treecreeper*	19	21%	Brood size
House Sparrow (R)	15	7%	Brood size
Chaffinch	23	20%	Brood size, Nest survival (E)
Linnet (R)	43	18%	Clutch size, Brood size, Nest survival (E & C)
Bullfinch* (A)	22	54%	Brood size, Nest survival (E & C)
Yellowhammer (R)	18	34%	Clutch size, Brood size, Nest survival (E & C)
Reed Bunting (A)	43	24%	Nest survival (E)

E indicates nest survival at the egg stage. **C** indicates nest survival at the chick stage.
* indicates that the average annual sample size is small (< 25 records per year).
Breeding population trends are taken from **www.bto.org/birdtrends**.
The inclusion of each species on the Red and Amber Lists of Conservation Concern is indicated by **R** or **A**, respectively, see **www.bto.org/psob.**

FIND OUT MORE AND GET INVOLVED

The new initiatives mentioned at the start of this article have encouraged many more people to join the scheme and, with our new materials, it's never been easier. Records of all species in all habitats are essential if we're going to continue to produce the information contained in this article in years to come. Please contact us at nrs@bto.org if you'd like to help. The Quickstart Guide is available to download from www.bto.org/nrs and the Wider Countryside Report from www.bto.org/birdtrends .

ACKNOWLEDGEMENTS

We're extremely grateful to all those nest recorders already taking part and to the support for the NRS given under the JNCC/BTO partnership. Much of the development work is funded by the Dilys Breese legacy.

Bird Populations 10:143-145
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WOODPIGEON JOINS THE GARDEN PREMIER LEAGUE

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Has the Woodpigeon become a permanent figure in your garden too? BTO Garden Bird Feeding Survey (GBFS) participants recorded all time high numbers last winter. BTO research ecologist, *David Glue*, describes the scene.

LAS PALOMAS TORCACES SE UNEN A LA PRIMERA DIVISION DEL JARDIN
¿Se ha convertido la paloma torcaz en presencia permanente también en su jardín? Los participantes del conteo de aves en comederos del BTO registraron números récord el pasado invierno. El ecólogo del BTO *David Glue* describe la escena.

WOODPIGEONS WADDLE INTO MORE GARDENS

Over recent decades Woodpigeons,essentially woodland birds, have found that the UK's gardens provide all of their year-round requirements. Forced by an unusually sparse wild food larder in our forests and hedgerows in winter 2007/08, rural Woodpigeons waddled into extra gardens to join their urban cousins, figuring in the 'Top 12' species recorded by the GBFS for the first time.

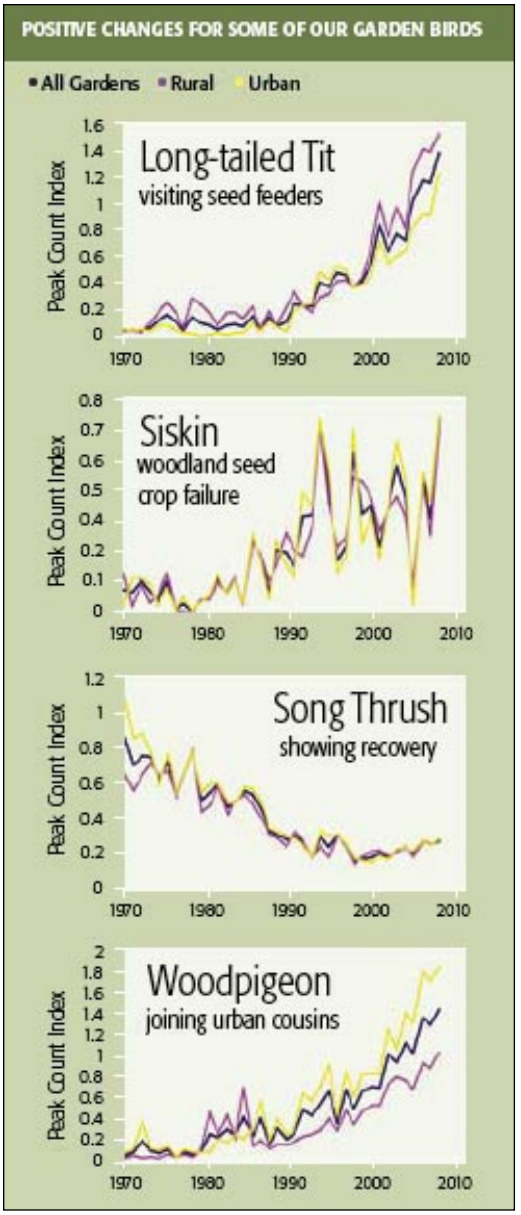
Birdtable activity in general was frenetic over a memorable winter 2007/08, with these dozen commonest species supported by four-fifths of the representative sample of gardens across the UK (see Premier League table). Robin, Blackbird and Blue Tit faithfully retained podium positions. High attendance of Chaffinch, Greenfinch and Coal Tit remain, but House Sparrow and Starling dipped to ever lower levels. The 251 observers who meticulously recorded weekly counts of feeding birds from October '07 to March '08 charted one of the busiest in the 38 year history of GBFS.

In total 90 species took food or water provided by GBFS observers, but as ever these varied widely in character. 'Barest' garden was a suburban one in S Yorkshire, with just four species; Blackbird and Woodpigeon (two of each) being highlights. 'Richest' plot is a rural hillside garden with pools in Dyfed, managed with wildlife in mind, with 59 species including Woodcock, Buzzard, Raven, Merlin and Barn Owl.

On average, gardens in towns and cities supported 22.1 species (19.1 in 06/07) and in rural settings 23.0 species (19.8). The richer feeding communities in general last winter reflected challenging conditions for UK's birds, but an extra visual pleasure for recorders. Indeed the last 2 winters contrasted sharply in character.

A WELL-BALANCED BIRDTABLE

Diversity – with a range of colours, shapes, antics and sounds remains the aim of most GBFS observers. Many, though, report a growing dominance by larger species, notably Feral Pigeon, Woodpigeon, Pheasant, Rook and



The Premier League...

POS	SPECIES	1970s AVERAGE	1990s AVERAGE	WINTER 2007/08
1	**Robin**	99	99	**99**
2	**Blackbird**	99	99	**99**
3	**Blue Tit**	99	100	**98**
4	**Dunnock**	95	95	**97**
5	**Great Tit**	93	97	**97**
6	**Chaffinch**	92	96	**97**
7	**Greenfinch**	92	96	**97**
8	**Coal Tit**	70	85	**88**
9	**Collared Dove**	60	87	**87**
10	**Starling**	96	92	**85**
11	**House Sparrow**	97	92	**84**
12	**Wood Pigeon**	19	52	**80**

Jackdaw. Perversely, a few complained of the aggressive nature, expense and daylong chatter from flocks of Goldfinch and Tree Sparrow. How times change!

Water tables remain high, and mid winter downpours quickly saturated sodden gardens. Several GBFS sites charted first ever feeding waterfowl, chiefly Mallard and Moorhen, but also Wigeon, Snipe, Green Sandpiper and Common Sandpiper, the last two species 'new' to the GBFS, lifting the list to 174 species.

Elsewhere, fortunate observers logged feral exotic Peacock (Bucks) and Ring-necked Parakeet (several), fleeting visits by migrant Woodcock (Durham), Whinchat and Ring Ouzel (Gwent) to refuel, surprise lingering Jack Snipe (Suffolk), Lesser Spotted Woodpecker (Dyfed), Stonechat (Cornwall) and Hawfinch (Wilts). Sparrowhawk easily retained 'Top Predator' status appearing at 51% of gardens sampled, 3-4 individuals regularly hunting in some sites. Red Kite and Buzzard, alongside raven scavenged at extra gardens, reflecting range expansions.

Winter 2007/08 finished with a flourish. A dogged chilly 10-week long spell from mid February, with northerly winds dominant, in combination with exhausted seed stocks, drove Bramblings and Siskins to seed dispensers widely in sizeable flocks, but with fewer Lesser Redpoll. Many stayed until the third week of April, when winds headed back to the south. With another winter on the horizon, early indications suggest improved yields of wild berries and seed, when the UK's resident birds may be under less pressure. It is foolish, however, to predict Nature's fickle ways and cold winters will still figure occasionally despite the trends towards warmer and wetter ones.

BARE WOODS BUT BUSY BIRD TABLES: WINTER 2006/2007 EXPLAINED

- An abysmal breeding season – fewer tits, Treecreeper and some finches.
- A very dry autumn – wagtails, warblers and doves drawn to bird baths.
- Cold late autumn weather in Fennoscandia – winter thrushes and finches pushed to UK.
- Poor forest tree 'masting' – more tits, finches and Great Spotted Woodpecker using feeders.
- Bitterly cold arctic air in mid Nov – late Dec encouraging flocks of starlings and thrushes onto garden berry bushes and windfall apples.
- Continuing losses to diseases such as Trichomoniasis – Greenfinch and Chaffinch hardest hit.
- A drawn-out winter through to a snowy Easter – extra finches and buntings at feeders.

ACKNOWLEDGEMENTS

Thanks to the relatively small, but highly committed, team of garden bird counters across the UK, including a core of observers with a series of weekly counts extending back to the 1970s! Also to Margaret Askew, Frances Bowman, Jacky Prior and Heather Pymar for help with recording forms, and to Mike Toms for help with the calculation of Peak Count Indices.

Bird Populations 10:146-148
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CHANGING THE GUARD AT UK BIRDTABLES

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In winter 2008/09, Goldfinch usurped House Sparrow from the 'Top 12' league of BTO's Garden Bird Feeding Survey (GBFS). *David Glue*, BTO Research Ecologist, explores findings from last winter, the ever-evolving feeding community and the need to continue monitoring.

CAMBIO DE GUARDIA EN LOS COMEDEROS DEL REINO UNIDO
En el invierno 2008/09, el jilguero le usurpa el puesto al gorrión común en la liga de los '12 principales' del censo de comederos de jardín del BTO. *David Glue*, ecólogo del BTO, explora los resultados del invierno pasado, la siempre cambiante comunidad de los comederos, y la necesidad de seguir monitorizando.

BUSIER BIRD TABLES BY DESIGN

When GBFS was launched in 1970/71, home-crafted tables, wire-mesh peanut feeders and seed mixes purchased from corner shops were the staple fare for birds in our gardens with an average of 16–17 species recorded. Spin forward 40 years and our garden bird scene is very different, averaging 18 –23 species supported by huge improvements in bird care provisions, with the BTO at the forefront of research into garden bird 'furniture' and feeding.

ALL POINTS ON THE COMPASS

As ever, birdtables from around the UK revealed contrasting bird assemblages. The most northerly site (Orkney) supported 15 species, including Peregrine and Hen Harrier, whilst in the south-west (Scilly) only 10 species were recorded, but included Water Rail coming to water and good numbers of Song Thrush. Interestingly, both these gardens held good numbers of House Sparrow and Starling, in welcome contrast to many UK mainland sites. Data from Garden BirdWatch (which in comparison to GBFS has had a considerably shorter amount of time in which to record changing trends) has shown a marked decrease in reporting rate for these two species. This could reflect a decrease in breeding populations as two thirds of House Sparrows and Starlings nest in human habitats. The 'barest' birdtable (Kent) held just five species, whereas the richest garden was once again in Dyfed, with a fantastic 59 species, including Teal, Green Sandpiper, Buzzard and Goshawk coming to a modest hillside plot with shallow pools crafted with wildlife in mind.

GARDEN TALES OF THE UNEXPECTED

After a frenetic feeding winter the previous year, predictions were for a quieter season in 2008/09,

Changing faces...

...at UK feeders showing percentage of GBFS garden feeding stations used

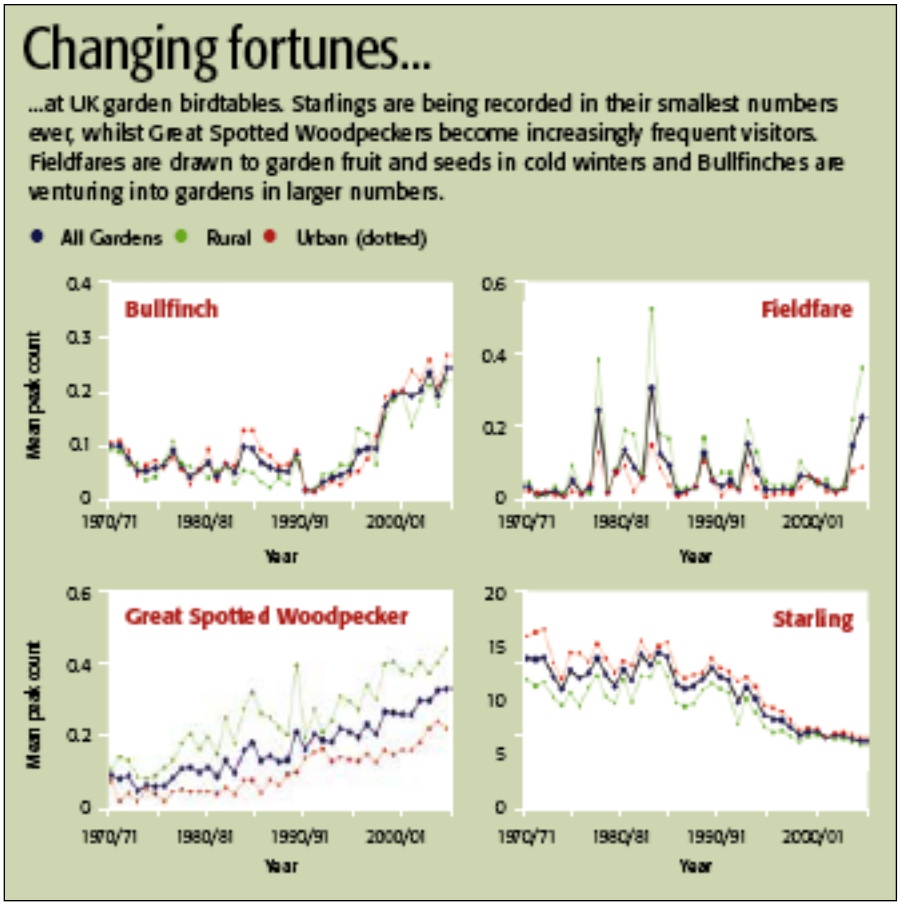
SPECIES	1970s AVERAGE	1990s AVERAGE	WINTER 2008/09
RELIABLE EACH WINTER...			
Robin	99	99	99
Blue Tit	99	100	99
Blackbird	99	99	98
Dunnock	95	95	96
DECLINING AT FEEDERS...			
Starling	96	92	81
House Sparrow	97	92	79
Song Thrush	88	65	62
Mistle Thrush	35	24	14
INCREASING IN NUMBERS			
Coal Tit	70	85	94
Goldfinch	3	33	84
Long-tailed Tit	11	40	80
Brambling	10	21	31

but the unusually severe cold weather quickly pushed many birds into gardens. Intriguingly, birds appeared to move progressively into warmer urban areas as the winter went on, and GBWers also picked up an increase in the number of Long-tailed Tits during the cold snap. Overall, an impressive 89 species took food or water provided, with Robin, Blackbird and Blue Tit continuing to occupy the top three positions. Wood Pigeon maintains its new presence in the Top 12, joined this year by Goldfinch which is also being increasingly recorded by GBW. This does not necessarily indicate an overall population increase but rather a change in feeding behaviour.Where there are winners there are always losers,and House Sparrow and Song Thrush have both been knocked off the leader board. Several other species are increasingly being recorded at feeding stations, including Long-tailed Tit, Goldcrest and Wren. Sparrowhawk, in half of all sites, easily retains 'Top Predator' slot, but Raven, Buzzard and Red Kite continue their expansion into new gardens. Sadly, some birds were noticeable by their absence, with both Marsh and Willow Tit failing to materialise at many GBFS feeding stations.

Some unusual species were noted during the February cold snap with Grey Partridge (Gwynedd), Lesser Spotted Woodpecker (Dyfed) and escapee California Quail (Kent) adding variety. Some species could only be tempted by water with Crossbill (Herts) and Waxwing (Perth) the stars. A Little Grebe taking grain (Dyfed) from the side of a pool brings the total number of species recorded by GBFS to 175 in its 39th winter. One wonders what the 40th year may bring, as we continue to see changes unimagined when the survey started, showing just how important continued long-term monitoring is.

WINTER 2008/09 EXPLAINED

- A second successive abysmal breeding season – fewer tits, thrushes and some finches.
- Coldest early winter for 30 years – pushing birds into gardens earlier than normal.
- Bumper crop of apples and pears – lots of windfalls for thrushes and gamebirds.
- A bitter new year and February snows – more thrushes, Goldcrest, Pied Wagtail and Wren pushed into gardens.
- Ongoing disease-related losses to *Trichomoniasis* and *Fringilla* papilloma virus.
- A warm,dry spring bringing thirsty birds into bird baths and feeders.


Changing fortunes...
...at UK garden birdtables. Starlings are being recorded in their smallest numbers ever, whilst Great Spotted Woodpeckers become increasingly frequent visitors. Fieldfares are drawn to garden fruit and seeds in cold winters and Bullfinches are venturing into gardens in larger numbers.
All Gardens
Rural
Urban (dotted)
Bullfinch
Fieldfare
Great Spotted Woodpecker
Starling
Mean peak count
Year
1970/71
1980/81
1990/91
2000/01

Bird Populations is an entirely electronic annual journal of dynamic global avian demography and biogeography that publishes original research and review papers dealing with changes in the numbers, demographics, distributions, and ecological relationships of birds. Papers providing documentation of quantitative changes in bird populations or distributions are preferred, but papers providing baseline population or distribution information are also acceptable. Papers describing or evaluating field techniques or analytical methods for assessing population and distribution changes are also welcome. Contributions are encouraged from throughout the world from both well-known and little-studied avifaunas. *Bird Populations* is published in English with abstracts in Spanish. *Bird Populations* can be accessed free-of-charge at www.birdpop.org.

Authors should submit one complete, double-spaced, electronic copy of each manuscript, in English, to: David G. Ainley, Editor, *Bird Populations*, dainley@penguinscience.com. Please contact David G. Ainley at H.T. Harvey and Associates, 983 University Avenue, Bldg D, Los Gatos, CA 95032, if you are unable to submit an electronic copy. Guidelines for preparing and submitting papers to *Bird Populations*, including the format for literature citations, are similar to those of *The Condor* and *Studies in Avian Biology*. Authors are urged to examine a recent volume of *Bird Populations* and follow the niceties of the journal's style. All research papers and review articles submitted to *Bird Populations* are subject to peer review.

Bird Populations also publishes, reprints, and provides links to reports of major avian monitoring programs from around the world. These reports are an important focus of the journal which is intended to serve as a yearbook on the status of the Earth's birdlife by bringing together, under a single cover, information from many widespread localities on the annual and interim changes in the abundance, demographics, and distribution of birds. We believe that publishing, reprinting, and providing links to these reports will draw attention in a timely manner to short-term avian population fluctuations that may ultimately prove to be geographically widespread or that may signal the beginnings of longer-term trends. We hope that the dissemination of these reports will provide ornithologists with a global informational network for addressing avian population changes, will encourage an integrative global approach to avian monitoring studies, will stimulate the establishment of additional avian monitoring programs, and ultimately will aid in the conservation of global avian diversity.

Any agency or organization from anywhere in the world coordinating or conducting a long-term, standardized avian monitoring program is invited to submit an annual (or longer time period) report of that program to *Bird Populations* for publication or reprinting. All reports submitted for original publication will undergo peer review. Please submit one complete, double-spaced, electronic copy of any such report, in English, to David G. Ainley, Editor, *Bird Populations*, dainley@penguinscience.com. Already published reports submitted for reprinting will not be peer reviewed, but will be screened by the Editor when first submitted with regard to the scope and scientific merit of the monitoring program and the appropriateness of the methods and analyses. Please submit electronic copies of such reports, in English, to the Editor. *Bird Populations* also invites the authors of previously published annual or interim reports of standardized avian monitoring programs to request that we provide an electronic link to their reports. Reports to which *Bird Populations* will provide a link do not need to be in English, but we ask that the authors provide an English translation of the abstract or summary. Reports to which we provide links will not be peer reviewed, but will be screened by the Editor when first submitted with regard to the scope and scientific merit of the monitoring program and the appropriateness of the methods and analyses.

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