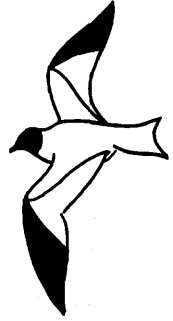


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A REVIEW OF THE STATUS OF THE WHITE-FACED IBIS IN WINTER IN CALIFORNIA

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The White-faced Ibis (*Plegadis chihi*) has been classified as a Bird Species of Special Concern in California (Remsen 1978, S. Laymon pers. comm.) and a potential candidate for federal threatened or endangered status (USFWS 1991, Trapp 1995) because of population declines in the western United States, particularly in the 1960s and 1970s (USFWS 1985, Ryder and Manry 1994). Although the breeding status of the ibis in this region has been reviewed (Ryder 1967, USFWS 1985, Ryder and Manry 1994), little has been published on its abundance and distribution in winter. Here we summarize data on the winter distribution, abundance, and habitat use of the White-faced Ibis in California during the last half century. We also estimate the current winter population size and review historical population trends.

METHODS

We determined the winter status of the White-faced Ibis from wetland censuses, roost counts, and published and unpublished observations. As part of Point Reyes Bird Observatory's Pacific Flyway Project, we organized surveys of all shorebirds and ibis in all key wetlands of California's Central Valley and the Mojave, Colorado, and southern Great Basin deserts once to twice per winter from November 1992 to February 1995. Surveys were conducted from the ground, except in the Central Valley where logistical constraints dictated a combination of aerial and ground counts. The aerial counts were conducted primarily from a Cessna 172 aircraft by Page and

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Shuford, the ground counts by a network of skilled volunteers, agency personnel, and project staff. We relied on ground counts for all wetlands in the San Joaquin Valley, except for the southern Tulare Basin, where we used aerial surveys for private duck clubs, a few other private wetlands, and flooded agricultural lands. Aside from the Tulare Basin, we did not survey much agricultural habitat in the San Joaquin Valley. We knew of no ibis concentrations in agricultural habitat in this region except next to the 72,000-ha Grasslands wetlands complex near Los Banos, Merced County, where roost counts described below appear to have included ibis from agricultural lands. Aerial surveys were the primary census method for the Suisun Marsh, Sacramento–San Joaquin River Delta (Delta), and Sacramento Valley, though we regularly undertook ground counts on federal and state wildlife areas and a few selected private wetlands and sewage ponds. We gathered data on habitat use by assigning observations of ibis occurrence to broad habitat categories, namely, managed state or federal wildlife refuges, managed duck clubs, pasture lands, rice-stubble fields, fallow fields, alfalfa fields, and reservoirs or ponds. We were not able to assign some flying ibis to specific habitats.

We also obtained data from counts of ibis coming to nighttime roost sites in four known areas of concentration. From 29 January to 11 April 1995, Safran and colleagues made 14 counts of ibis at a primary roost and 3 at a secondary roost at duck clubs in the Grasslands wetlands complex. Four to seven observers conducted coordinated counts at several roosts in the Grasslands and at Mendota Wildlife Area (WA), Fresno County, on 28 December 1995 and 29 January 1996. Three additional counts were taken at the main Grasslands roost site from 16 to 22 February 1996. From 5 December 1994 to 29 March 1995 and on 16 January 1996, K. Sturm, other Salton Sea National Wildlife Refuge (NWR) personnel, and volunteers made five counts at three to five roosts near Calipatria and Imperial in the Imperial Valley south of the Salton Sea, Imperial County. J. Pike conducted roost counts at the Prado Basin, Riverside and San Bernardino counties, on 28 February and 28 November 1995 and on 8 January and 26 February 1996. A. Montoya and B. Rasch counted ibis at a roost at Cibola NWR, Imperial County, on 7 dates from 5 December 1995 to 18 January 1996.

We also examined ibis counts taken by the California Department of Fish and Game during aerial waterfowl surveys of the Grasslands and Mendota WA, Fresno County, from November through February, 1980–81 to 1993–94; surveys for 1994–95 and 1995–96 were not used because they included only areas closed to hunting, where few ibis occurred.

For additional winter (Nov–Mar) records of White-faced Ibis in California, we searched the published literature, including the seasonal reports and Christmas Bird Counts (CBC) in *Audubon Field Notes* (AFN), *American Birds* (AB), and *National Audubon Society Field Notes* (NASFN); we checked the unpublished notebooks of the regional editors of the middle Pacific coast region of NASFN (cited as NB) and contacted regional and local experts in California. We summarized all CBC data and used them to assess population trends from 1970 to 1994 and to estimate the number of ibis wintering on the coastal slope of central and southern California in 1994–95, when our surveys from the more inland sections of California were most

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complete. CBC data for given years are reported by the beginning year of the count period (e.g., 1994 for 1994–95). We graphed data for only the two inland CBCs that sampled core areas for wintering ibis and had complete [Salton Sea (south)] or nearly complete (Los Banos, missed 1987) records from 1970 to 1994. We graphed numbers for all coastal CBCs (combined) from Ventura County southward from 1980 to 1994, when data were nearly complete for all sites. We also obtained specimen records of wintering ibis from the Los Angeles County Museum of Natural History (LACM), Museum of Vertebrate Zoology (MVZ), San Bernardino County Museum (SBCM), San Diego Natural History Museum (SDNHM), Santa Barbara Museum of Natural History (SBMNH), and Western Foundation of Vertebrate Zoology (WVZ).

Our designations of various drainage basins in the Central Valley follow the maps of the Central Valley Habitat Joint Venture (USFWS 1990), except that we include Mendota WA in the San Joaquin rather than the Tulare Basin.

RESULTS

Historical Status, Pre-1945

Data on the winter status of the White-faced Ibis in California prior to 1945 are very limited. Grinnell and Miller (1944) believed that the White-faced Ibis was chiefly a summer resident in California and that “in some years a few have wintered.” They listed the following wintering localities: between Colusa and Williams, Colusa County, in the Sacramento Valley; Stockton, San Joaquin County, in the Sacramento–San Joaquin River Delta; Los Banos, Merced County, in the San Joaquin Valley; and in Los Angeles County and near San Diego, San Diego County, along the southern California coast. They also listed records of “migrant or vagrant occurrence,” including a 10 December 1925 record from Humboldt Bay, Humboldt County, which falls outside the main historical or current wintering range (Figure 1). Other sites of pre-1945 winter ibis occurrence apparently unknown to Grinnell and Miller were Mendota Pool, Fresno County, and Tulare Lake in the southern San Joaquin Valley (see below and Appendix) and the Salton Sea, Imperial County (specimen [SDNHM 18121] collected by B. Bailey on 28 February 1940).

Grinnell et al. (1918) summarized most of what was known of the former abundance of ibis wintering in California. Up to that time the largest winter numbers noted were “several dozen” in the markets of Stockton in the winter of 1885, “more than a hundred” near Stockton on 9 February 1886, and “about 200” near Los Banos on 30 October 1914. W. Minturn (unpubl. field notes) recorded 100 on the Los Banos Game Refuge (now Los Banos WA) on 7 Dec 1935. He also recorded flocks of 300 and 200 on 28 Nov and 10 Dec 1938, respectively, from Tulare Lake (other records in Appendix) and of 12 on 28 March 1936 and 2 on 11 Feb 1939 near Mendota Pool, Fresno County. Holterhoff (1885) reported 20 from Mission Valley, San Diego County, on 1 January 1885, but considered a flock of this size “especially unusual” for the area. The only historical report from the Sacramento Valley was of two birds between Colusa and Williams, Colusa County, on 23 and 27

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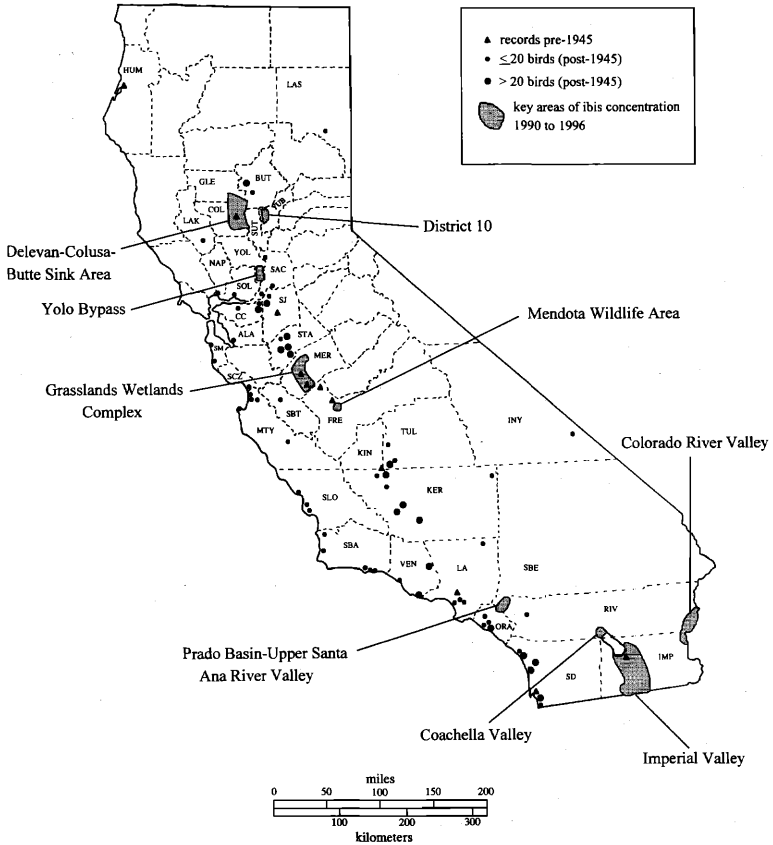


Figure 1. Historical and recent distribution of the White-faced Ibis in winter in California. Records since 1945 were not plotted if they fell within the key areas of ibis concentration, 1990 to 1996 (see Appendix for additional records). County abbreviations: ALA, Alameda; BUT, Butte; COL, Colusa; CC, Contra Costa; FRE, Fresno; GLE, Glenn; HUM, Humboldt; IMP, Imperial; INY, Inyo; KER, Kern; KIN, Kings; LAK, Lake; LAS, Lassen; LA, Los Angeles; MER, Merced; MTY, Monterey; NAP, Napa; ORA, Orange; RIV, Riverside; SAC, Sacramento; SBT, San Benito; SBE, San Bernardino; SD, San Diego; SJ, San Joaquin; SLO, San Luis Obispo; SM, San Mateo; SBA, Santa Barbara; SCZ, Santa Cruz; SOL, Solano; STA, Stanislaus; SUT, Sutter; TUL, Tulare; VEN, Ventura; YOL, Yolo; YUB, Yuba.

February 1941 (Harwell 1941). The largest number reported at any season was Belding's (1905) observation of a northbound passage of 4000 to 5000 ibis near Stockton from 5 to 7 May 1879. But neither he nor other authors (Grinnell et al. 1918, Grinnell and Miller 1944) speculated on whether or not these birds may have wintered in the Delta or elsewhere in California.

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Status, 1945 to Present

During the past 50 years, White-faced Ibis have wintered in California primarily in the Sacramento, San Joaquin, Coachella, Imperial, and Colorado River valleys and on the coastal slope from Ventura County southward (Figure 1), as documented below by region.

Great Basin Desert. The only winter record of ibis in the Great Basin is of one bird near Standish on the Honey Lake CBC on 21 December 1995 (Appendix).

Interior Coast Range. The only winter record of ibis in the northern Coast Range is of one bird at Clear Lake, Lake County, from 2 January to 5 February 1981 (Appendix).

Sacramento Valley. Wintering ibis were rare and irregular in the Sacramento Valley through the 1970s, with high counts of 11 in both November 1978 and March 1979 (Appendix). Numbers of sightings increased greatly in the 1980s, when flocks of up to 225 were seen regularly, usually at or near Colusa and Delevan NWRs in Colusa County (Appendix, M. Wolder in litt.). Numbers continued to increase in the 1990s. In 1990, up to 145 wintering ibis appeared at Sutter NWR, Sutter County, for the first time (M. Wolder in litt.). Eleven hundred ibis on 12 January 1994 and 1370 on 5 December 1994 at Delevan NWR (M. Wolder pers. comm.) may have represented the entire population in the Colusa Basin at the time (cf. Table 1). Ibis numbers on Pacific Flyway Project counts of the Sacramento Valley from November and January, 1992–93 to 1994–95, ranged from 763 to 3120 birds (Table 1). On these counts ibis concentrated in the Colusa Basin (Glenn and Colusa counties) from Willow Creek Waterfowl Management Area (WMA) south through Delevan NWR, Lurline WMA, and Colusa NWR; in the Butte Basin (Butte, Glenn, and Sutter counties) from the vicinity of the Little Dry Creek Unit of Upper Butte Basin WA south through the Butte Sink WMA; in District 10 of

Table 1 Numbers of White-faced Ibis on Pacific Flyway Project Winter Surveys of the Central Valley (Figure 1), 1993–1995

Subarea	Jan 1993	Nov 1993	Jan 1994	Nov 1994	Jan 1995
Colusa Basin	362	679	883	1275	1507
Butte Basin	401	755	862	1432	21
American Basin	0	102	110	101	75
Sutter Basin	0	116	28	12	6
Yolo Basin	0	25	282	300	2
Delta	0	0	0	13	60
Suisun Marsh ^a	0	1	2	—	—
San Joaquin Basin ^b	1479	3409	2949	3559	2556
Tulare Basin	54	1	0	206	1
Totals	2296	5088	5116	6898	4228

^aNo surveys of Suisun Marsh were conducted in November 1994 and January 1995.

^bNumbers of ibis on these surveys underrepresented the size of the wintering population of the San Joaquin Basin; see text for possible explanations.

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the American Basin north of Marysville (Yuba County); in the Sutter Basin (Sutter County) on or near Sutter NWR; and in the southern portion of the Yolo Bypass (Yolo County) (Figure 1).

Sacramento-San Joaquin River Delta. After 1886, ibis were not recorded in the Delta again until two were reported from Staten Island, San Joaquin County, on 3 Dec 1988 (NB). That ibis have been recorded on only 3 of 25 Stockton CBCs since 1969 (Table 2) documents the paucity of recent winter records for the Delta. We found 13 and 60 ibis on 2 of 5 winter surveys of the Delta from January 1993 to January 1995 (Table 1).

Suisun Marsh. The first winter records of ibis in the Suisun Marsh were of six birds at Grizzly Island WA, Solano County, in December 1975 and nine near West Pittsburg, Contra Costa County, in December 1982 (Appendix, Table 2). That ibis have been recorded on only 3 (all in 1990s) of 26 Benicia CBCs since 1969 (Table 2) indicates the scarcity of wintering ibis in the Suisun Marsh. We found only one to two ibis on two of three winter surveys from January 1993 to January 1994 (Table 1).

San Joaquin Valley. For the last 50 years, the Los Banos area, Merced County, has been a stronghold of ibis in the San Joaquin Valley. Although systematic surveys of the entire area are lacking, high numbers from opportunistic winter counts in the mid-1960s to late 1970s ranged from 100 to 250 (Appendix). Median numbers of wintering ibis on multi-species surveys of Los Banos WA were 0 in 1969 (min.-max. = 0-111, $n = 5$), 124 in 1970 (min.-max. = 20-200, $n = 7$), 72 in 1971 (min.-max. = 0-171, $n = 9$), 37 in 1972 (min.-max. = 0-50, $n = 4$), and 75 in 1973 (min.-max. = 0-130, $n = 7$); no ibis were seen on Volta WA on these surveys (R. O. Wilbur unpubl. data). Median numbers of ibis on the Los Banos CBC increased from 115 in both the 1970s and 1980s to 595 from 1990 to 1994 (Table 2, Figure 2). The more comprehensive California Department of Fish and Game aerial surveys of the Grasslands wetland complex near Los Banos and Mendota WA, Fresno County, also showed a marked increase in ibis numbers from 100-300 in the early 1980s, to 500-700 in the mid- to late 1980s, to 2000-2200 in 1992-93 and 1993-94 (Figure 3). Pacific Flyway counts in these same wetlands between January 1993 to January 1995 ranged from 1479 to 3559 ibis (Table 1).

Ten roost counts from late January to mid-March 1995 at the Willow Farms duck club in the north Grasslands, however, yielded 4323 to 7872 birds (median = 6050), and two mid-March counts at a smaller roost in the south Grasslands found 434 and 635 ibis, which were probably additional (Safran et al. pers. obs.). Coordinated roost counts in the greater Grasslands area on 28 December 1995 yielded 8682 ibis and on 29 January 1996 10,115-12,115 ibis. Of these, 6064 and about 6000-8000 were at Willow Farms duck club in the north Grasslands, 2300 and 3235 at one to two duck clubs in the south Grasslands, and 318 and 880 at Mendota WA (S. Brueggemann, M. Peters, T. Poole, D. Shuford et al. pers. obs.). Three additional counts at Willow Farms duck club from 16 to 22 February 1996 ranged from 5439 to 8192 ibis (S. Frazer in litt.).

Up to 145 ibis were reported to the north of the Grasslands along the San Joaquin River, Stanislaus County, from the late 1970s to the early 1990s (Appendix). Although ibis numbers may have increased there over this

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period, limited and irregular observer coverage in the 1990s makes assessment of trends difficult (H. Reeve pers. comm.).

After occasional sightings in the late 1940s and 1950s, small numbers of ibis began to be recorded regularly in the southern San Joaquin Valley, beginning in the 1980s in the Tulare Lake basin and Goose Lake bottoms areas of Kings, Tulare, and Kern counties (Appendix, Table 2). Numbers in these areas appear to have increased in the 1990s (Appendix). The highest count in the southern San Joaquin Valley was 500 ibis on 30 Dec 1995 foraging at shallow ponds along Brimhall Road southwest of Rosedale, Kern County and roosting at night about 3.5 km to the south in the Kern River recharge ponds southwest of Bakersfield (M. Chichester pers. comm.).

Northern and Central California Coast. Except for a 10 December 1925 record for Humboldt County previously cited, and recent records

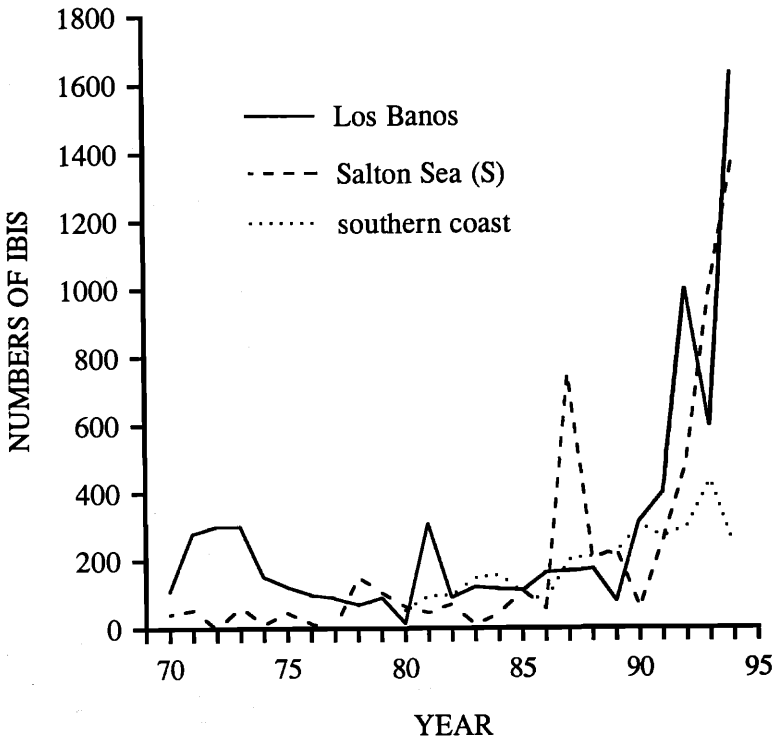


Figure 2. Trends in numbers of White-faced Ibis on Christmas Bird Counts, 1970 to 1994. Data presented separately for the two key inland counts—Los Banos and Salton Sea (south)—and for all counts combined on the southern California coast (Ventura County southward, 1980 to 1994). See Methods for explanation of data presentation and Table 2 and Appendix for additional CBC data.

Table 2 Numbers of White-faced Ibis on California Christmas Bird Counts, 1970–1994^a

Count name	1970 to 1979			1980 to 1989			1990 to 1994					
	No. counts/ total counts	min.	med.	max.	No. counts/ total counts	min.	med.	max.	No. counts/ total counts	min.	med.	max.
Northern Coast Range												
Clear Lake	0/5	0	0	0	1/9	0	0	1	0/5	0	0	0
Sacramento Valley												
Peace Valley	0/7	0	0	0	0/10	0	0	0	2/5	0	0	4
Sacramento	0/10	0	0	0	0/10	0	0	0	2/5	0	0	21
Suisun Marsh												
Benicia	0/10	0	0	0	0/10	0	0	0	3/5	0	1	13
Contra Costa County												
Sacramento–San Joaquin River Delta	0/10	0	0	0	1/10	0	0	9	0/4	0	0	0
Stockton	0/10	0	0	0	1/10	0	0	1	2/4	0	3.5	94
San Joaquin Valley												
Caswell–Westley	—	—	—	—	4/6	0	1	22	1/5	0	0	67
Los Banos	10/10	68	115	301	9/9	15	115	307	5/5	313	595	1631
Creighton Ranch	—	—	—	—	1/5	0	0	2	—	—	—	—
Buena Vista	—	—	—	—	0/1	0	0	0	1/2	0	30	60
Central and Southern Coast												
Moss Landing	0/5	0	0	0	2/10	0	0	1	5/5	1	3	6
Santa Maria–Guadalupe	0/1	0	0	0	1/9	0	0	1	0/5	0	0	0
La Purisima	—	—	—	—	1/3	0	0	1	0/4	0	0	0
Santa Barbara	2/10	0	0	2	0/9	0	0	0	0/5	0	0	0
Ventura	—	—	—	—	1/10	0	0	1	1/5	0	0	14
Thousand Oaks	2/7	0	0	11	3/10	0	0	60	5/5	2	78	82
Pasadena–San Gabriel Valley												
Pasadena–San Gabriel Valley	0/10	0	0	0	0/10	0	0	0	3/5	0	1	2
San Bernardino Valley	0/10	0	0	0	0/10	0	0	0	1/4	0	0	30
Santa Ana River Valley	0/50	0	0	0	3/9	0	0	134	5/5	1	65	151
Orange County (northeastern)	1/9	0	0	5	0/10	0	0	0	1/5	0	0	1

Orange County (coastal)	5/10	0	0.5	8	2/10	0	0	1	4/5	0	2	8
Oceanside-Vista-Carlsbad	10/10	1	9.5	68	10/10	8	37	100	5/5	36	145	184
Escondido	—	—	—	—	2/5	0	0	6	4/5	0	41	75
Rancho Santa Fe	—	—	—	—	10/10	2	13.5	55	4/5	0	6	23
San Diego	2/9	0	0	6	9/10	0	12	100	2/5	0	0	4
<i>Coachella and Imperial Valleys</i>												
Salton Sea (north)	3/10	0	0	280	7/7	15	67	256	5/5	138	217	570
Salton Sea (south)	8/10	0	43.5	150	10/10	9	67.5	746	5/5	58	485	1366
<i>Other Interior Sites</i>												
Lancaster	—	—	—	—	1/10	0	0	2	0/5	0	0	0
Sespe WA	0/9	0	0	0	1/6	0	0	66	—	—	—	—

^aData reported as ratio of number of counts on which ibis were counted to number of counts taken, minimum count, median count, and maximum count. The limited data available prior to 1970 are reported in the text or the Appendix.

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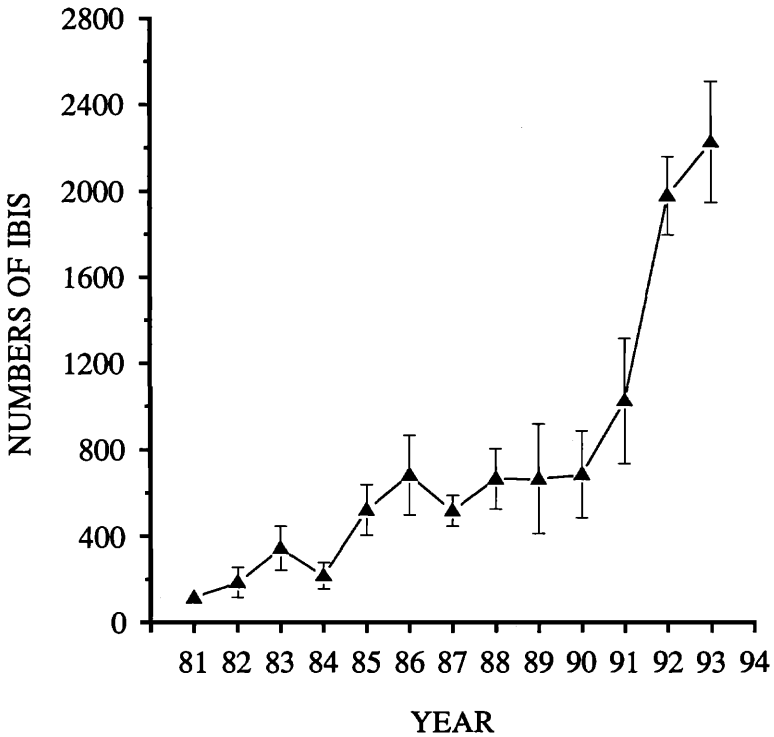


Figure 3. Numbers of White-faced Ibis on California Department of Fish and Game winter (Nov–Feb) waterfowl surveys of the Grasslands wetlands complex around Los Banos, Merced County, and Mendota WA, Fresno County, 1981–82 to 1993–94. Data expressed as means (± 1 standard error).

there in early November (presumably representing late fall migrants), there are no winter records of ibis for the California coast north of San Francisco Bay (Appendix). In the San Francisco Bay area there are only four winter records (from Napa, Alameda, and San Mateo counties; Appendix). In Santa Cruz County, one to six ibis have been recorded irregularly in winter since 1991 (Appendix). In Monterey County, aside from one sighting in 1953, all winter records are post-1980 and range from one to seven individuals each (Appendix, Table 2). The lone record for San Benito County is of one ibis at Paicines Reservoir on 24 December 1995 (D. Serdehelyi fide K. Van Vuren).

Southern California Coast. Ibis have continued to winter on the southern California coast in recent decades. They occur irregularly in San Luis Obispo and Santa Barbara counties and regularly, though locally, from Ventura County south to the Mexican border (Figure 1, Table 2, Appendix). The core areas of most regular occurrence are near Point Mugu, Ventura

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County; the Prado Basin and adjoining upper Santa Ana River Valley area of western San Bernardino and Riverside counties; and lowlands of northwestern San Diego County from the Santa Margarita River to the San Dieguito River (Del Mar and Lake Hodges). The largest numbers have been at a nighttime roost at the Prado Basin, where there were 630 birds on 28 February 1995 and 680 birds on 26 February 1996 (J. Pike in litt.). The Santa Ana River Valley CBC, on which ibis numbers have increased greatly from the 1980s to the 1990s, samples only a portion of the agricultural fields of that river valley and the Prado Basin used by ibis (L. LaPré in litt.).

Reports of declines in wintering ibis on the southern California coast in the 1970s (Remsen 1978; AB 25:627, 29:741) seem equivocal in light of CBC data. Median ibis numbers on the Orange County (coastal) CBC decreased from 5 (min. = 0, max. = 16) from 1960 to 1969 to 0.5 (min. = 0, max. = 8) from 1970 to 1979, whereas on the Oceanside-Vista-Carlsbad CBC they increased from 2 (min. = 0, max. = 20) to 9.5 (min. = 1, max. = 68) over a similar period. Overall ibis numbers increased on the southern coast in the 1980s and, particularly, the 1990s (Table 2, Figure 2). This was not universal, though; despite increases on most counts, ibis numbers decreased from the 1980s to the 1990s on the Rancho Santa Fe and San Diego counts (Table 2). During this period, however, there was inconsistent observer coverage of potential ibis habitat on the Rancho Santa Fe CBC, and decreases in ibis numbers on the San Diego CBC are attributable to the termination of alfalfa growing and abandonment of moist agland in the Tijuana River Valley, the only area where the species was ever regular on the count (P. Unitt pers. comm.).

Imperial and Coachella Valleys. Although first recorded in the region in winter in 1940, by the late 1940s and early 1950s up to 3500 White-faced Ibis were being reported from the vicinity of the Salton Sea, Imperial County (Appendix). By the mid-1950s numbers had declined sharply, and through the 1970s the highest counts were in the low hundreds (Appendix). Numbers increased greatly in the 1980s to 1990s, as evidenced by opportunistic January counts of 450 near Seeley in 1983 and 6000 near Brawley in 1989 (Appendix) and by sharp upward trends on the Salton Sea (south) (Table 2, Figure 2) and Salton Sea (north) CBCs (Table 2). The true magnitude of the increase was revealed by Pacific Flyway Project counts of up to 16,000 ibis at various nighttime roosts in agricultural lands in the Imperial Valley in 1994–95 and 1995–96 (Table 3).

Colorado River Valley. Rosenberg et al. (1991) considered the White-faced Ibis a rare but regular winter visitor along the lower Colorado River Valley. They did not list any specific winter records for the California side of the river but did cite counts of up to 50 ibis for adjacent Arizona. On a 8 December 1993 Pacific Flyway Project survey, 95 ibis were found in agricultural lands south of Blythe, Riverside County, California (B. W. Anderson in litt.). In recent years, wintering ibis have been associated with agricultural fields on the California side of the Colorado River Valley in two disjunct areas: from Parker Dam south to Cibola NWR and from Imperial Dam south to Yuma (B. W. Anderson pers. comm.). Numbers of ibis at a roost north of Oxbow Lake, Cibola NWR, Imperial County, that reached a peak of 350 on 5 December 1995 had dwindled to 40 by 18 January 1996 (B. Rasch in litt.).

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Table 3 Numbers of White-faced Ibis Counted at Evening Roosts at Various Sites in the Imperial Valley, Imperial County, Winters 1994–95 and 1995–96^a

Roost Sites	1994	1995			1996
	Dec	Jan ^b	Feb	Mar	Jan ^c
Ramer Lake ^d	7935	1007	2144	7100	4046
Ostercamp duck club ^e	2500	115	dry	dry	3500
Mesquite Lake duck club ^e	5400	1	3000	2169	700
McElvaney duck club ^e	—	—	838	—	—
Wilderness Unlimited duck club ^e	—	—	3420	3354	435
Totals	15,835	1123	9402	12,623	8681

^aData from K. Sturm et al./Salton Sea NWR.

^bHeavy rain showers prior to count may have influenced numbers.

^cWindy at time of count, and many ibis already at roost sites when survey began, making them hard to count.

^dLocated 4.5 km S of Calipatria.

^eLocated within an 8-km arc NE to SE of Imperial.

Other Sites in the Interior of Southern California. One or two ibis have been recorded in winter in Death Valley, Inyo County, at China Lake, Kern County, at Corona and the San Jacinto Valley, Riverside County, and near Lancaster, Los Angeles County (Appendix).

Estimated Winter Population Size: 1994–95

From counts we estimated that a minimum of 27,800 to 28,800 ibis were wintering in California in 1994–95. Of these, 2000–3000 were in the Sacramento Valley (Table 1), ≤ 60 in the Sacramento–San Joaquin River Delta (Table 1), at least 13 in the Suisun Marsh (Benicia CBC), up to 8000 in the Grasslands wetlands area in the San Joaquin Valley, ≤ 200 in the Tulare Basin of the San Joaquin Valley (Table 1), at least 570 in the Coachella Valley [Salton Sea (north) CBC], up to 16,000 in the Imperial Valley (Table 3), at least 95 along the Colorado River in the Palo Verde Valley, Riverside County (B. W. Anderson in litt.), and at least 873 along the coastal slope of central and southern California (630 in Prado Basin, Riverside Co.—J. Pike in litt.; rest on various CBCs, NASFN 49:788–835).

Habitat Use

Habitat use by wintering ibis in California varies by region. On five winter surveys of the Sacramento Valley, ibis were concentrated in agricultural fields and managed wetlands (Table 4). Agricultural fields supported an average of 66% [standard error (SE) = 6.45, min. = 52%, max. = 87%] of all ibis on these surveys; rice stubble fields were the single most important habitat, as they held on average 53% (SE = 7.98, min. = 23%, max. = 79%) of all ibis. State, federal, and private wetlands combined supported an

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average of 28% (SE = 6.90, min. = 7%, max. = 47%) of the ibis. Pasture lands supported 6% of all ibis on one of the five surveys. Flying birds that we were unable to assign to habitat ranged from 0% to 14% of the ibis on the surveys. We believe the percentages reported in Table 4 reflect the habitat distribution of foraging rather than roosting ibis. Despite the presence of apparently suitable foraging habitat throughout much of the Sacramento Valley during our winter surveys, all ibis recorded were within five kilometers of managed wetlands. We did not locate nighttime ibis roosts in the Sacramento Valley, but suspect that they were in managed wetlands, as in the San Joaquin and Imperial valleys.

It was difficult to compare ibis use among habitats in the San Joaquin Valley because we did not survey most agricultural fields directly. At the Grasslands wetlands, much larger ibis numbers at evening roosts suggest that we either greatly undercounted ibis foraging during the day and/or missed many ibis because of minimal coverage of agricultural lands. Information on use of agricultural habitats in the San Joaquin Valley is fragmentary. The largest number reported from agricultural lands in winter was about 500 in an irrigated pasture near Los Banos in winter 1994-95 (D. Wollington pers. comm.). Safran observed about 200 ibis foraging in flooded alfalfa fields west of Kesterson NWR, Merced County, on 18 March 1995. During March that year, water levels in nearby duck clubs were high from an extended period of heavy rain, and ibis were rarely seen foraging in these wetlands. Hundreds of ibis flying south along the San Joaquin River in northern Merced County on 11 February 1995 had likely been foraging in nearby pasture lands (S. Frazer pers. comm.). G. Gerstenberg and H. Reeve (pers. comm.) also have seen smaller numbers of ibis foraging periodically in pastures and other agricultural fields in Merced and Stanislaus counties in winter.

On five ground counts in managed wetlands in the Grasslands, about 66.6% of the ibis (SE 6.54, min. = 47%, max. = 84%) were on private duck

Table 4 Percentage of White-faced Ibis Found in Various Habitats on Surveys of the Sacramento Valley, Winters 1992-93 to 1994-95

Habitats	Nov 1993	Nov 1994	Jan 1993	Jan 1994	Jan 1995
Managed refuges	7	1	8	7	41
Managed duck clubs	0	35	5	31	6
Pasture lands	0	0	0	0	6
Rice stubble fields	79	57	53	53	23
Fallow fields	0	0	34	0	23
Alfalfa fields	0	<1	0	0	0
Flying birds	14	6	0	9	0
Total numbers	1677	3120	763	2165	1611

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clubs and 33.4% (SE = 6.54, min. = 16%, max. = 53%) were on state and federal wildlife refuges. This suggests that on average ibis showed no preference for either type of wetland, as private lands make up about two-thirds and public lands about one-third of the wetlands in the Grasslands (T. Poole pers. comm.). At the large nighttime roost at the Willow Farms duck club in the Grasslands, ibis were standing in shallow open water at the center of a 52.6-ha pond bordered on the margins with 90% emergent vegetation—75% Broad-leaved Cattail (*Typha latifolia*) and 25% Hardstem Bulrush (*Scirpus acutus*) (Safran pers. obs.) At Mendota WA in December 1995 ibis were roosting amid annual vegetation up to a meter tall on slightly submerged or exposed islands in ponds (S. Brueggemann in litt.).

In the Coachella Valley–Salton Sea–Imperial Valley area, the vast majority of the thousands of ibis appeared to forage in irrigated agricultural lands, particularly alfalfa and wheat (K. Sturm pers. comm.). U. S. Fish and Wildlife aerial waterfowl surveys of all key wetland habitats there on 15 February and 23 March 1994 found only 75 and 30 ibis, respectively (K. DesRoberts in litt.). By contrast, all large nighttime ibis roosts in the Imperial Valley were on managed wetlands (Table 3), where birds roosted either in open ponds, in stands of drowned Saltcedar trees (*Tamarix chinensis*), or in cattails (K. Sturm pers. comm.). Ibis wintering near the Colorado River also concentrated their foraging in alfalfa fields (B. W. Anderson pers. comm.).

On the coastal slope of central and southern California wintering ibis use a variety of habitats including marshy pasture lands, managed or natural freshwater marsh, pond edges and lakeshores, and, occasionally, the margins of brackish lagoons and estuaries (R. L. Barber, D. DesJardin, L. LaPré, D. Roberson, K. Weaver, and D. Willick in litt.).

DISCUSSION

Historical Status

It is difficult to compare the picture of the historical status of wintering ibis in California painted by Grinnell and Miller (1944) to that which we have compiled for the last half century. Grinnell and Miller (1944) listed only 5 sites where ibis were known to winter, but from unpublished sources we have located three additional sites where ibis wintered prior to 1941. Two of these sites—the Mendota area and the Salton Sea—are currently of major importance to wintering ibis. The Tulare Lake area currently does not support large numbers of wintering ibis, but given that under favorable conditions it was formerly the largest freshwater lake and marsh system west of the Mississippi River (Johnson et al. 1993, Thelander and Crabtree 1994), it seems likely that this site, along with the Los Banos area, had the potential historically to have been a stronghold of wintering ibis in California. In fact, the highest numbers recorded before 1940 were from Tulare Lake, the Los Banos area, and the Delta.

Grinnell and Miller (1944) implied that the ibis formerly wintered only irregularly in California. By contrast, unpublished observations by W. Minturn indicate that in the late 1930s and early 1940s, at least, ibis were of regular occurrence in the San Joaquin Valley. This single observer recorded ibis in

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winter in this region in at least 6 of the 8 years from 1935 to 1942 and had at least two sightings in each of 4 years (Appendix). Grinnell et al. (1918) concluded that because of the small winter population at the time hunting probably had little effect on ibis numbers in California. But the state's having from 1866 to 1915 an October to March open season and a bag limit of 20–25 ibis argues that the species must have occurred at least somewhat regularly to warrant such regulations. Prior to these regulations, Kennerly (1859) and Heermann (1859), respectively, reported that ibis were “very common” in the market in San Francisco and often on sale in the California markets.

The remark by Grinnell et al. (1918: 1) that California up to that time had a small number of careful observers, coupled with the difficulty then of travel to remote parts of the state, must have biased these authors' appreciation of the status of ibis in comparison to our knowledge from recent decades, when both observer coverage and ease of travel have increased greatly. Today the Mendota area still gets limited observer coverage as reflected in the few reports of wintering ibis there (Appendix) even in the 1980s and 1990s when ibis numbers were expanding rapidly and hundreds were seen on systematic surveys. By contrast, the Los Banos area has had much better coverage, and during the species' population low for the last half century in the 1970s the species was still recorded annually (Appendix). It is unclear whether ibis were not recorded in winter in the Imperial Valley until 1940 because they first colonized the area then, possibly in response to changing agricultural practices, or because they were previously overlooked. Although Grinnell and his colleagues made superlative efforts to document the avifauna of the state via various monographs (e.g., Grinnell 1923, Grinnell et al. 1930), no substantial historical publications exist on the waterbird avifauna of most of the state's great (or formerly great) interior wetlands and lakes, such as Tulare, Mono, and Owens lakes and the Salton Sea (see Jehl 1994). Hence, our historical knowledge of the wetland avifauna of these areas and the Central Valley is fragmentary at best.

It is also difficult to compare the numbers of ibis reported by Grinnell et al. (1918) to those from similar unsystematic surveys in recent decades. For example, the low numbers cited above for the Los Banos area prior to 1940, when observers were also few, ranged up to 200 ibis. By contrast, when multi-observer systematic surveys of most wetland habitat at the Grasslands and Mendota WA in the 1990s found up to 3500 ibis and roost counts found up to 10,000–12,000, other single observers making occasional observations reported numbers only up to the 300–500 range (Appendix). Similarly, during studies of foraging ibis in duck clubs in the Grasslands in 1994–95, Safran's records of 49 scattered flocks with an average size of 18 birds (SE = 4.27, min. = 1, max. 183) did not even hint at the total size of the ibis population documented by roost counts.

In the post-Grinnell and Miller era, both an increase in observers and the publication of seasonal reports in *Audubon Field Notes* and its predecessors improved the documentation of ibis numbers. Still, through the 1950s and 1960s, data for most regions of the state remained too limited to reveal populations trends. An exception to this was in the Imperial Valley, where high counts of up to 3500 ibis in the late 1940s and early 1950s dropped

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to the low 100s by the 1970s, when numbers appeared to reach a nadir statewide.

By far the best documented population change in wintering ibis in California was from the 1980s through the 1990s, when our compilation of ground and aerial wetland surveys, roost counts, CBCs, and anecdotal observations all showed a many-fold increase over numbers in the 1970s. Although population estimates of wintering ibis in 1994–95 were the highest yet recorded this may not necessarily have been the peak period of ibis abundance in California, given the limited prior data available. For example, the high counts of up to 3500 ibis in the Imperial Valley in the 1940s and 1950s may have rivaled those in the 1990s. In the latter period, single-observer counts (comparable to those in the earlier period) rarely exceeded 1000 birds (a count of 6000 in 1989 was exceptional; Appendix), whereas only by roost counts were 16,000 ibis found in 1994.

Causes of Recent Population Increases

We suspect that recent large increases in the wintering White-faced Ibis population in California reflect increased numbers on the breeding grounds, particularly in the western portion of the range. Despite a lack of rangewide surveys of breeding colonies, Ryder and Manry (1994) concluded that White-faced Ibis populations have increased in the West in the last two decades because of improved nesting habitat management, increased planting of alfalfa used by foraging ibis, the ban on DDT and other pesticides in the 1970s, and improved breeding success at major colonies. At Lower Klamath NWR, Siskiyou County, a large increase in nesting ibis from the 1980s to the 1990s appears to have been aided by the conversion of 1600 hectares of planted grain crops to new marshlands, since used extensively as colony sites, and changing water management practices improving ibis foraging habitat (D. Mauser pers. comm.). On a broader scale, efforts in the 1980s to enhance habitat quality and increase the extent of wetlands in California for waterfowl (Heitmeyer et al. 1989) also may have benefited wintering ibis. Fleury and Sherry (1995) reported dramatic increases in ibis and other colonial waders in Louisiana from 1949 to 1988, particularly during the last 20 years, which they attributed to an increase in acreage of crayfish aquaculture. By contrast, we know of no large increases in habitat used by ibis at the key California wintering areas at the Grasslands (T. Poole pers. comm.) or the Imperial Valley that would explain recent increases in the wintering population. In the Imperial Valley, acreage of alfalfa increased somewhat from the 1970s to the 1980s while acreage of other field crops, some of which probably were also used by ibis, decreased sharply (Figure 4).

That ibis readily shift breeding sites as fluctuating water levels affect habitat conditions makes assessment of rangewide population trends difficult. Large population increases in the 1980s and early 1990s of breeders at the western edge of the range in the Harney Basin, Oregon, and Lower Klamath NWR, California (and in eastern Idaho), may have resulted at least in part from displacement of ibis from Great Salt Lake, Utah, by flooding in the early and mid-1980s (Ivey et al. 1988, Taylor et al. 1989) or shifting among various colonies during droughts in the late 1980s and early 1990s. The key colonies in the eastern Great Basin at Great Salt Lake were reduced

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80% from 1982 to 1985 by flooding (Ivey et al. 1988). Conversely, Oregon populations increased from <1000 pairs in the early 1980s to 2595 pairs in 1987 (Ivey et al. 1988), and the Lower Klamath population increased from 12 pairs in 1986 to 3900 pairs in 1994 (D. Mauser pers. comm.). These rates of increase seem too rapid to be from recruitment of locally produced young (Ivey et al. 1988). In the Lahontan Valley, Nevada, there was no unidirectional population trend in the 1980s. Instead, a population that exceeded 3000 pairs (peak 5930) in 7 of 12 years from 1979 to 1990 dropped to 0 and 450 pairs, respectively, during the extreme drought years of 1977 and 1992 (Henny and Herron 1989, L. Neel in litt.). A dearth of non-breeders remaining during these droughts suggests that birds from Nevada shifted to other areas to breed.

Limited band-recovery data also suggest that the increase in the wintering ibis population in California mirrors the western expansion and productivity of breeding ibis. The 11,462 ibis banded in the Great Basin/Intermountain West region from 1916 to 1994 produced 172 winter (Nov-Mar) recoveries (National Biological Service, Bird Banding Lab unpubl. data; Ryder 1967). California accounted for 2 of 15 recoveries from 3597 ibis banded in the

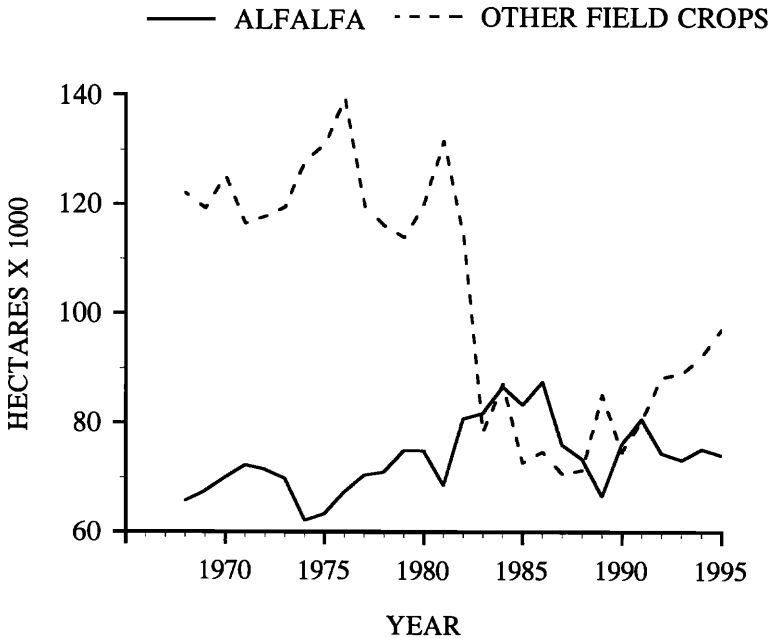


Figure 4. Acreage of irrigated alfalfa and other field crops in the Imperial Valley, Imperial County, California, 1968 to 1995. Data from Imperial Irrigation District via J. Setmire, Bureau of Reclamation.

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western portion of the region (California, Oregon, Nevada) and 1 of 157 recoveries from 7865 banded in the eastern portion of the region (Idaho, Utah). Although the number of recoveries from California is too low to allow for a powerful statistical test, these data suggest that ibis wintering in California are more likely to originate from the western rather than the eastern portion of the breeding range. The small sample size of winter recoveries also suggests that many ibis wintering in the San Joaquin Valley of California may be coming from breeding colonies in Oregon or perhaps from nearby Lower Klamath NWR, California, where thousands of ibis are now breeding (banding first began in 1995; J. Hainline pers. comm.). All three winter recoveries in California were from the San Joaquin Valley (2 from Oregon colonies [1572 banded], 1 from Utah [6674 banded]). Color-banding of 1205 ibis in 1995 at various breeding sites in the western Great Basin has yielded promising preliminary results in unraveling the species' migratory pathways to wintering grounds (B. Henry and E. Kelchlin pers. comm.). As of late January 1996, of 15 winter (Nov-Jan) recoveries of ibis color-banded in the Lahontan Valley, Nevada, 10 were from California (8 from Imperial Valley, 1 from San Joaquin Valley, 1 from interior Monterey County), 3 from the Arizona side of the Colorado River at Cibola NWR, and 2 from Bosque del Apache NWR, New Mexico (Kelchlin 1996, E. Kelchlin pers. comm.). As at least six of these ibis, including adults, were banded in September, they may have represented birds from other colonies that were staging at Stillwater NWR during migration.

Habitat Use

Although our data document broad patterns of habitat use on the wintering grounds in California, there is much more to be learned about ibis foraging and roosting needs. Visual observations or radio-tracking of ibis coming to or leaving roosts would be valuable to better determine their local dispersal and habitat use patterns. Observations in the Grasslands area suggest that wintering ibis may respond opportunistically to changing food resources, particularly by shifting from managed wetlands to agricultural lands after heavy winter rains. Similarly, during extreme flooding in the Sacramento Valley in January 1995, ibis were forced from favored foraging areas (Shuford and Page pers. obs.). Detailed work has been conducted on foraging-site preferences of ibis in agricultural fields near breeding colonies in Nevada (Bray and Klebenow 1988), but little such information is available for the wintering grounds and how ibis respond to temporal changes in habitat conditions.

Threats to Wintering Ibis

Ryder and Manry (1994) reported that the size of the North American nesting population of the White-faced Ibis decreased precipitously in the 1960s and 1970s because of pesticides and loss of habitat to drought and drainage. In California, a loss of 91% of the state's wetlands (Dahl 1990), much of it prior to the 1960s (Frayer et al. 1989), must have had a great impact on both breeding and wintering populations of ibis. It is unclear to what degree an increase in agricultural habitats used by ibis has offset losses of wetlands. Nevertheless, that the increase in the number of ibis wintering in

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California in the 1980s and 1990s occurred after a period of great habitat loss emphasizes the need to protect habitat that may be used intermittently by a nomadic species that is responding to habitat conditions over a broad range.

Although most organochlorine pesticides have been banned for use in the U.S. since the 1970s, White-faced Ibis are still being affected. At Carson Lake, Nevada, in 1985 and 1986, DDE accumulation affected about 40% of the breeding ibis population and lowered overall reproductive success by about 20% (Henny and Herron 1989). Investigations from 1989 to 1991 at Lower Klamath and Colusa NWRs also found high levels of DDE and eggshell thinning in ibis (S. Schwarzbach in litt.). At Colusa, at least, reproductive success was impaired, and eggshell thinning was similar to that in the DDE-contaminated colony at Carson Lake (Dileanis et al. 1992, S. Schwarzbach in litt.). Birds from these Nevada and California breeding colonies are thought to have been exposed to pesticides on the wintering grounds (Henny and Herron 1989, S. Schwarzbach pers. comm.), perhaps to DDT used recently in Mexico (Henny and Herron 1989). Between 1986 and 1990, wintering White-faced Ibis in the Imperial Valley had DDE levels in their tissues similar to those found in ibis eggs at Carson Lake, but, in contrast, appeared to accumulate DDE by foraging in agricultural fields on invertebrates that were concentrating pesticides remaining in the soil from historical, rather than recent, use (Setmire et al. 1993). Levels of DDE residues in the Imperial Valley are among the highest in the U. S. (J. Bennett pers. comm.). Comparisons of the various organochlorine compounds in ibis samples from Colusa NWR and the Imperial Valley suggest that the Colusa birds were not wintering in the Imperial Valley (S. Schwarzbach pers. comm.).

When agricultural drainage was formerly a main source of water for the Grasslands wetlands in the San Joaquin Valley, selenium accumulated to levels sufficient to cause reproductive harm to various birds (Ohlendorf et al. 1987). Since a change to an uncontaminated supply of water for the Grasslands in 1985, selenium levels have declined steadily, though concentrations in some species are still above those associated with impairment of reproduction (Hothem and Welsh 1994a, 1994b; F. L. Pavaglio pers. comm.). Although agricultural fields in the area might prove to be a source of pesticide contamination, this important foraging habitat for ibis serves as a buffer from urbanization that might replace or degrade the adjacent wetland habitat upon which ibis and many other wetland species depend (Fredrickson and Laubhan 1995, Thomas Reid Associates 1995).

More work is needed in both the U. S. and Mexico to assess whether current wintering habitat is too contaminated to provide for the long-term health of ibis populations.

Monitoring

Ryder and Manry (1994) recommended long-term monitoring of ibis populations via coordinated, standardized surveys covering colonies throughout the entire breeding range. They did not make any recommendations regarding monitoring of wintering populations. We feel that population monitoring in wintering areas would complement that on the breeding grounds by identifying key wintering habitats, determining trends in winter distribution and abundance, and pinpointing areas where wintering ibis face risks to their survival.

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Current methods are not adequate to monitor wintering populations of ibis. Data gathered opportunistically or by Christmas Bird Counts have only a limited ability to track trends in winter populations of ibis. Aerial surveys in the Grasslands of the San Joaquin Valley have proved valuable for detecting trends of ibis using local wetlands, but these counts give only an index of population trends for that whole region. Because prior aerial surveys were designed to monitor waterfowl populations they did not cover agricultural lands and often concentrated their efforts on zones closed to hunting, which few ibis use. Although aerial surveys could be used to monitor ibis populations, they would work best if surveys for ibis were conducted separately from those for waterfowl and all ibis habitats were covered thoroughly.

We believe that annual coordinated roost counts taken at all key ibis wintering areas over a short period would be the best method to monitor population trends of wintering ibis. Roost counts need survey only a few sites where ibis concentrate after foraging over a large area and can be conducted by relatively few people at low cost. Because White-faced Ibis are opportunistic and may shift wintering areas, local foraging areas, and roost sites over relatively short periods, to be successful monitoring efforts will also have to be opportunistic. Periodic aerial surveys might be best used to identify locations of roosts.

SUMMARY

Historical data on the distribution and abundance of the White-faced Ibis in winter in California are limited. Winter numbers declined to a low point in the 1970s, began to increase in the 1980s, and increased sharply in the early 1990s. Winter surveys in 1994–95 found at least 28,000 ibis in California, with the largest concentrations in the Sacramento Valley (2000–3000), the Grasslands of the San Joaquin Valley (8000), and the Imperial Valley (16,000). Additional surveys in 1995–96 estimated about 10,000 to 12,000 ibis in the greater Grasslands area. The wintering population in California likely increased as a byproduct of a westward shift in the abundance of breeding ibis, perhaps caused by a combination of flooding at Great Salt Lake, Utah, in the 1980s, similar shifts caused by drought conditions in the late 1980s to early 1990s, and improved habitat conditions on the breeding grounds in Oregon and northern California. Most ibis wintering in California forage in managed wetlands or agricultural fields, and private lands provide the majority of foraging habitat in all of the state's main wintering areas. Even in areas, such as the Imperial Valley, where ibis forage mostly in fields, managed wetlands are extremely important as nighttime roost sites. Ibis wintering in California remain at risk from accumulation of toxins, particularly in the Imperial Valley where they concentrate DDE residues that persist in the soil from historical use. Population monitoring on the wintering grounds is needed to identify key wintering areas, assess trends in wintering populations, and pinpoint areas where wintering ibis may face risks to their survival.

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APPENDIX

Winter (Nov–Mar) Records of the White-faced Ibis in California, 1908–09 to 1995–96, Other Than Those Listed or Summarized in the Text

Great Basin Desert

Lassen County: Bass Hill WA, near Standish, 21 Dec 1995 (T. D. Manolis).

Interior Coast Range

Lake County: Anderson Marsh, 1, 2 Jan 1981 (AB 35:331); Clear Lake CBC, 1, 4 Jan 1981 (AB 35:705); 3 km S of Lower Lake, 1, 5 Feb 1981 (AB 35:331, NB); all records probably pertain to the same bird.

Sacramento Valley

Glenn County: 11 km S of Willows, 1, 16–18 Mar 1955 (AFN 9:354, NB); Willows, 1, 16 Mar 1976 (AB 30:761); Sacramento NWR, 5 individual records, Dec–Jan 1965–66 (AFN 20:454); present, 12 Feb 1973; 1, 16 Mar 1976 (NB); 11, 4 Nov 1978 (AB 33:210); 1–3, Nov 1982; 33, 31 Jan 1984; 40, winter 1983–84; 25, 3 Jan 1985; 50, 22 Nov 1986; McGowan Ranch, Biggs–Afton Rd., 25, 2 Dec 1990 (NB).

Butte County: 1.6 km E of Butte Creek at Gridley–Colusa Hwy, 9, 24 Nov 1987; Gray Lodge WA, 1, 17 Mar 1981 (NB); 3, 20 Dec 1986 (AB 41:322); 2, 27 Nov 1987 (NB); 80, 3 Dec 1988 (B. E. Deuel); 60, 1 Dec 1990 (E. C. Beedy); 4, 26 Dec 1991; 1, 4 Dec 1993; 1, 28 Dec 1993 (B. E. Deuel); 65, 4 Dec 1991 (NB); 6, 28 Dec 1995 (E. C. Beedy); W of Biggs, 1, 14 Nov 1993 (T. D. Manolis); Little Dry Creek Unit, Upper Butte Basin WA, 7, 16 Nov 1989 (J. H. Snowden); 400, 5 Dec 1990 (B. E. Deuel); SW of Dayton, 110+, 2 Nov 1995 (J. H. Snowden).

Colusa County (other records for Colusa and Delevan NWRs available via Sacra-

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mento NWR complex): Delevan NWR, 3, 3 Nov 1973 (NB); 11, 16 Mar 1979 (AB 33:803); 45, 11 Nov 1982; 80, 27 Jan 1984; 60, 28 Jan 1985; 50-60, winter 1986-87; 12, 13 Feb 1991 (NB); Colusa NWR, 30, winter 1981-82; 75, 19-22 Jan 1983; 100, 29 Dec 1983 (NB); 125, 1 Dec 1984 (AB 39:97); 225, 17 Dec 1985 (AB 40:325); 50-60, winter 1986-87; 10, 26 Nov 1987; 3, 11 Dec 1988; 8, 11 Nov 1989 (NB); 40, 24 Nov 1990 (E. C. Beedy); 23, 23 Dec 1990 (NB); 60, 28 Nov 1994 (E. C. Beedy); Colusa and Delevan NWRs, 30, winter 1981-82 (AB 36:326); 50-60, winter 1986-87 (AB 41:322); Butte Creek on Gridley-Colusa Hwy, 13, 5 Nov-7 Dec 1986; 300, Colusa-Grimes Rd., 24 Nov 1990 (NB); Hwy 20 near Colusa, 500, 10 Nov 1991 (AB 46:143, NB); 50, 24 Jan 1995 (NB); Hwy 20 x Hwy 45, 190, 25 Jan 1995 (T. D. Manolis); rice field N of Laux Rd., 700, 6 Jan 1995 (fide M. Wolder/USFWS); I-5 near Maxwell, 60, 3 Dec 1995 (E. C. Beedy).

Yuba County: District 10, about 11 km N of Marysville, 60-70, 14 Nov 1993 (T. D. Manolis); 140, 20 Feb 1994 (D. Shuford); 155, 22 Nov 1994 (T. D. Manolis).

Sutter County: Pennington Rd., 30-40, 25 Nov 1990; Sutter NWR, 4, 24 Dec 1990; 21, 29 Jan 1991; 14, 4 Dec 1991; 2, 3 Jan 1993 (NB).

Yolo County: Univ. Calif. Davis, 1 flyover, 30 Nov 1972 (NB); 4, 18 Dec 1993 (NASFN 48:856, E. C. Beedy pers. comm.); Rd. 155, 6, 29 Mar 1992; Yolo Bypass at Rd. 25, 9, 31 Jan 1993 (NB); Laurel G duck club, Yolo Bypass, 12, 22 Feb 1992; 15, mid-Jan 1993 (E. C. Beedy).

Sacramento-San Joaquin River Delta

Sacramento County: Brannan Island, 11, 30 Dec 1992 (NB); flying over Sacramento Metro Airport, 19, 3 Jan 1995 (T. D. Manolis); Consumnes River Preserve, 2, 26 Mar 1994 (NB).

San Joaquin County: Staten Island, 2, 19 Dec 1993; Bouldin Island, 5, 24 Dec 1990; 22, 31 Dec 1990; 1, 5 Jan 1991; 75, 21 Nov 1992 (NB).

Contra Costa County: Holland Tract, 1-7, 7-9 Dec 1994; Webb Tract, 20-25, 25 Jan 1995 (NB).

Suisun Marsh

Solano County: Grizzly Island WA, 6, 23 Dec 1975 (AB 30:761); Joice Island Unit, Grizzly Island WA, 1, 26 Nov 1991 (NB).

Contra Costa County: W. Pittsburg, 9, 18 and 25 Dec 1982 (AB 37:333, 749; NB).

San Joaquin Valley

Stanislaus County (all H. Reeve unless otherwise noted): along Hwy 132, 84, 26 Mar 1978 (NB); near Newman, 145, 16 Mar 1985; valley floor in SW part of county, 1, 9 Feb 1986; Mapes Ranch, 5, 23 Mar 1986; 7, 17 Dec 1989; River Rd. NE of Newman, 20, 23 Mar 1986; 15, 29 Nov 1987; W. Main St., 27, 31 Mar 1986; 125, 26 Nov 1988; 3-6, 13-14 Jan 1989; 60, 12 Mar 1989; fields at Modesto sewage ponds, 1, 16 Feb 1987; 1, 27 Jan 1989; 2 flybys, 3 Dec 1989; 40, 16 Dec 1989; Jennings Rd., 1, 17 Feb 1989; Faith Ranch, 28, 30 Dec 1991.

Merced County: sites unspecified, 2, 9 Nov 1908 (CAS 12687, 12832); 1, 26 Nov 1908 (CAS 12834); 1, 30 Nov 1908 (CAS 12833); 1, 12 Dec 1908 (CAS 12831); 1, 4 Feb 1909 (CAS 13220); 1, 6 Feb 1909 (CAS 13219); 5, 18 Feb 1909 (CAS 13218, 13221-13224); Kesterson NWR, 14, 23 Dec 1974 (NB); Los Banos WA, 10, 14 Dec 1935; 34, 10 Jan 1946 (W. Minturn); 16, 11 Dec 1955; 20, 30 Mar 1963; 12, 13 Feb 1965 (NB); 100, 23 Jan 1966 (AFN 20:454); 27, 24 Mar 1968 (AFN 22:473); 160, 2 Feb 1969 (AFN 23:515, NB); 200, winter 1969-70 (AFN 24:90, 534); 140, 16 Feb 1974 (NB); 60, 12 Feb 1977 (AB 31:368); 120, 19 Feb 1978 (NB); 160, 3 Feb 1979 (AB 33:309); 49, 27 Jan 1980; 40-50, 7 Feb 1981; 50, 5 Feb 1984; 6, 6 Dec 1984 and 25 Feb 1985; 130, 1 Mar 1987; 300, 10 Feb 1990 (NB); Los Banos CBC, 21, 30 Dec 1969 (AFN 24:443); "Los Banos Road," 2, 31 Jan 1942; 1, 10 Jan 1946; 16, 28 Mar 1947 (W. Minturn); near Gustine, 2, 3

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Nov 1967 (AFN 22:84); 300, 1 Mar 1983 (AB 37:333); 60, 14 Mar 1987 (NB); San Luis NWR, 200, 6 Dec 1967 (AFN 22:473); 250, 15 Dec 1971; 40, 10 Dec 1972; 2, 13 Mar 1982 (NB); San Luis NWR and Los Banos WA, up to 250, winter 1971-72 (AB 26:650); Los Banos area, 1, 25 Nov 1911 (MVZ 22085); 1, 4 Dec 1911 (MVZ 22086); 1, 23 Dec 1911 (MVZ 22087); 1, 8 Mar 1939 (MVZ 91174); 23, 24 Mar 1962 (NB); 80, 26 Feb 1967 (AFN 21:453); 200, winter 1970-71 (AB 25:621); 122, 22 Feb 1972; 35, 13 Mar 1975 (NB); 56, 25 Jan 1976 (AB 30:761); 30, 11-25 Mar 1978; 130, 25 Feb 1980; 20, 4 Feb 1981 (NB); 78, 29 Dec 1981 (AB 36:326); 60, 28 Feb 1982; Los Banos to Merced NWR area, 30, 21 Feb 1981; Merced NWR, 54, 2 Dec 1982; 300, 29 Nov 1983 (NB); 220, 24 Nov 1984 (AB 39:97); 36, 15 Dec 1986; present, 22 Mar 1988; Santa Fe Grade, 30, 4 Feb 1973; 1, 23 Nov 1975; 12, 5 Feb 1977; 1, 20 Nov 1977; 65, 25 Jan 1980; 32, 4 Jan 1981; 30, 3 Mar 1985; 30, 6 Feb 1987; 100-130, 9 Jan-6 Feb 1988; 250-500, 23 Feb 1991; 80, 9 Nov 1991; 40, 21 Nov 1994 (NB); South Dos Palos, 6, 18 Feb 1939; 3, 23 Jan 1946 (W. Minturn); Dos Palos, 1, 10 Jan 1985; Sandy Mush Rd., 50, 19 Nov 1986; Volta WA, 150, 24 Nov 1971 (NB).

Fresno County: 3 mi S of Dos Palos, Merced County, 2, 7 Dec 1935; Mendota Pool, 12, 28 Mar 1936; Herminghaus Ranch, S of Mendota Pool, 2, 11 Feb 1939 (W. Minturn); Mendota WA, 1, 26 Dec 1974 to 9 Feb 1975; 250, 21 Feb 1985 (NB).

Kings, Tulare, and Kern counties: mouth of Tule River, 3, 16 Nov 1940; Tulare Lake, 4, 4 Dec 1927 (W. Minturn); 1, winter 1941-42 (CAS 58375); 1, 23 Mar 1946 (W. Minturn); Tulare Lake basin, 1, Nov 1957 (NB).

Tulare County: Creighton Ranch Preserve, 3, 3 Dec 1982 to 19 Jan 1983 (NB); Pixley NWR, 6, 6 Dec 1993; Alpaugh Irrigation District Reservoir, 20, 27 Mar 1995 (Kern NWR waterfowl survey).

Kern County (except as noted, all records from Kern NWR aerial waterfowl surveys): Goose Lake Bottoms, 10, 4 Nov 1980; 5, 5 Dec 1991; 2, 4 Feb 1992; 17, 3 Mar 1994; Kern NWR, 3, 23 Jan and 11 Feb 1981; Kern-Wasco duck clubs near Kern NWR, 15, 3 Nov 1989 and 6 Mar 1990; 31, 4 Nov 1991; 15, 5 Dec 1991; 20, 8 Jan 1992; 2, 4 Feb 1992; 1, 6 Dec 1993; 1, 4 Mar 1993; 30, 10 Jan 1994; 5, 3 Mar 1994; 5, 15 Nov 1994; 6, 8 Dec 1994; 4, 13 Jan 1995; 1, 15 Feb 1995; 1, 27 Mar 1995; duck clubs near Arvin, 10, 3 Nov 1989; 30, 4 Nov 1992; 1, 1 Feb 1993; 5, 1 Feb 1993; 10, 3 Mar 1994; 55, 8 Dec 1994; 50, 13 Jan 1995; Tenneco sewage overflow ponds, SW of jct. I-5 x Hwy 119, 40, 5 Dec 1991; 50, 8 Jan 1992; Bakersfield sewage ponds, 1, 21 Mar 1994; Kern NWR, 1, 16 Mar 1984 (M. O. Chichester); SW of Kern NWR, 2, 22 Feb 1985 (M. O. Chichester); Kern River groundwater recharge ponds W of Bakersfield, 4, 19 Nov 1995 (M. O. Chichester).

Southern California Interior and Deserts

Kern County: China Lake sewage ponds, 2, 24 Nov 1991 (D. V. Blue, M. O. Chichester).

Inyo County: Death Valley National Monument CBC, 1, 22 Dec 1965 (AFN 20:366).

Los Angeles County: near Lancaster, present, 11 Nov 1979 (Garrett and Dunn 1981); Piute Ponds, 2, 3 Dec 1993 (K. Garrett, M. San Miguel).

San Bernardino County: Chino Basin, 20, 1 Dec 1990 (M. A. Patten).

Riverside County: Corona, 1, winter 1952-53 (AFN 7:234); duck clubs, San Jacinto Valley, 1, 29 Jan 1994 (B. Carlson et al.); north end of Salton Sea, 4, 20 Mar 1987; 25, 2 Jan 1989; 2, 17 Dec 1989; 120, 29 Dec 1990; 25, 2 Feb 1991; 21, 15 Dec 1991; 15, 2 Jan 1994; 30, 4 Dec 1994; 25, 21 Jan 1995; Lake Norconian, 1, 23 Nov 1989; Hidden Valley WA, 30, 11 Feb 1990; Santa Ana R. Valley, 12, 19 Dec 1992; Oasis Station, 10, 26 Jan 1991; 40, 22 Jan 1994 (M. A. Patten); Prado Basin, 375, 28 Nov 1995; 180, 8 Jan 1996 (J. Pike).

Imperial County: Imperial Valley, 1000, 28 Dec 1947 (AFN 2:149); numbers "far

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below normal," winter 1962–63 (AFN 17:357); "flocks of up to 50," winter 1966–67 (AFN 21:457); 1, 20 Nov 1988; 2, 28 Jan 1989; 30, 3 Nov 1990; 25, 18 Dec 1993; 150, 29–30 Jan 1994; 12, 13 Feb 1994; 150, 11 Dec 1994; 2000, 11 Jan 1995 (M. A. Patten); Seeley, 275, 9 Dec 1956 (AFN 11:290); 450, 14 Jan 1983 (AB 37:337); near Brawley, 6000, 29 Jan 1989 (AB 43:365); 57, 20 Mar 1987; 150, 27 Jan 1990; Fig Lake, 75, 29 Dec 1994 (M. A. Patten); Salton Sea, 1, 6 Jan 1945 (LACM 86530); 1, 29 Dec 1945 (SBCM M13); 300, winter 1948–49 (AFN 3:185); numbers down, winter 1953–54 (AFN 8:269); 1, 27 Nov 1977 (SBMNH 4319); 2, 12 Nov 1978 (SBMNH 1735, 4268); Ramer Lake, 2000 at roost, winter 1950–51 (AFN 5:226); 50, 19 Feb 1955 (AFN 9:285); 70, 13 Jan 1962 (AFN 16:364); Salton Sea NWR, 50, 25 Nov 1960 (AFN 15:75); vicinity Salton Sea NWR, Unit 1, 35, 20 Nov 1979 (P. Unitt); south end of Salton Sea, 3500, winter 1952–53 (AFN 7:234); 34, 27 Dec 1955 (AFN 10:281); "quite common," winter 1969–70 (AFN 24:538); 100, 8 Jan 1977 (AB 31:373); 3, 1 Feb 1987; 75, 22 Dec 1987; 100, 17 Jan 1988; 200, 23 Jan 1988; 1, 11 Nov 1988; 50, 24 Dec 1988; 30, 10 Dec 1989; 125, 21 Dec 1989; 94, 21 Nov 1992; 32, 22 Dec 1992; 250, 6 Feb 1993; 30, 29 Dec 1993; 25, 20 Dec 1994 (M. A. Patten); Salton Sea (south) CBC, 2, 31 Dec 1965 (AFN 20:377); 15, 28 Dec 1968 (AFN 23:423); 4, 28 Dec 1969 (AFN 24:453); near Sheldon Reservoir, 7 km NW Imperial, 250, 30 Jan 1988; duck club 5 km NE Imperial, 2000, 30 Dec 1988 (P. Unitt).

Coastal California

Humboldt County: School Rd., McKinleyville, 1, 6 Nov 1988 (NB); Humboldt County, fall records through 7 Nov (Harris 1991).

Napa County: 1, 24–28 Jan 1996, Skaggs Island Rd. (NB).

Alameda County: Fremont, 31 circling, 15 Feb 1970 (AFN 24:534).

San Mateo County: Pescadero Marsh, 1, 14 Dec 1985 (AB 40:325); Half Moon Bay, 1, 28 Dec 1985 (AB 40:325).

Santa Cruz County: Pajaro River mouth, 2, 2 Jan 1991 (NB); Harkins Slough, 1–2, 16–26 Mar 1993 (R. Merrill); 4–6, 12–27 Dec 1993 (D. E. George); 1–2, 1–4 Jan 1995, on Moss Landing CBC (NASFN 49:192,

808; fide D. L. Suddjian); College Lake, 2, 1 Jan 1994, on Moss Landing CBC (NASFN 48:836, D. L. Suddjian).

Monterey County (all records from Roberson 1985 or D. Roberson in litt.; includes all Moss Landing CBC records): Moss Landing/Elkhorn Slough vicinity, 1, 14 Aug–25 Dec 1953 (probably the same bird at McClusky Slough, 19 Nov 1953); 5, 20 Mar 1982; 1, 1 Jan–25 Feb 1984 (Kirby Park); 1, 30 Oct 1988–4 Jan 1989; 1–2, 20 Aug–3 Nov 1990; 1, 12 Dec 1990 (possibly one of the previous birds); 1, 1 Jan 1992 (Packard Ranch); 1–2, 16 Oct–24 Dec 1992 (Zmudowski State Beach); 1, 12 Dec 1992; 1, 24 Dec 1992 (Packard Ranch, possibly one of the preceding individuals); 5, 7 Feb 1993 (Packard Ranch); up to 7, 14 Nov 1993–25 Feb 1994 (groups at Moss Landing WA and adjacent Packard Ranch and Moro Cojo Slough and adjacent Castroville ponds); 1–2, 27 Mar–9 May 1994 (Moonglow Dairy); 1, 19 Nov 1994 (Moonglow Dairy); 1–2, 11 Feb–23 Apr 1995 (Moonglow Dairy); 1, 27 Dec 1995–29 Feb+ 1996 (Moonglow Dairy); San Juan Grade, Salinas, 1, 6 Feb 1983; 1, 19 Feb 1996; Salinas River mouth, 1–3, 17 Sep–8 Dec 1990; Crespi Pond, Pt. Pinos, 1, 2–5 Jan 1993; King City vineyard, 5, 21 Jan–1 Feb 1996.

Southern California coast (as whole): flocks of up to 9, winter 1963–64 (AFN 18:386); "a few," winter 1966–67 (AFN 21:457); a few in coastal Ventura, Orange, and San Diego counties, winter 1968–69 (AFN 22:477).

San Luis Obispo County: Laguna Lake, 13 Oct–11 Nov 1974 (fide T. M. Edell); Villa Creek, 1, 15 Oct 1979–21 Apr 1980 (T. M. Edell); Los Osos Valley, 1, 27 Dec 1989 (AB 44:327, D. Elmendorf); upper Morro Bay estuary, 10–12, 6 Nov 1990 (D. Stinson).

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Santa Barbara County: Goleta, on Santa Barbara CBC, 1, 30 Dec 1967 (AFN 22:396, Lehman 1994); Goleta, 1, Oct 1977–Mar 1978 (AB 32:398, Lehman 1994); 2, 15–20 Feb 1984; Santa Barbara, 1, 11 Nov 1978–10 Jan 1979 (Lehman 1994); Santa Ynez River mouth, 1, 1 Dec 1988–3 Feb 1989 (Lehman 1994, AB 43:1149); 1, 8 Feb 1994; Lake Cachuma, 1–2, 1 Nov 1991–17 Feb 1992; 1, 3 Nov 1992 (Lehman 1994); near Santa Maria, 1, 28 Jan 1995 (D. Quesenberry).

Ventura County: Pt. Mugu area, 1, 19 Jan 1948 (AFN 2:149); 1, 15 Feb 1962 (AFN 16:364); small group, winter 1962–63 (AFN 17:357); 3–8, 11–18 Jan 1964; 6, 29 Jan 1967; 7, 28 Jan 1968; 1–3, Jan 1969 (SBMNH files); present, winter 1969–70 (AFN 24:538); 15, 24 Jan 1971; 12, 28 Nov 1971 (SBMNH files); 1, 5 Dec 1971 (LACM 85222); 1, 12 Dec 1978 (fide D. DesJardin); 8–10, 2 Feb 1974 (SBMNH files); up to 85, through 22 Nov 1980 (AB 35:225, fide D. DesJardin); 40, 1 Nov 1981 (fide D. DesJardin); 37, 4 Mar 1996 (D. DesJardin); Mugu Lagoon, 16, 15 Dec 1992 (W. Wehtie et al.); near Saticoy, 15+, 9 Feb 1985 (fide D. DesJardin); 4, 18 Feb 1996 (D. DesJardin); Santa Clara River estuary, 1, 1 Nov 1970 (SBMNH files); 25, 4 Feb 1986 (fide D. DesJardin); Sespe WA CBC, 66, 3 Jan 1988 (AB 42:1138 (probably from Santa Clara River Valley near Fillmore, K. Garrett pers. comm.)).

Los Angeles County: Playa del Rey, 1, 5 Jan 1953 (AFN 7:234); El Monte, 3, 12 Nov 1988 (AB 43:167); Whittier Narrows, El Monte, 2, 1 Dec 1991–29 Jan 1992 (Long 1993).

Orange County: Bolsa Chica, 1, 14 Feb 1949 (AFN 3:185); 1, 29 Mar 1956 (AFN 10:363); 1, 9 Nov 1957 (AFN 12:58); 2, 4 Feb 1985 (fide D. Willick); Upper Newport Bay, 1–2, 21 Feb and 28 Mar 1959 (AFN 13:321); Upper Newport Bay, 8, 28 Jan 1962 (AFN 16:364); Upper Newport Bay, small group, winter 1962–63 (AFN 17:357); 21, 18 Dec 1990 (fide D. Willick); San Joaquin Marsh, Irvine, 8, 16 Feb 1981; 1, 15 Jan–19 Feb 1983; 2, 28 Dec 1984–“Mar” 1985; 1, 5 Feb 1987 (fide D. Willick); 2, 24 Jan 1988 (M. A. Patten); 1, 5–11 Feb 1988; 10, 4 Mar 1990; 1, 4 Nov 1990 (fide D. Willick); 6–11, Dec 1994–Feb 1995 (fide J. Pike); Corona del Mar, 30 flying N along shore, 5 Jan 1984; Fountain Valley, Santa Ana River, 2, 21 Feb–“Mar” 1988; 14, 31 Jan–24 Feb 1990; 1, 15 Dec 1991; San Diego Creek, Irvine, 2, 12 Dec 1990; 1, 12 Dec 1991; Anaheim, up to 20, 20 Dec 1990–“Feb” 1991 (fide D. Willick).

San Diego County: San Diego area, 3, 29 Dec 1956 (AFN 11:290); Carlsbad, 1, Jan–Feb 1962 (AFN 16:364); Buena Vista Lagoon, small group, winter 1962–63 (AFN 17:357); San Diego CBC, 2, 2 Jan 1966 (AFN 20:378); Oceanside–Vista–Carlsbad CBC, 2, 30 Dec 1961 (AFN 16:284); 3, 31 Dec 1962 (AFN 17:280); 2, 28 Dec 1963 (AFN 18:311); 20, 30 Dec 1966 (AFN 21:370); 3, 30 Dec 1967 (AFN 22:388); 13, 28 Dec 1968 (AFN 23:417); Santa Margarita River mouth, small group, winter 1962–63 (AFN 17:357); present, winter 1968–69 (AFN 23:520); present, winter 1969–70 (AFN 24:538); San Elijo Lagoon, present, winter 1969–70 (AB 24:538); 1, 17 Nov 1991 (R. Patton et al.); 4, 18 Nov 1993 (R. Patton, B. Foster); Oceanside, present, winter 1970–71 (AB 25:627); 2, winter 1974–75 (AB 29:741); 35, winter 1976–77 (AB 31:373); Guajome Lake (Oceanside–Vista–Carlsbad CBC), 3, 26 Dec 1987 (P. Unitt); San Luis Rey River Valley between Oceanside and Bonsall, 45, 1 Jan 1979; 30, 28 Dec 1980 (Unitt 1984); 27, 9 Mar 1988 (P. Unitt); Tijuana R. mouth, 1, 19 March 1966 (Unitt 1984); Tijuana R. Valley, 4, 17 Dec 1983 (on San Diego CBC, P. Unitt); 12, 3 Nov 1985 (P. Unitt); 3, 8 Dec 1990 (M. A. Patten); Lake Hodges, 40, 7 Nov 1995; 72, 9 Nov 1995; 160, 16 Nov 1995; 40, 5 Dec 1995; 65, 12 Jan 1996; 40, 18 Feb 1996 (R. L. Barber); Mission Valley, 1, 3 Feb–7 Apr 1991; San Dieguito River estuary (Rancho Santa Fe CBC), 10, 16 Dec 1994 (P. Unitt).