WESTERN BIRDS

Vol. 20, No. 1, 1989

WESTERN BIRDS

Quarterly Journal of Western Field Ornithologists

Membership dues, for individuals and institutions, including subscription to *Western Birds:* Patron, $1000; Life, $250; Supporting, $50 annually; Contributing, $25 annually; Regular, $14 U.S. ($17 outside U.S.) annually. Dues and contributions are tax-deductible to the extent allowed by law.

Send membership dues, changes of address, correspondence regarding missing issues, and orders for back issues and special publications to the Treasurer. Make checks payable to Western Field Ornithologists.

Back issues of *California Birds/Western Birds:* $15 per volume, $4.00 for single issues. Xerox copies of out of print issues (Vol. 1, No. 1; Vol. 2, Nos. 1 and 4; Vol. 6, No. 2): $4.50 each. *Checklist of the Birds of California:* $2.00 each, 10 or more $1.50 each. *Pelagic Birds of Monterey Bay, California:* $2.50 each, 10 or more $2.00 each, 40 or more $1.50 each. All postpaid.

Published July 31, 1989 ISSN 0045-3897

WESTERN BIRDS ADVERTISING RATES AND SPECIFICATIONS

Full page	4 x 6¾ inches	$60 per issue	$200 per year
Half Page	4 x 3⅜ inches	$40 per issue	$130 per year
Quarter Page	4 x 1 11/16 inches	$30 per issue	$110 per year

Offset printing, one column per page, 4 inches wide. Glossy, black and white photos are acceptable; half-tone screen size: 133 line. Photo-ready copy is requested. If this is not possible, extra charges for typesetting will be made as follows: $15 full page, $10 half page, $5 quarter page. Send copy with remittance to the Treasurer. Make checks payable to Western Field Ornithologists. A 15% commission is allowed for agencies.

WESTERN BIRDS

Volume 20, Number 1, 1989

DIETS OF FIVE SPECIES OF DESERT OWLS

CAMERON W. BARROWS, 53277 Avenida Diaz, La Quinta, California 92253

Common Barn-Owls (*Tyto alba*), Great Horned Owls (*Bubo virginianus*), Long-eared Owls (*Asio otus*), Western Screech-Owls (*Otus kennicottii*), and Burrowing Owls (*Athene cunnicularia*) all occur as year-round or seasonal residents of southern California deserts. This species richness provided me an opportunity to compare the diets of these owls both within and between desert regions. Within-region comparisons allowed analyses in situations where all owl species had access to the same prey base, eliminating differential prey availability as a factor. Interspecific differences under these conditions might then be due to differences in predatory behavior or prey preferences. Additionally, I was able to follow month-to-month variation in diets of three sympatric owl species to determine if their dietary fluctuations were synchronous or independent.

STUDY AREA AND METHODS

Diets were determined from the contents of regurgitated pellets found below the owls' diurnal roosts or burrow entrances. With the exception of one Long-eared Owl sample from Anza-Borrego State Park in 1980, the pellets were collected from December 1985 through the summer of 1988. Unless otherwise noted, the collections represent one visit to each site.

A few sites were occupied nearly continuously, allowing temporal analysis of their inhabitants' diets. These roosts were located primarily in the Coachella Valley Preserve, a 5260-ha natural area in Riverside Co., California (0 to 100 m elevation). This area is in the Colorado Desert subdivision of the Sonoran Desert (Jaeger 1957) and is dominated by Creosote Bush (*Larrea divaricata*) scrub and scattered Desert Fan Palm (*Washingtonia filifera*) oases. Thousand, Horseshoe, Indian, and Biskra Palms are found within this preserve. Other samples from within the Coachella Valley were taken at the University of California's Boyd Deep Canyon Research Center and Seven Palms oasis. Except for those of Burrowing Owls, 85% of these samples were collected in Desert Fan Palm oases. All these collection sites were dominated by natural vegeta-

tion. For comparison, pellets were also gathered in areas that included irrigated farmlands and downtown Indio.

Additional sites outside the Coachella Valley but within the Colorado Desert included two locations near the SE shore of the Salton Sea, Imperial Co. (−65 m elevation, Common Barn-Owl and Great Horned Owl), in the Orocopia Mountains, Riverside Co. (300 m elevation, Common Barn-Owl), at Yaqui Well in Anza-Borrego State Park, San Diego Co. (300 m elevation, Long-eared Owl) and in Chemehuevi Wash, San Bernardino Co. (200 m elevation, Long-eared Owl).

Three sites occupied by Common Barn-Owls were at intermediate elevations (650-900 m) and supported vegetation common to both the Colorado and Mojave deserts. These sites included the Oasis of Mara in Twentynine Palms and Morongo Valley, both in San Bernardino Co., along with a location near Corn Spring, Riverside Co.

The Mojave Desert sites (1000 to 1600 m elevation) were dominated by Joshua Trees (*Yucca brevifolia*) and Mojave Yucca (*Y. schidigera*). Common Barn-Owl diet samples were collected near Cima Dome and in the Lanfair Valley, San Bernardino Co., and at Devil's Punch Bowl, Los Angeles Co. A Long-eared Owl diet sample was collected near China Lake, Kern Co. Locations of all sites are shown in Figure 1.

RESULTS

Species Accounts

COMMON BARN-OWL. This year-round resident was commonly found roosting in palm oases, mine addits, and cliffs. At all sites sampled within the Colorado Desert, pocket mice (*Perognathus* sp.) were the most common prey in Common Barn-Owl diets (Table 1). This pattern held both between sites and between years (at Thousand Palms Oasis), indicating a regional diet similarity. In the Mojave Desert, and at two of the sites at intermediate elevations, kangaroo rats (*Dipodomys* sp.) dominated this owl's diet, again showing a regional similarity. Common Barn-Owl diets from Morongo Valley varied between years from a preponderance of pocket mice to a nearly equal proportion of pocket mice and kangaroo rats, illustrating Morongo's intermediate position. Irrigating or urbanizing the desert appears to result in an increased frequency of rodents adapted to mesic conditions in the owls' diet. House Mouse (*Mus musculus*) and Pocket Gopher (*Thomomys bottae*) remains became more abundant, while pocket mice and especially kangaroo rats were reduced.

Despite diet similarities within regions and within habitats, there was a high degree of month-to-month variation at Thousand Palms Oasis (Figure 2). Throughout my study, the frequency by month of pocket mice or kangaroo rats varied from above 70% to near 0%.

LONG-EARED OWL. These owls are primarily winter residents; most arrive in October through December and leave the area by March. However, a few stay to breed, with records from Yaqui Well and Morongo Valley. These owls occasionally roost in palms, but were more common in Palo Verde (*Cercidium floridum*), Ironwood (*Olneya tesota*), and tamarisk (*Tamarix* sp.) trees in oases or desert washes.

Pellet analyses indicated temporal shifts in Long-eared Owl prey selection (Table 2). Diets from the Coachella Valley, in the winter of 1985-86, were dominated by pocket mice (52%); in 1986-87 kangaroo rats predominated (72%); in 1987-88 pocket mice again dominated (67%). All sites and years combined, this owl and Common Barn-Owls from the Colorado Desert had the highest percentage of similarity, 89%, of any owl species pair in this study. Percentage of similarity is the sum of the smaller frequencies in all prey categories for the two diets being compared (Brower and Zar 1977). The result of this comparison indicates that these owls have similar prey selection capabilities. However, month-to-month comparisons of adjacent Common Barn-Owls and Long-eared Owls at Thousand Palms (Figure 2) revealed striking differences in their temporal patterns of predation on pocket mice.

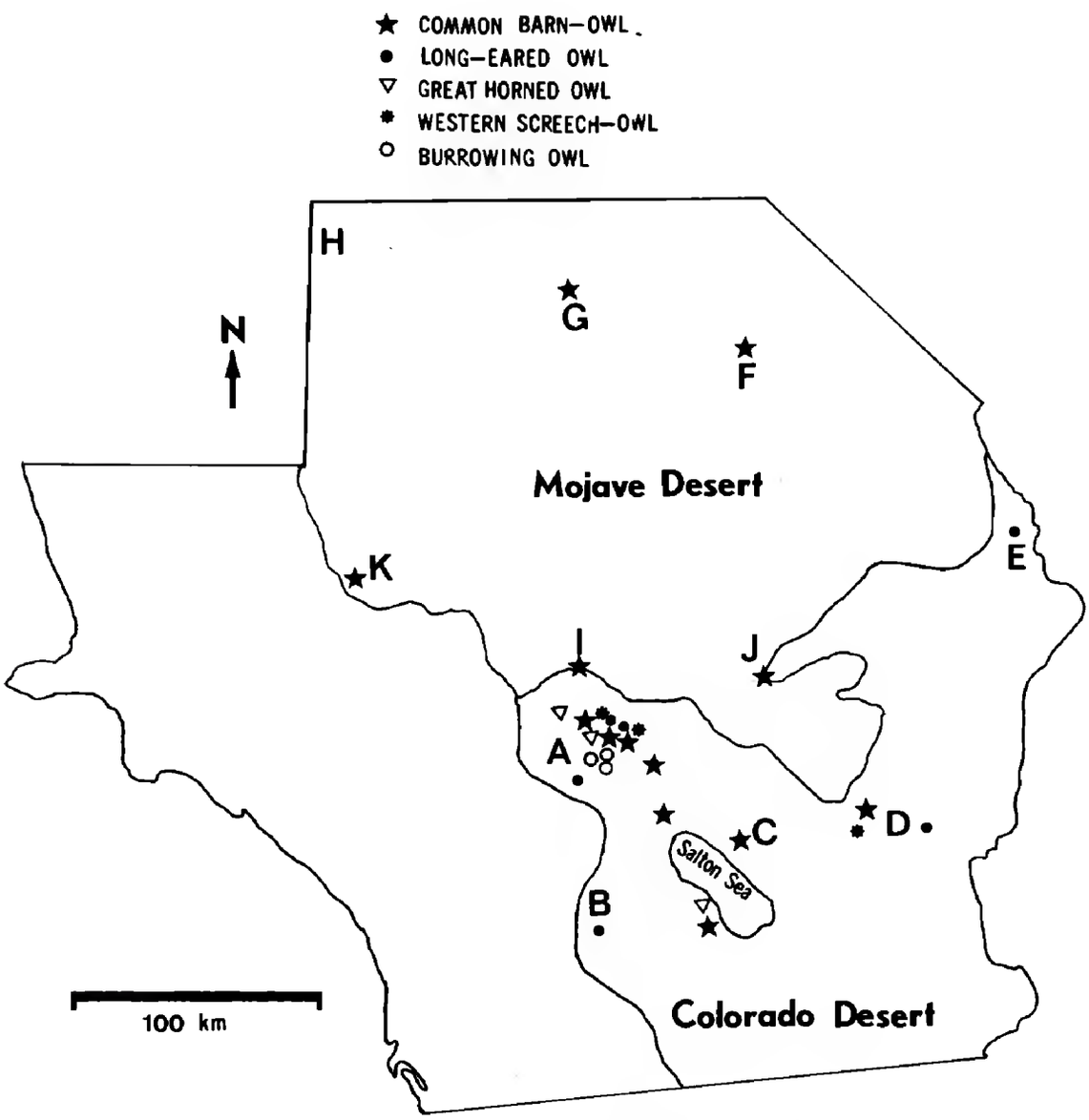


Figure 1. Sites where owl pellets were collected. A = Coachella Valley; B = Anza-Borrego State Park; C = Orocopia Mountains; D = Corn Spring/Chuckwalla Mountains; E = Chemehuevi Wash; F = Lanfair Valley; G = Cima Dome; H = China Lake; I = Morongo Valley; J = Twentynine Palms; K = Devil's Punchbowl.

Table 1 Percentages of Prey in the Diets of Common Barn-Owls in the Southern California Deserts

	Salton Sea Basin		Coachella Valley Natural Habitats							
							Thousand Palms			
Prey	Salton Sea	Orocopia Mountains	Horseshoe Palms	Biskra Palms	Tyler Rd. Palms	Edom Hill	1985	1986	1987	1988
Ground squirrels (*Spermophilus* sp.)	0	0	0	0	0	0	0	0	0	0
Audubon's Cottontail (*Sulvilagus audubonii*)	0	0	0	0	0	0	0	0	+[a]	1
Woodrats (*Neotoma* sp.)	0	6	3	7	6	12	4	2	5	18
Pocket Gophers (*Thomomys bottae*)	19	12	3	19	10	1	10	7	11	6
Kangaroo rats (*Dipodomys* sp.)	8	10	7	24	12	40	31	24	32	15
Pocket mice (*Perognathus* sp.)	72	68	79	31	45	57	45	60	46	50
Deer mice (*Peromyscus* sp.)	0	2	4	7	7	0	6	3	5	6
House mice (*Mus musculus*)	0	0	3	7	20	0	0	1	+	3
Voles (*Microtus* sp.)	0	+	0	0	0	0	0	0	0	0
Harvest mice (*Reithrodontomys* sp.)	0	0	0	0	0	0	0	0	0	0
Desert Shrew (*Notiosorex crawfordi*)	0	0	0	0	0	0	0	0	0	+
Birds	0	0	0	5	0	0	0	0	0	+
Arthropods	0	0	0	0	0	0	2	+	1	1
No. of prey items	57	233	67	42	138	47	51	255	401	350

[a] + indicates a frequency of less than 1%.

Table 1 (Continued)

Prey	Coachella Valley Disturbed Habitats		Intermediate Elevations				Mojave Desert		
					Morongo				
	Indio	Farmland	Corn Spring	Twenty-nine Palms	1987	1988	Cima Dome	Lanfair Valley	Devil's Punchbowl
Ground squirrels (*Spermophilus* sp.)	0	0	0	0	1	0	0	0	3
Audubon's Cottontail (*Sulvilagus audubonii*)	0	0	0	0	1	1	0	0	0
Woodrats (*Neotoma* sp.)	0	2	9	2	4	2	20	24	7
Pocket Gophers (*Thomomys bottae*)	32	48	0	0	7	6	4	6	26
Kangaroo rats (*Dipodomys* sp.)	0	0	51	74	25	36	54	54	51
Pocket mice (*Perognathus* sp.)	36	26	31	22	38	35	10	6	0
Deer mice (*Peromyscus* sp.)	5	0	9	2	14	10	11	6	7
House mice (*Mus musculus*)	22	17	0	0	0	0	0	0	0
Voles (*Microtus* sp.)	0	0	0	0	4	3	0	0	7
Harvest mice (*Reithrodontomys* sp.)	0	0	0	0	3	0	0	0	0
Desert Shrew (*Notiosorex crawfordi*)	0	0	0	0	1	1	0	0	0
Birds	1	0	0	0	0	2	0	0	0
Arthropods	2	2	0	0	3	2	0	0	0
No. of prey items	85	42	57	55	271	94	130	63	31

Table 2 Percentages of Prey in the Diets of Long-eared Owls in the Southern California Deserts

Prey	Anza-Borrego Yaqui Well	Chemehuevi Wash	China Lake	Chuckwalla Mountains	Coachella Valley: Pushwalla Palms 1985	Pushwalla Palms 1986	Pushwalla Palms 1987	Thousand Palms 1985	Thousand Palms 1986	Thousand Palms 1987	Deep Canyon
Sylvilagus audubonii	0	0	0	0	0	0	0	0	+[a]	+	0
Neotoma sp.	4	3	6	0	0	6	0	4	3	9	1
Thomomys bottae	1	0	9	0	0	0	0	0	0	+	0
Dipodomys sp.	52	55	26	10	52	6	24	37	65	15	65
Perognathus sp.	18	42	23	80	48	88	69	54	26	70	27
Microtus californicus	1	0	0	0	0	0	0	0	0	0	0
Peromyscus sp.	18	0	35	0	0	0	1	2	2	3	7
Notiosorex crawfordi	3	0	0	0	0	0	0	0	0	0	0
Bats	1	0	0	0	0	0	0	0	0	0	0
Birds	0	0	0	0	0	0	0	2	2	1	0
Arthropods	0	0	0	0	0	0	0	0	1	+	0
No. of prey items	66	31	34	10	25	17	29	46	127	496	75

[a] + indicates a frequency of less than 1%.

GREAT HORNED OWL. This resident owl was regularly found in two palm oases I surveyed in the Coachella Valley. An additional pair was in an abandoned building on the SE shore of the Salton Sea.

Great Horned Owls selected the broadest range of prey sizes of any of the species considered here, taking large numbers of Audubon Cottontails (*Sylvilagus audubonii*) and woodrats (*Neotoma* sp.) along with arthropods, especially scorpions (Table 3). Overall diets of Great Horned Owls in the Coachella Valley had a moderate percentage of similarity with Common Barn-Owls (66%) and Long-eared Owls (65%) from the same region.

WESTERN SCREECH-OWL. Western Screech-Owls are year-round residents of the palm oases. Large pellet accumulations were located in three oases, although a few screech-owl pellets were found in almost every palm oasis examined. This owl's diet seems to reflect the availability of prey in and around the palms (Table 3). Deer mice (*Peromyscus* sp.) and Spiny Pocket

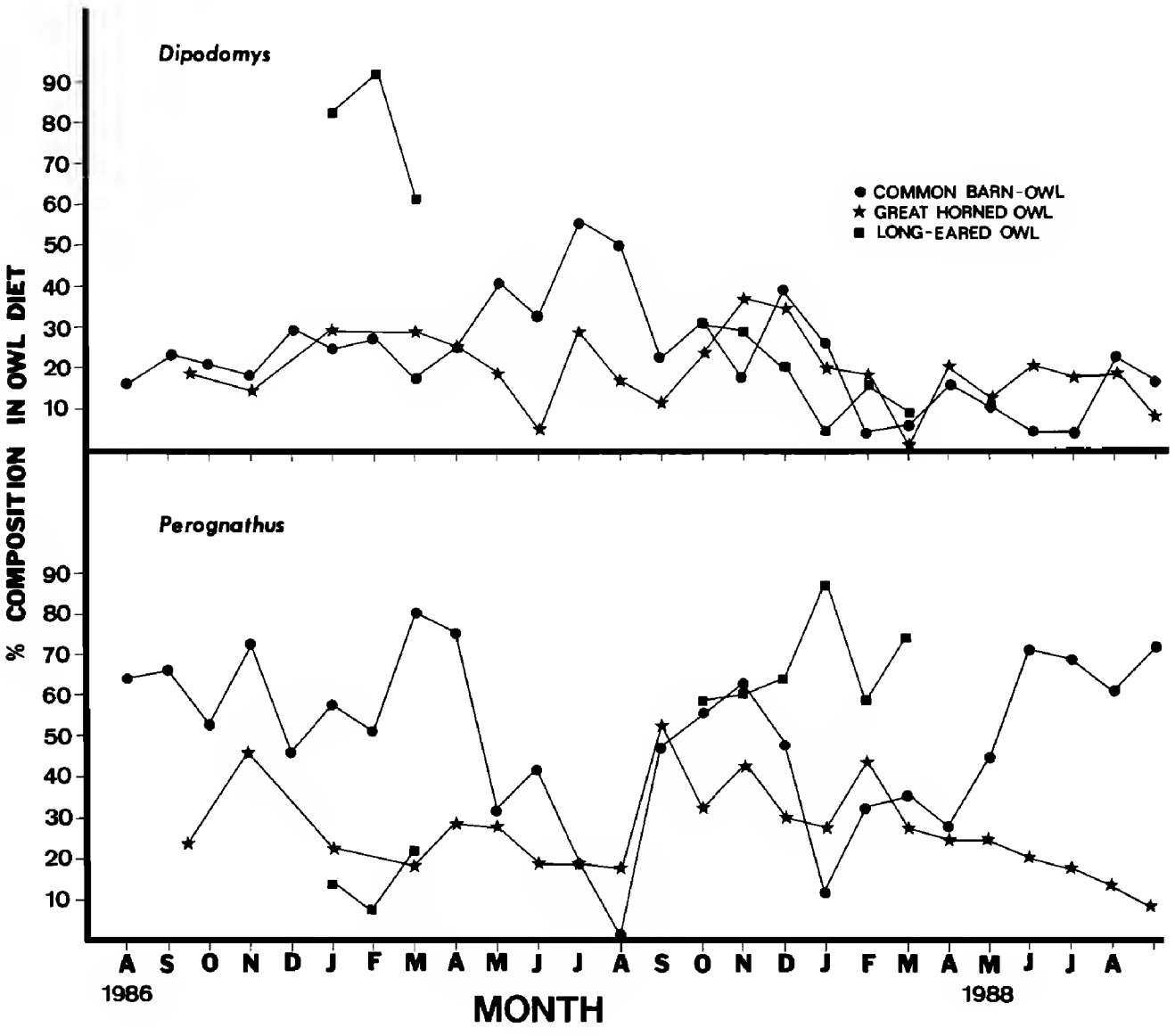


Figure 2. Monthly frequencies of kangaroo rats and pocket mice in the diets of three owl species in the Coachella Valley.

Table 3 Percentages of Prey in the Diets of Great Horned Owls, Western Screech-Owls, and Burrowing Owls in the Colorado Desert

	Great Horned Owl					Western Screech-Owl			Burrowing Owl		
			Indian Palms						Coachella Valley		
Prey	SE Salton Sea	Seven Palms	1986	1987	1988	Thousand Palms	Biskra Palms	Corn Spring	A	B	C
Sylvilagus audubonii	13[a]	2	0	2	3	0	0	0	0	0	0
Neotoma sp.	26	21	12	18	22	0	0	5	0	0	0
Thomomys bottae	2	3	3	1	1	0	0	0	2	0	2
Dipodomys sp.	26	28	18	24	18	13	0	0	8	18	13
Perognathus sp.	5	29	29	28	28	25	20	30	4	29	17
Peromyscus sp.	0	3	3	+[b]	2	14	13	35	0	0	0
Mus musculus	0	0	0	0	0	0	2	0	0	0	0
Bats	0	0	0	0	0	2	0	0	0	0	0
Birds	8	0	1	+	3	1	0	5	1	0	0
Reptiles	0	1	1	8	8	0	0	0	0	0	5
Insects	10	10	4	2	5	40	58	10	75	53	54
Scorpions	10	2	29	14	9	1	7	15	9	0	9
Crayfish	0	0	0	0	0	2	0	0	0	0	0
No. of prey items	39	120	66	342	190	90	45	20	122	17	78

[a]May include some Black-tailed Jackrabbits (*Lepus californicus*).

[b] + indicates a frequency of less than 1%.

Mice (*Perognathus spinatus*) are especially numerous in palm oases (pers. obs.); their abundance appears to be reflected in the Western Screech-Owl's diet.

BURROWING OWL. This year-round resident was the only species considered in this study that was not at least partly associated with palm oases. Burrowing Owls are the most insectivorous of the five owl species (Table 3); one of their most common prey was earwigs (Dermaptera).

The similarly sized Burrowing Owl and Western Screech-Owl were the most allopatric of any species pair considered here; the percentage of similarity in their diets was 67%. Burrowing Owls were found lower on the alluvial fans, far from the palm oases.

Two Common Barn Owl roosts, a Great Horned Owl roost, and a Long-eared Owl communal roost (the number of owls varied between 2 and 15) were in use regularly enough to allow a monthly diet analysis (Figure 2). These roosts were about 1 km apart, separated by a large wash that was a likely hunting area for all three species. Over the 21-month study, there was little if any similarity in the frequencies of pocket mice taken by the owl species. The frequency oscillations of kangaroo rats in the diets of Common Barn-Owls and Great Horned Owls, the species pair with the most similar diet fluctuations for this prey, were synchronous only 65% of the time.

DISCUSSION

Regional and habitat-related similarities of Common Barn-Owls in the Colorado and Mojave Deserts lend support to a hypothesis that owls' diets are a direct reflection of prey availability (Errington 1932). Dietary differences between the high and low deserts may be explained in part by the limited seasonal availability of pocket mice in the Mojave Desert. In the Mojave, the most common pocket mouse, *Perognathus longimembris*, hibernates during the winter months (Ingles 1965) and is therefore unavailable to the owls much of the year. The Colorado Desert has more pocket mouse species (Ingles 1965), many of which are active year round. These pocket mice are available in all seasons and are an integral part of the Common Barn-Owl's diet. Similarly, woodrat lodges were observed to be much more abundant within the ranges of those Common Barn-Owls in the Mojave Desert that took a high percentage of this rodent in their diets.

Other studies have also documented a correlation between prey availability and owl diets. Schwartz and Bleich (1985) found that the proportions of prey species in the diets of Common Barn-Owls at two California locations roughly matched the frequencies of those prey in the surrounding environment. While their data is suggestive of Common Barn-Owl predatory patterns, they did not provide a temporal analysis to determine whether the owls actually tracked prey availability. Broad temporal relationships were reported by Evans and Emlen (1947), Fitch (1947), and Marti (1974). These studies documented the seasonal availability of certain prey matching their occurrence in the owl diets; again, they didn't examine the tendency of owls to track the abundance of those prey.

In my analysis, I compared the diets of three owl species hunting over the same time and space to interpret predation patterns. The overall similarity

in the diets of Long-eared Owls, Common Barn-Owls, and, to a lesser extent, Great Horned Owls indicates similar predatory capabilities and predilections.

Month-to-month comparisons of the three owl species' predation on pocket mice, the most common prey (overall) for each species, indicated no consistent tracking of availability. For Common Barn-Owls and Long-eared Owls, there were striking differences between the monthly rates of predation on pocket mice and to a lesser extent on kangaroo rats. The large proportion of kangaroo rats in many Long-eared Owl pellets (during the winter of 1986-87) from the Coachella Valley confirm that these rodents were available to Common Barn-Owls. Yet, during that period, barn-owls took approximately twice as many pocket mice as kangaroo rats, even when kangaroo rats constituted as much as 72% of neighboring Long-eared Owls' diets.

Geographic and habitat-related patterns in desert owl diets can be explained by prey availability. However, prey availability alone appears to fall short of explaining the monthly variation of the owl diets reported here. Selective predation appears likely, and competitive interference and differences in habitat selection may have influenced the observed diets.

ACKNOWLEDGMENTS

Pete Bloom, Bob McKernan, and Allan Muth aided in locating Long-eared Owl pellets. Katherine Barrows, Pete Bloom, Mark Fisher, Tim Manolis, Allan Muth, Bruce Webb, and Jon Winter offered suggestions to improve drafts of my manuscript. The Nature Conservancy, Bureau of Land Management, Joshua Tree National Monument, U.S. Fish and Wildlife Service, California Department of Fish and Game, and Boyd Deep Canyon Research Center generously allowed access to their facilities and land.

LITERATURE CITED

Brower, J. E., and Zar, J. H. 1977. Field and Laboratory Methods for General Ecology. Wm. C. Brown, Dubuque, IA.

Errington, P. L. 1932. Studies on the behavior of the Great Horned Owl. Wilson Bull. 44:212-220.

Evans, F. C., and Emlen, J. T. 1947. Ecological notes on the prey selected by a Barn Owl. Condor 49:3-9.

Fitch, H. S. 1947. Predation by owls in the Sierran foothills of California. Condor 49:137-151.

Ingles, L. G. 1965. Mammals of the Pacific States. Stanford Univ. Press, Stanford, CA.

Jaeger, E. C. 1957. The North American Deserts. Stanford Univ. Press, Stanford, CA.

Marti, C. D. 1974. The feeding ecology of four sympatric owls. Condor 76:45-71.

Schwartz, O. A., and Bleich, V. C. 1985. Optimal foraging in Barn Owls? Rodent frequencies in diet and fauna. Bull. S. Calif. Acad. Sci. 84(1):41-45.

Accepted 1 November 1988

The following article is the third in a series on California rarities edited by Morlan and Roberson. It is based on materials submitted to the California Bird Records Committee (CBRC). The description and circumstances were edited from the accounts of the observers and have been reviewed by them. Roberson prepared the distributional summary and Morlan prepared the identification summary. In this way we hope that much important information accumulated in CBRC files will become widely available.

Common Black-Hawk *Sketch by Tim Manolis*

FIRST RECORD OF THE COMMON BLACK-HAWK FOR CALIFORNIA

BRIAN E. DANIELS, 3471 Lama, Long Beach, California 90808

LOREN and DEBRA HAYS, 9896 Argyle, Huntington Beach, California 92646

JOSEPH MORLAN, 417 Talbot Ave., Albany, California 94706

DON ROBERSON, 282 Grove Acre Ave., Pacific Grove, California 93950

On 13 April 1985, Daniels and the Hayses found a Common Black-Hawk *Buteogallus anthracinus* at Thousand Palms Nature Conservancy Preserve, Riverside County, California, a lush California Fan Palm *Washingtonia filifera* oasis with a creek lined by Fremont Cottonwoods *Populus fremontii*. They first saw the hawk at 0700 flying downstream about 50 yards away. A Common Raven *Corvus corax* whose nest was nearby harassed it. The hawk flew back over the observers (within about 50 feet) and disappeared into the palm trees. At about 0800 they saw it again about a half mile upstream. It flew past them and then circled higher and higher, disappearing toward the north. They observed the bird for a total of about 15 minutes. Efforts to follow it by car were unsuccessful. They, and others, searched for the hawk later that day, but did not find it.

The following description was compiled from those of the three observers:

A buteonine hawk about the size of a Red-tailed Hawk *Buteo jamaicensis* (not directly compared but soaring in the same general area) but differing by its very broad rounded wings and short wide tail. It was perhaps the same length as the adjacent raven but was noticeably bulkier and soared with a flat flight profile.

The entire plumage was black—dull black to coal black—except for a pale white patch on the underwing at the base of the primaries, a broad bright white median tail band, and a narrow terminal tail band. The white wing patch was not as bright as the tail bands and was limited to the basal portions of the outer 4 or 5 primaries. The tail bands were seen on both the dorsal and ventral surfaces; the median band was perhaps 5 to 7 times wider than the terminal band (noted only by Daniels). The upper tail coverts were particularly scrutinized (to eliminate the possibility of the Great Black-Hawk *B. urubitinga*); they were black.

The cere was bright yellow, noticeable even from a distance, the yellow seeming to extend onto the face. The rest of the heavily hooked large bill was black. The legs and feet, seen well when the bird was overhead, were lemon yellow and extended in flight to the center of the median tail band, emphasizing the tail's shortness. The talons were black. When the bird was directly overhead, no bands or jesses were seen on its legs.

L. Hays described a loud "scree" call.

The record was unanimously accepted by the California Bird Records Committee on the first circulation. Daniels and most CBRC members disputed the described call, suggesting it was given by the nearby Red-tailed Hawk, but L. Hays felt the call was similar to ones he had heard from Common Black-Hawks in Arizona (see below for further discussion of vocalizations). This represents the first record of the Common Black-Hawk for California (Roberson 1986).

DISTRIBUTIONAL SUMMARY

The Common Black-Hawk ranges from northwestern Arizona, southwestern Utah, southern New Mexico, and western Texas (Figure 1) to northern South America, with isolated local populations in the Caribbean. The northernmost populations are migratory (A.O.U. 1983). Birds are present in Arizona from mid-March to early October (Monson and Phillips 1981); there are no authentic winter records (DeSante and Pyle 1986).

At least 150 pairs breed in the United States portion of the hawk's range, of which 80-90% are in Arizona (Schnell 1979, Helen Snyder in litt. to Minnesota Ornithologists' Records Committee). A few pairs nest in the Davis Mountains of western Texas and occasionally along the Rio Grande in southern Texas (Schnell 1979, Texas Ornithological Society 1984). There are a few nesting records from the Virgin River in southwest Utah (Behle et al. 1985). A vagrant was at Chatfield State Recreation Area, Jefferson County, Colorado, 20-21 June 1980 (Gent 1987).

A Common Black-Hawk in heavy postjuvenal molt was hit by a truck on 18 September 1976 at Bemidji, Minnesota. This bird was first considered to be possibly a wild vagrant (Elwell et al. 1978), but it has since been regarded as a probable escape (DeSante and Pyle 1986). The species was offered commercially for sale in the mid-1970s, and the specimen shows asymmetrical molt, fret marks (the result of stress, such as inadequate nutrition) on the juvenal primaries of the left wing, and abnormally heavy wear on the central retrices (Harrison B. Tordoff in litt. to Minnesota Ornithologists' Records Committee). These facts persuaded the Minnesota Records Committee to reject the record (R. Janssen pers. comm.).

In southern Florida between 1972 and 1976 there were at least four black-hawks that were originally published as Common Black-Hawks, possibly of

Caribbean orgin (Abramson 1976). However, these birds did not have the prominent white wing patch of Caribbean birds (Ogden 1975) and are treated as escaped birds, possibly Great Black-Hawks, by the A.O.U. (1983). Wally George (in litt.) observed one of the adults numerous times; that bird had white uppertail coverts and a white tail with a black subterminal band. These characters rule out the Common Black-Hawk and are marks of the Great Black-Hawk. In addition, the tail pattern of the immature bird shown in the published photo (Abramson 1976) suggests the bird may be a second-year Great Black-Hawk (see below for further discussion of plumages). These black-hawks have successfully nested in south Florida (Ogden 1975, W. George in litt.). Details have not been submitted to the Florida Ornithological Society Records Committee and neither species is accepted on the state list (Helen Dowling in litt.).

The previous records nearest California are from the Arizona side of the Colorado River, southern Nevada, and northwestern Baja California, Mexico. The Common Black-Hawk was reported along the Colorado River in Arizona at Parker, near Ehrenberg (11 April 1978 and 5 May 1979, the latter published as "possibly *urubitinga*," Monson and Phillips 1981), and in the Bill Williams

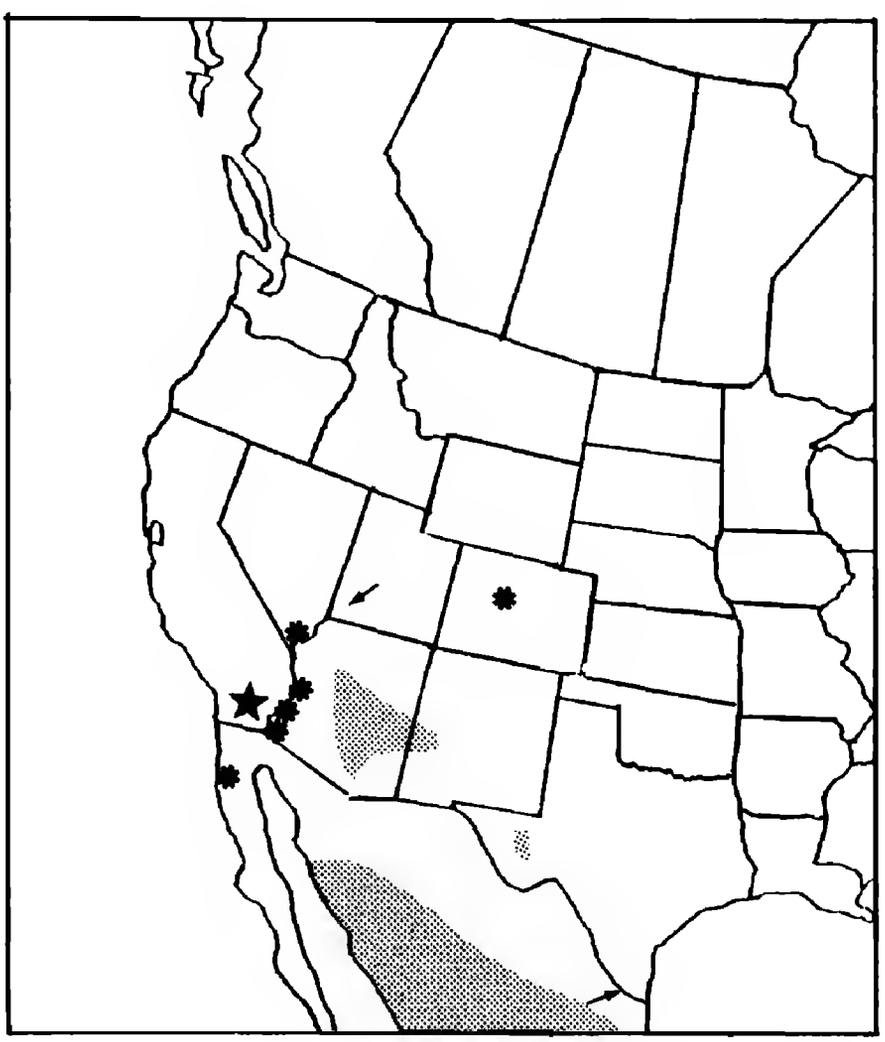


Figure 1. Approximate breeding range of Common Black-Hawk (shaded; U.S. range after Schnell 1979), with extralimital nesting (arrows), and records of vagrants mentioned in text (asterisks), and the California record (star).

Delta from March to May 1979 and in summer 1981 (Rosenberg et al. 1981). There are at least five records from southern Nevada (Kingery 1980), but the species has not attempted to nest there (DeSante and Pyle 1986, contra A.O.U. 1983). Short and Crossin (1967) reported seeing an adult on 7 April 1967 (not "7 May" as stated by Palmer 1988a) near San Vicente, northwestern Baja California.

Because of the number of records just across the border, a California sighting was expected, and this species was chosen by 4 of 5 experts asked by Jehl (1980) to predict the ten likeliest birds to be added to the California state list. The mid-April date and the desert oasis locale seem appropriate. A Common Black-Hawk reported ten days later in Joshua Tree National Monument (McCaskie 1985) was judged by the CBRC to be inadequately documented (Bevier in prep.).

SUBSPECIES

The A.O.U. (1957) regarded United States birds as part of the subspecies *B. a. anthracinus*. The population from Cuba and the Isle of Pines is a subspecies, *gundlachii*, of the Common Black-Hawk, according to the A.O.U. (1983). *B. a. gundlachii* differs from nominate *anthracinus* by the much larger white patch on its underwing (Bond 1979), its browner overall coloration, and its whitish malar stripe (Brown and Amadon 1968). Because of the size of the wing patch and lack of malar stripe, as well as geographic distribution, we assign the California bird to the *anthracinus* group (A.O.U. 1983), generally regarded as comprising a single subspecies *B. a. anthracinus* (Blake 1977, Brown and Amadon 1968), with which *B. a. utilensis* of islands in the Gulf of Honduras, recognized by Stresemann and Amadon (1979), is synonymized. According to the A.O.U. (1983), populations from Pacific coastal areas of El Salvador southward are a separate species, the Mangrove Black-Hawk *B. subtilis* (discussed further below), but some authors (e.g., Palmer 1988a) still treat these populations as subspecies of *B. anthracinus*.

IDENTIFICATION SUMMARY

In the United States, the Common Black-Hawk is most likely to be confused with the Zone-tailed Hawk *Buteo albonotatus*, although dark morphs of other species may bear some resemblance to it (Clark and Wheeler 1987). The Common Black-Hawk resembles the Black Vulture *Coragyps atratus* in that both birds are black with a white patch at the base of the primaries (faint on the Common Black-Hawk) and have rounded wings and a short tail. Both soar on flat wings, but the Black Vulture flaps its wings quickly, while the Common Black-Hawk flaps its wings slowly. The tails of adult Common Black-Hawks and adult Zone-tailed Hawks both show a broad white band across the center of the tail. The Zone-tailed has one or two additional narrow bands across the base of the tail. These are usually lacking or concealed by tail coverts on the Common Black-Hawk, but narrow white edges on the tail coverts of the Common Black-Hawk may give the illusion of narrow bands. On the Common Black-Hawk the bands are white on both the upper and lower sides of the tail, but on the Zone-tailed the bands on the upper side are gray and

much less distinct. The Common Black-Hawk appears to have a shorter tail than the Zone-tailed, but on perched birds tail differences may be difficult to see and the clearest differences are on the bill and legs. The bill of the Common Black-Hawk is about 30% larger than that of the Zone-tailed Hawk and has a larger yellow cere connecting to more extensive yellow lores. The Common Black-Hawk's yellow legs are much longer than the Zone-tailed's (Stallcup 1985, Friedmann 1950).

In the tropics, several other species closely resemble the Common Black-Hawk. The Mangrove Black-Hawk replaces the Common Black-Hawk in coastal mangroves along the Pacific coast from El Salvador (possibly southern Mexico; Davis 1972) south to Peru (A.O.U. 1983). The Mangrove Black-Hawk exhibits substantial geographic variation, with three well-marked subspecies differing in the amount of rufous in their secondaries and inner primaries. South American birds (*B. s. subtilis*) have the most rufous and El Salvador/Honduras birds (*B. s. rhizophorae*) have the least; Costa Rica/Panama birds (*B. s. bangsi*) are intermediate (Blake 1977, Monroe 1968). Otherwise, the Mangrove Black-Hawk is similar to the Common Black-Hawk (which also has faint rufous in the secondaries but not the inner primaries) except for its smaller size and more white in its underwing (Brown and Amadon 1968).

The Great Black-Hawk of Middle and South America is also quite similar to the Common Black-Hawk. It ranges north to northern Mexico, and some previous reports of Common Black-Hawks in Florida and Arizona have been suspected of pertaining to this species. The adult Great Black-Hawk is best distinguished by its uppertail coverts, which are white in all populations. It also has longer legs, which nearly reach the tip of the tail in flight, and its underwings average less white than the Common Black-Hawk's. Middle American populations (*B. u. ridgwayi*) have two or three white bands on the tail, fairly conspicuous white barring on the thighs, and slaty lores with yellow confined to the cere (Ridgely 1976). The South American *B. u. urubitinga* lacks the thigh markings, has yellow lores, and has a single white band across the entire base of the tail connecting to the white uppertail coverts.

The rare Solitary Eagle *Harpyhaliaetus solitarius*, whose range broadly overlaps that of the Great Black-Hawk, is even larger, lacks the white wing patch of the Common Black-Hawk, and has a larger, more projecting head, often with a bushy crest (Hilty and Brown 1986).

All juvenal black-hawks are similar to each other and quite different from immature Zone-tailed Hawks. They have a highly patterned head with a bold dark malar stripe, and many have a pale supercilium that contrasts with a darkish cap. Their underparts are largely buff or whitish with heavy dark streaks and large teardrop-shaped brown spots, especially on the flanks and sides of the breast. Their backs are blackish brown, heavily mottled with white or buff, especially on the upper back and nape. On the juvenal Common Black-Hawk, the tail is whitish, crossed by about 5-8 wavy narrow dark bars. The Great Black-Hawk is similar, but its tail is crossed by 10-14 dark bars (Ridgely 1976, Hilty and Brown 1986). In both species, juvenal plumage is retained through winter and gradually molted during the next spring, summer, and fall (Palmer 1988a). Unlike the Common Black-Hawk, the Great Black-Hawk has a distinctive second-year immature plumage, similar to the juvenal, but

with only 5 or 6 tail bands. In this plumage, the subterminal blackish band is much wider, constituting about a fifth of the entire tail length, unlike juvenal plumages of both species, in which the subterminal band is only slightly broader than the others (Friedmann 1950). The longer legs of the Great Black-Hawk remain helpful in identification of immatures. Juvenal Solitary Eagles apparently lack prominent tail barring (Friedmann 1950, Hilty and Brown 1986). Juvenal Mangrove Black-Hawks are very similar to juvenal Common Black-Hawks, differing only in their smaller size and possibly in having less streaking on the underparts and more rufous in their secondaries and wing coverts (Friedmann 1950). However, these plumage differences probably vary depending on the subspecies.

Juvenal Broad-winged Hawks *Buteo platypterus* and Gray Hawks *B. nitidus* are smaller and have straighter, more even gray-and-brown rather than wavy black-and-white tail bands. However, the juvenal Broad-winged Hawk varies conspicuously in the width of its proximal tail bands, variation not illustrated in field guides. On such birds, the tail bands are about equal in width and much broader than the narrow wavy bands on the tails of juvenal black-hawks. Forbush (1927) and Oberholser (1974) misinterpreted this variant as a second-year plumage, and Friedmann (1950) suggested that it might be transitional, but Johnson and Peeters (1963) showed that it was merely normal variation in juvenal plumage (cf. also Palmer 1988a,b).

Further study of vocalizations is needed. Hilty and Brown (1986), Ridgely (1976), and Schnell (1979) stated that the calls of Common and Great Black-Hawks are distinctive, but descriptions in other literature are confusing. The Common Black-Hawk typically gives a series of shrill, high-pitched, whistled screams best described as "whee-wheee-we-we-we-we" or "fle-fle-flee-fle-fle-fle-fle" with the longest syllable higher and louder than the rest (Terrill 1983). These are the high-pitched "spinking" whistled notes described by Ridgely (1976) and Hilty and Brown (1986) and the seven to eight piercing staccato, multi-pitched notes described by Schnell (1979). A harsh prolonged cry "ka-a-a-ah, ka-a-a-ah" (Bent 1937) or "haaaaaah" (Peterson and Chalif 1973), a weak, long, high-pitched whistle (Edwards 1972), and a night-heron-like squawk (Bent 1937) have also been attributed to the Common Black-Hawk, possibly in error (cf. also Schnell 1988). The voice of the Great Black-Hawk is usually described as a high-pitched whistled scream "wheeeeeeeur" (Hilty and Brown 1986, Ridgely 1976, Peterson and Chalif 1973) or a rasping extended high-pitched whistle (Edwards 1972). This call is given by both flying and perched birds, but Peterson and Chalif (1973) attribute a "keek-keek-keek-keek" to the aerial display of the Great Black-Hawk, and Davis (1972) describes this as "ka-ka-ka-keeeo," with the final "keeeoo" sometimes given alone as a loud scream.

ACKNOWLEDGMENTS

We thank CBRC members Louis Bevier, Laurence C. Binford, Jon L. Dunn, Richard A. Erickson, Jeri M. Langham, Guy McCaskie, Benjamin D. Parmeter, and Richard Stallcup for their comments in reviewing this record, and Richard L. Glinski for helpful comments on an earlier draft. Robert B. Janssen graciously provided the file on the Minnesota record of the Common Black-Hawk. Helen P. Dowling kindly provided information regarding Florida black-hawks and Wally George forwarded much useful infor-

mation about those birds. We also thank Stephen F. Bailey for assistance in Morlan's examination of specimens at the California Academy of Sciences, and Tim Manolis for preparing the sketch.

LITERATURE CITED

Abramson, I. J. 1976. The Black Hawk (*Buteogallus anthracinus*) in south Florida. Am. Birds 30:661-662.

American Ornithologists' Union. 1957. Check-List of North American Birds. 5th ed. Am. Ornithol. Union, Baltimore, MD.

American Ornithologists' Union. 1983. Check-List of North American Birds. 6th ed. Am. Ornithol. Union, Washington, D.C.

Behle, W., Sorensen, E., and White, C. 1985. Utah Birds: A revised checklist. Utah Mus. Nat. Hist. Occ. Publ. 4.

Bent, A. C. 1937. Life histories of North American birds of prey, part 1. U.S. Nat. Mus. Bull. 170.

Bevier, L. in prep. Eleventh report of the California Bird Records Committee. W. Birds.

Blake, E. 1977. Manual of Neotropical Birds. Univ. of Chicago Press, Chicago.

Bond, J. 1979. Birds of the West Indies. Collins, London.

Brown, L., and Amadon, D. 1968. Eagles, Hawks and Falcons of the World. Country Life, Feltham, England.

Clark, W., and Wheeler, B. 1987. A Field Guide to Hawks of North America. Houghton Mifflin, Boston.

Davis, L. I. 1972. A Field Guide to the Birds of Mexico and Central America. Univ. of Texas Press, Austin.

DeSante, D., and Pyle, P. 1986. Distributional Checklist of North American Birds. Artemisia Press, Lee Vining, CA.

Edwards, E. P. 1972. A Field Guide to the Birds of Mexico. E. P. Edwards, Sweet Briar, VA.

Elwell, L., Mathisen, J., and Mathisen, A. 1978. Black Hawk found in Bemidji. Loon 50:31-34.

Forbush, E. H. 1927. Birds of Massachusetts and Other New England States. Vol. 2. Mass. Dept. Agric., Norwood, MA.

Friedmann, H. 1950. The birds of North and Middle America. U.S. Natl. Mus. Bull. 50, part XI.

Gent, P. 1987. Colorado Field Ornithologists' Records Committee report for 1978-1985. W. Birds 18:97-108.

Hilty, S., and Brown, W. 1986. A Guide to the Birds of Colombia. Princeton Univ. Press, Princeton, NJ.

Jehl, J. R., Jr. 1980. Trends in the state list of California birds. W. Birds 11:103-109.

Johnson, N. K., and Peeters, H. J. 1963. The systematic position of certain hawks in the genus *Buteo*. Auk 80:417-446.

Kingery, H. 1980. The spring migration: Mountain West region. Am. Birds 34:800-803.

McCaskie, G. 1985. The spring migration: Southern Pacific Coast region. Am. Birds 349-351.

Monson, G., and Phillips, A. 1981. Annotated Checklist of the Birds of Arizona. Univ. of Ariz. Press, Tucson.

Monroe, B. L., Jr. 1968. A distributional survey of the birds of Honduras. Ornithol. Monogr. 7.

Oberholser, H. 1974. The Bird Life of Texas. Univ. of Texas Press, Austin.

Ogden, J. C. 1975. The nesting season: Florida region. Am. Birds 29:960-963.

Palmer, R. S. 1988a. Handbook of North American Birds. Vol. 4. Yale Univ. Press, New Haven, CT.

Palmer, R. S. 1988b. Handbook of North American Birds. Vol. 5. Yale Univ. Press, New Haven, CT.

Peterson, R. T., and Chalif, E. L. 1973. A Field Guide to Mexican Birds. Houghton Mifflin, Boston.

Ridgely, R. 1976. A Guide to the Birds of Panama. Princeton Univ. Press, Princeton, NJ.

Roberson, D. 1986. Ninth report of the California Bird Records Committee. W. Birds 17:49-77.

Rosenberg, K., Hubbard, J., and Rosenberg, G. 1981. The nesting season: Southwest region. Am. Birds 35:966-969.

Schnell, J. H. 1979. Habitat management series for unique or endangered species. Report 18: Black Hawk (*Buteogallus anthracinus*). U. S. Dept. Interior, Bur. Land Mgmt., Technical Note T/N 329, Filing Code 6611. Available for $15.95 postpaid from National Technical Information Services, 5285 Port Royal Rd., Springfield, VA 22161.

Schnell, J. H. 1988. Lesser Black-Hawk—Voice, in Handbook of North American Birds, (R. S. Palmer, ed.), Vol. 4, p. 382. Yale Univ. Press, New Haven, CT.

Short, L. L., and Crossin, R. S. 1967. Notes on the avifauna of northwestern Baja California. Trans. San Diego Soc. Nat. Hist. 14:281-300.

Stallcup, R. 1985. Birds for Real. R. Stallcup, Inverness, CA.

Stresemann, E., and Amadon, D. 1979. Order Falconiformes, in Check-list of Birds of the World, Vol. 1, 2nd ed. (E. Mayr and G. W. Cottrell, eds.), pp. 271-425. Mus. Comp. Zool., Cambridge, MA.

Terrill, S. B. 1983. Common Black-Hawk, in The Audubon Society Master Guide to Birding (J. Farrand, Jr., ed.), Vol. 1, pp. 232-234. Knopf, New York.

Texas Ornithological Society. 1984. Checklist of the Birds of Texas, 2nd ed. (K. Arnold, ed.). Texas Ornithol. Soc., Austin, TX.

Accepted 13 January 1989

THE BREEDING BIRDS OF ALCATRAZ ISLAND: LIFE ON THE ROCK

WILLIAM I. BOARMAN, Department of Biological Sciences, Rutgers University, Piscataway, New Jersey 08854

Grinnell and Wythe (1927) summarized the bird life of the San Francisco Bay region, paying particularly close attention to distribution and nesting sites. However, neither their report nor any other covering the area has mentioned the avifauna of one of the most prominent and well-known land features in the region: Alcatraz Island. The avifauna of Alcatraz is of interest because the island is only 1.6 km from a large city and a large number of people (an average of 2300 daily, R. Weideman pers. comm.) visit it year round.

Until recently, no ornithologist or natural historian had visited or at least had reported on any visits to the island. The only publications on the island's birds are by Binford (1980), Howell et al. (1983), and Howell (1983). Here I summarize my observations of the birds breeding on Alcatraz. The data are based on many casual observations between May and August 1981 and between April and July 1982. All Western Gull nests were mapped during this period and on 10 and 30 May 1983.

STUDY AREA

Alcatraz is an 8.6-ha sandstone island in San Francisco Bay and lies 4.1 km east of the Golden Gate Bridge and 1.6 km north of Fisherman's Wharf in the city of San Francisco (Figure 1). Oblong, the island runs northwest to southeast and measures roughly 550 by 200 m. The southwest edge consists primarily of sheer cliffs rising to a rather flat plateau approximately 13 m above water level at the island's northwest end and another plateau 18.5 m above water level at the southeast end. The northeast edge rises more slowly to a higher plateau 40 m above water level. The plateaus are covered with concrete, abandoned buildings, rubble of demolished buildings, bare dirt, and in some places grass or thick vegetation.

Floristically the island is disturbed. Originally it was solid "sandstone covered with a thin coating of guano" (U.S. Army 1879, cited in Thompson 1979) devoid of shrubs and trees. During the late 1800s dirt brought over from nearby Angel Island for gun battery emplacements probably contained seeds of various native shrubs and annuals including Dwarf Coyote Bush (*Baccharis pilularis*), California Poppy (*Eschscholzia californica*), and California Blackberry (*Rubus vitifolius*), which have since colonized Alcatraz. After the mid-1860s several ornamental plants were introduced. Those prevalent today include eucalyptus (*Eucalyptus* sp.), Monterey Cypress (*Cupressus macrocarpa*), Century Plant (*Agave americana*), Nasturtium (*Tropaeolum majus*), and fuchsia (*Fuchsia hybrida*). Since 1963 the plants have been left untended and are now growing virtually wild.

The island has been used heavily by man since 1853 when a lighthouse was erected. Since then it has been used as a fort, military prison, and, until 1963, as a United States Federal Penitentiary. Today the penitentiary is closed and the island is administered by the National Park Service as part of Golden

Gate National Recreation Area, attracting an average of 2300 tourists daily. People are allowed to wander freely over certain portions of the island, but, only park personnel are currently permitted in the areas inhabited by most birds.

BREEDING BIRDS

Black-crowned Night Heron (*Nycticorax nycticorax*). Roosts and nests in eucalyptus and cypresses on the northeast side of island and in shrubs on northeast and southwest sides. Twenty-four nests located in 1981, 39 in 1982; some nests may have been overlooked amid thick foliage. In 1982 birds were first observed on 28 February (J. Barrons pers. comm.), and the first chick was heard calling from the tall cypresses northeast of the Cell House on 6 April. One presumably second-year bird (brown-tinged plumage) successfully nested in 1982. Ray Pierotti (pers. comm.) reports the population to be expanding.

Mallard (*Anas platyrhynchos*). One or two pairs bred each year. Females have been seen with chicks on most of the island, even inside buildings. One old nest with egg shell fragments was found under a small shrub immediately southwest of the Cell House.

Heermann's Gull (*Larus heermanni*). A pair attempted to nest each spring 1979 to 1981 but were unsuccessful (Howell et al. 1983). The nest was located under a Dwarf Coyote Bush on an exposed point near the incinerator. The species has attempted no nests since.

Western Gull (*Larus occidentalis*). Nests on exposed cliffs, building roofs, flat cement slabs with and without grass cover, within debris of felled buildings, on top of guard towers, and inside an old washing machine. Most avoid the northeast side of island where the majority of human activity is. In 1981 a minimum of 135 pairs bred; in 1982 censuses indicated 224 breeding pairs; in 1983 on two visits 126 active nests were located; however, the second visit was on 30 May, probably before all broods had been initiated (in 1982, only 74% of all nests had yet been located by 27 May). Ray Pierotti (pers. comm.) reported the population to contain over 350 breeding pairs in 1988.

Pigeon Guillemot (*Cepphus columba*). Several times during the summer of 1981 I saw Pigeon Guillemots flying from cliffs along the southwest edge of the island. During a boat trip around the island on 7 July I saw two guillemots on the water. More thorough observations were made during 1982. On 22 May and 15 June I flushed a guillemot from the cliff west of the fallen remains of the apartments. On 15 June two adults, one with a fish in its bill, were in the water below. During the following 15 minutes the bird carrying the fish flew toward the cliff then turned away several times. Finally, it landed on a small rock ledge 2 m from the top of the cliff and about 13 m above the water and stuck its head into a crevice. It retracted its head a moment later, without the fish, and flew back to the water. I climbed down the cliff and found a crevice among three large rocks that were part of an old retaining wall. The roughly triangular entrance was approximately 10 cm across at the base by 18 cm high. At a depth of 20 cm the cavity made a turn to the right. I did not see or hear any chicks but found at the entrance a broken egg shell (similar to Pigeon Guillemot eggs in the collection at the California Academy of Sciences). During my inspection of the nest site there were three guillemots in the water

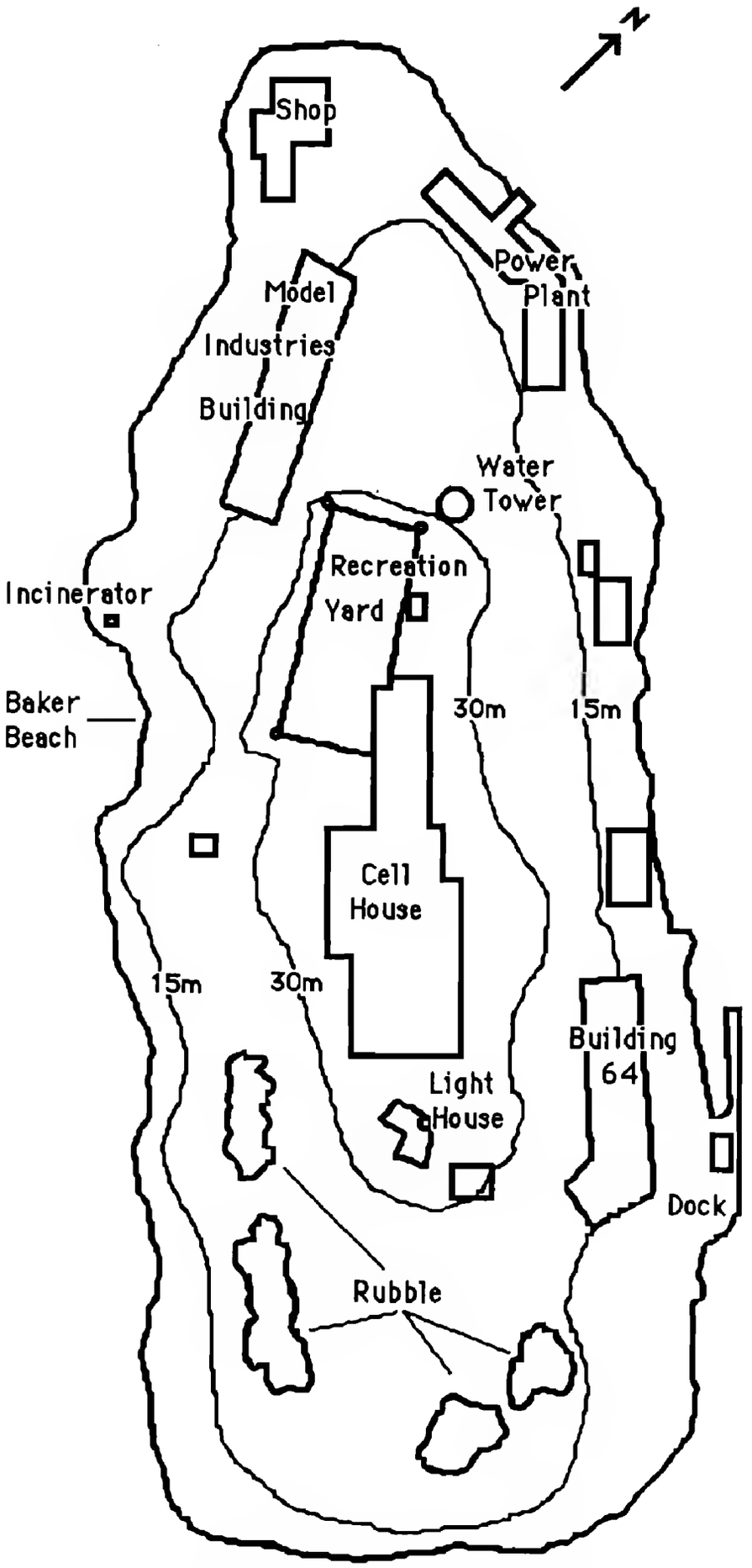


Figure 1. Alcatraz Island, showing all buildings mentioned in the text.

below, one giving an alarm "scream" (Nelson 1985) and two with fish in their bills. On 25 June, Paul Jones (pers. comm.) saw one slate-black chick with dark legs far back in the crevice. He found the remains of two dead fish (one a midshipman, *Porichthys* sp.) on the ledge immediately outside the opening.

I found only this one nest on Alcatraz but saw 15 to 20 birds begging, calling, carrying fish, flying in "figure-eight" patterns, and sitting on the cliffs or in crevices and holes, suggesting that as many as ten more nests may have been present. Island-based observations on 18 June, 25 June, and 8 July 1982 revealed five possible nesting locations: south and west of the shop building, southeast end of Baker Beach, 75 m southeast of this last site, north of the incinerator, and immediately west of the incinerator.

On 13 July 1982, during a survey by boat, I saw several guillemots, three of which were begging, along the southwest cliffs. Three birds were seen sitting in small man-made holes bored in rock approximately 6 m above the water, two near the industries building and one 75 m southeast of Baker Beach. These, and a fourth unoccupied hole at the southeast corner of Baker Beach, had fair amounts of guano below them and may have been nesting holes. I saw a guillemot perform the "figure-eight" flight, then land by a crevice next to another bird southwest of and well below the verified nest. Six birds were seen sitting quietly on the cliff west of the incinerator. This is the first time guillemots have been known to nest within San Francisco Bay (see Sowls et al. 1980).

The lack of previous records of Pigeon Guillemots breeding in San Francisco Bay indicates that this is most likely a newly formed colony. Two factors may have contributed to the colony's establishment. The National Park Service currently restricts public access to certain parts of the island, leaving the nesting birds relatively undisturbed by people. An increase in population size at other colonies may have increased competition for nesting sites, prompting some birds to pioneer new colonies. In support of this, population size at the South Farallon Islands colony did increase in the late seventies and early eighties (D. F. DeSante pers. comm.). Furthermore, DeSante and Ainley (1980) suggested that the Farallon guillemot population reached saturation in the late seventies. Pigeon Guillemots were still visiting Alcatraz daily during the 1983 through 1988 breeding seasons (R. Pierotti and J. Howell pers. comm.).

Song Sparrow (*Melospiza melodia*). I found approximately six singing males in heavily vegetated areas throughout island but saw no nests or young.

White-crowned Sparrow (*Zonotrichia leucophrys*). I found one nest with young on 14 June 1981. Approximately 14 singing males are distributed throughout the island. If the birds occupy the entire island and territories are contiguous, the average territory size is 0.6 ha. Luis Baptista (pers. comm.) has recorded songs from 12 individuals. He noted that their song-type is distinct from that of neighboring islands and may have been derived from the Marin dialect.

In addition, the following species nesting on the nearby mainland remained through the breeding season on Alcatraz, though I did not see them nesting there. Courtship behavior was observed often among the four to six Rock Doves (*Columbia livia*) present. One or two Mourning Doves (*Zenaida macroura*) were frequently observed in and around the tall trees northeast of the Cell House. Two to three Anna's Hummingbirds (*Calypte anna*) and Allen's

Hummingbirds (*Selasphorus sasin*) were most often seen in heavily vegetated areas along the northeast side of island. One Black Phoebe (*Sayornis nigricans*) was usually on the dock southwest of Building 64 or near the Model Industries Building. A pair of Barn Swallows (*Hirundo rustica*) was seen often in 1981 near the dock and around Building 64, where they may have nested (S. Paris pers. comm.). Approximately 12 European Starlings (*Sturnus vulgaris*) were usually seen in a flock over the entire island. One pair of Pine Siskins (*Carduelis pinus*) was active in 1982 in the trees east of the Cell House. Two House Finch (*Carpodacus mexicanus*) flocks, each of 8 to 10 individuals, were seen in the area around the water tower and west of the Cell House.

DISCUSSION

In all, five species were known with certainty to have successfully bred on Alcatraz Island (Black-crowned Night Heron, Mallard, Western Gull, Pigeon Guillemot, White-crowned Sparrow). Another species has made an unsuccessful attempt to breed (Heerman's Gull). A seventh species (Song Sparrow) most likely breeds on the island but nests have yet to be found. Nine other species have remained through the breeding season but have not been seen nesting (Rock Dove, Mourning Dove, Anna's Hummingbird, Allen's Hummingbird, Black Phoebe, Barn Swallow, European Starling, Pine Siskin, and House Finch). Additionally, R. Pierotti and C. Christensen (pers. comm.) believe that a pair of Common Ravens (*Corvus corax*) probably nested on the south end of the island in 1988.

The breeding birds of the South Farallon Islands have been discussed by DeSante and Ainley (1980). Of the twelve seabird species that breed on the Farallones, only two (Western Gull and Pigeon Guillemot) nest on Alcatraz. Remarkably, the two islands share no known species of breeding landbirds. Of the all the species nesting on the Farallones, the House Sparrow is the most curious for not nesting on Alcatraz. I have no explanation for this phenomenon.

Of the 101 species which have been seen on or near Alcatraz (pers. obs.; S. Abbors, I. Bletz, M. Flippo, S. Paris, pers. comm.) a maximum of 16 may have attempted to breed during 1981 and 1982. My results can be used as a baseline for tracking future trends in population sizes and will facilitate the correlation of these trends with environmental events (e.g., pollutants and weather patterns such as El Niño). The bird populations on Alcatraz Island may also provide research opportunities. The National Park Service has protected most of the breeding areas but is now considering plans to open most of the island to visitors (J. Howell and R. Weideman pers. comm.). The White-crowned Sparrow population is isolated enough that it has its own song dialect (or subdialect) and small enough that the entire population could be studied easily. There are no mammal predators, an uncontrollable factor on the mainland and many other islands. The other islands in San Francisco Bay provide the opportunity for comparative studies.

Finally, Alcatraz is a valuable natural resource. It has the third largest coastal colony of Western Gulls in central California (Sowls et al. 1980), the only colony of Pigeon Guillemots in San Francisco Bay, and a breeding population of Black-crowned Night Herons. I hope that a better understanding of

the birds on Alcatraz Island and their interactions with other local populations will help to eliminate activities and future developments that would be hazardous to them.

ACKNOWLEDGMENTS

I thank Judd Howell and Rich Weideman of the National Park Service for his valuable logistical support during the course of this study. My wife, Jeanie A. Mlenar, assisted with the field work. Jan Barrons, Chris Christensen, Bob Crabb, Paul Jones, Molly O'Malley and Sharon Paris provided valuable observations. Paul Jones crawled down the steep cliff face with loose stones while holding onto an old piece of cable for support to get a look inside the nest cavity. Robert Bowman, David F. DeSante, Judd Howell, Paul Jones, Joseph Morlan, Douglas Nelson, and Raymond Pierotti made valuable comments on early versions of the manuscript.

LITERATURE CITED

Binford, L. C. 1980. Heermann's Gull invades Alcatraz. Point Reyes Bird Observatory Newsl. 51:3.

DeSante, D. F., and Ainley, D. G. 1980. The avifauna of the South Farallon Islands, California. Studies Avian Biol. 4:1-101.

Grinnell, J., and Wythe, M. W. 1927. Directory to the bird-life of the San Francisco Bay region. Pac. Coast Avifauna 18.

Howell, J. A. 1983. Heermann's Gull (*Larus heermanni*) on Alcatraz Island in Golden Gate Recreation Area, California. Proc. First Biennial Conf. Res. Calif. Natl. Parks 1:230-233.

Howell, J. A., LaClergue, D., Paris, S., Boarman, W. I., DeGange, A. R., and Binford, L. C. 1983. First nests of Heermann's Gull in the United States. W. Birds 14:39-46.

Nelson, D. A. 1985. The syntactic and semantic organization of Pigeon Guillemot (*Cepphus columba*) vocal behavior. Z. Tierpsychol. 67:97-130.

Sowls, A. L., DeGange, A. R., Nelson, J. W., and Lester, G. S. 1980. Catalog of California seabird colonies. FWS/OBS 37/80, U.S. Dept. Interior, Fish and Wildlife Service.

Thompson, E. N. 1979. The rock: A history of Alcatraz Island, 1847-1972. Historic Resource Study, Golden Gate National Recreation Area, California. U.S. Dept. Interior, Natl. Park Service, Historic Preservation Division, Denver.

Accepted 19 December 1988

The following article is the fourth in a series on California rarities edited by Morlan and Roberson. It is based on materials submitted to the California Bird Records Committee (CBRC). The description and circumstances were drawn from the accounts of the observer and have been reviewed by him. Roberson prepared the distributional summary; Morlan prepared the identification summary. In this way we hope much important information accumulated in CBRC files will become widely available.

White-collared Swift *Sketch by Tim Manolis*

FIRST RECORD OF THE WHITE-COLLARED SWIFT IN CALIFORNIA

RICHARD A. ERICKSON, P. O. Box 523, Bayside, California 95524
JOSEPH MORLAN, 417 Talbot Ave., Albany, California 94706
DON ROBERSON, 282 Grove Acre Ave., Pacific Grove, California 93950

At midmorning on 21 May 1982, Erickson and his birding companions Lynn C. Berner, Gary S. Lester, Gary J. Strachan, and Richard S. Tryon were near the spruce grove at Point St. George, Del Norte County, extreme northwestern California, when a swift caught their attention. Erickson's first impression was of Black Swift *Cypseloides niger*, but Strachan noted white on its neck; soon the whole group focused on the bird. It was a large swift with tattered primaries that fed with a flock of swallows, including Barn *Hirundo rustica*, Cliff *H. pyrrhonota*, Tree *Tachycineta bicolor*, and Violet-green *T. thalassina* swallows, over the grassy headland northeast of the spruce grove. The morning fog was breaking up and lighting conditions were good. The observers watched the bird with binoculars and a 20 × telescope, as it approached them sometimes to within 15 m, for 20 to 40 minutes. The swift fed from a height of 100 m to within 8 m of the ground. The following description is paraphrased from Erickson's field notes:

A swift of typical shape (slim body with extremely long wings and apparently no "wrists") with a tiny bill and a slightly forked tail of moderate length. It absolutely dwarfed every swallow in association, even at great distances. It was substantially longer than a Cliff Swallow seen in direct comparison. Gary Lester felt the wingspan was double that of a Barn Swallow; I thought it was maybe not quite twice as much. The plumage was entirely blackish except for a conspicuous complete white collar, narrowest and cleanest across the nape but broader and less distinct and descending posteriorly somewhat across the breast. This collar, especially on the nape, was visible

at great distances. A speckling of whitish on the forehead was visible only at close range.

The bird flew rather like other large swifts, with much gliding and occasional bouts of rapid flapping. Once or twice the bird seemed to stall out and fold up for a considerable drop in elevation. On at least one occasion, the wings were held arched below the level of the body as the bird flew parallel to the ground.

Although the bird resembled White-collared Swifts *Streptoprocne zonaris* that Erickson had seen previously in Belize, the whitish speckling to the forehead seemed anomalous, so the observers considered the possibility of a partially albino Black Swift. Erickson telephoned Morlan, who then checked the nine specimens of *S. zonaris* at the Museum of Vertebrate Zoology, University of California, Berkeley. None had a whitish forehead, although a brief literature search suggested that the Caribbean race might be so marked. Morlan noted that the White-collared is a blackish species, whereas the Black Swift is decidedly sooty brown.

Erickson next telephoned J. V. Remsen, Jr., Curator of Birds at the Museum of Zoology, Louisiana State University (L.S.U.). Remsen compared the verbal description to a collection of about 60 *S. zonaris*, of which 43 were of the northern, mainland race *mexicana*. Twelve of these had scaly or mottled breast bands, evidently a sign of immaturity. This variation did not appear to be related to sex or season. Adult females had narrower breast bands than had males. Many birds had pale dusky feathers on the forehead which, when viewed head-on, gave the forehead an almost whitish appearance (less obvious from the side). Remsen eventually reviewed written descriptions and concluded that the bird was a White-collared Swift, and because the collar was less well marked on the breast, probably an immature of the subspecies *mexicana*.

Nine days after the sighting, Erickson and Lester visited Burney Falls, Shasta County, to study Black Swifts, five of which they watched at length and compared to a nearby Vaux's Swift *Chaetura vauxi*. Of the Black Swifts Erickson wrote

Although these were clearly large swifts, they somehow didn't seem quite as massive to me as the Pt. St. George bird. More significant, though, was the brownish tinge to these birds, primarily on the throat and breast, and their manner of flight. The extremely rapid, almost "twinkly" wingbeats of these birds were much more like those of a Vaux's Swift than I had recalled. In no way did I ever compare the flight of the Pt. St. George bird to that of a Vaux's Swift. The amount of tail forking and the extent of the whitish on the foreheads of these birds varied from rounded and blackish, respectively, to forked and whitish, comparable to the Pt. St. George bird.

This record of the White-collared Swift was accepted as a first for California by the California Bird Records Committee by a 9-1 vote after two circulations (Morlan 1985). The Committee reviewed descriptions from all five observers, Erickson's sketch (Figure 1), and the analysis of J. V. Remsen. All but one agreed that the size, flight, blackish color, whitish-tinged forehead, and collar pattern (clean and narrow on the nape, broader and more diffuse on the breast) ruled out an aberrant Black Swift. Obvious albinism is unknown in the Black Swift (Ross 1963, Gross 1965, C. T. Collins pers. comm.) but is known in other swifts, in which it usually involves only a few

scattered feathers (Collins 1967, Catley 1978, Sharrock 1978; see also the discussion of the White-chested Swift under "Identification" below). The lone dissenter objected that the large size should have been more obvious, and noted how huge the White-naped Swift *S. semicollaris* of western Mexico appears in the field. Other members pointed out that the White-collared is a species much smaller that the White-naped and that the size estimates (about twice the wingspan of the Barn Swallow) fit the White-collared better than the Black Swift.

The issue of the worn remiges was discussed and the possibility of an escape was discounted. J. V. Remsen wrote (to L. C. Binford) that "we have at least one specimen of half a dozen species with extremely worn primaries (not shot damaged), including one White-collared from Peru. These individuals are bedraggled enough that it would be apparent in the field." K. L. Garrett noted (in CBRC comments) similar tattered primaries on the Chimney Swift *Chaetura pelagica* in summer in southern California. In most swifts, the post-juvenal molt in fall does not include the remiges (Dickey and van Rossen 1938), and this accounts for worn remiges not being shed until the second autumn.

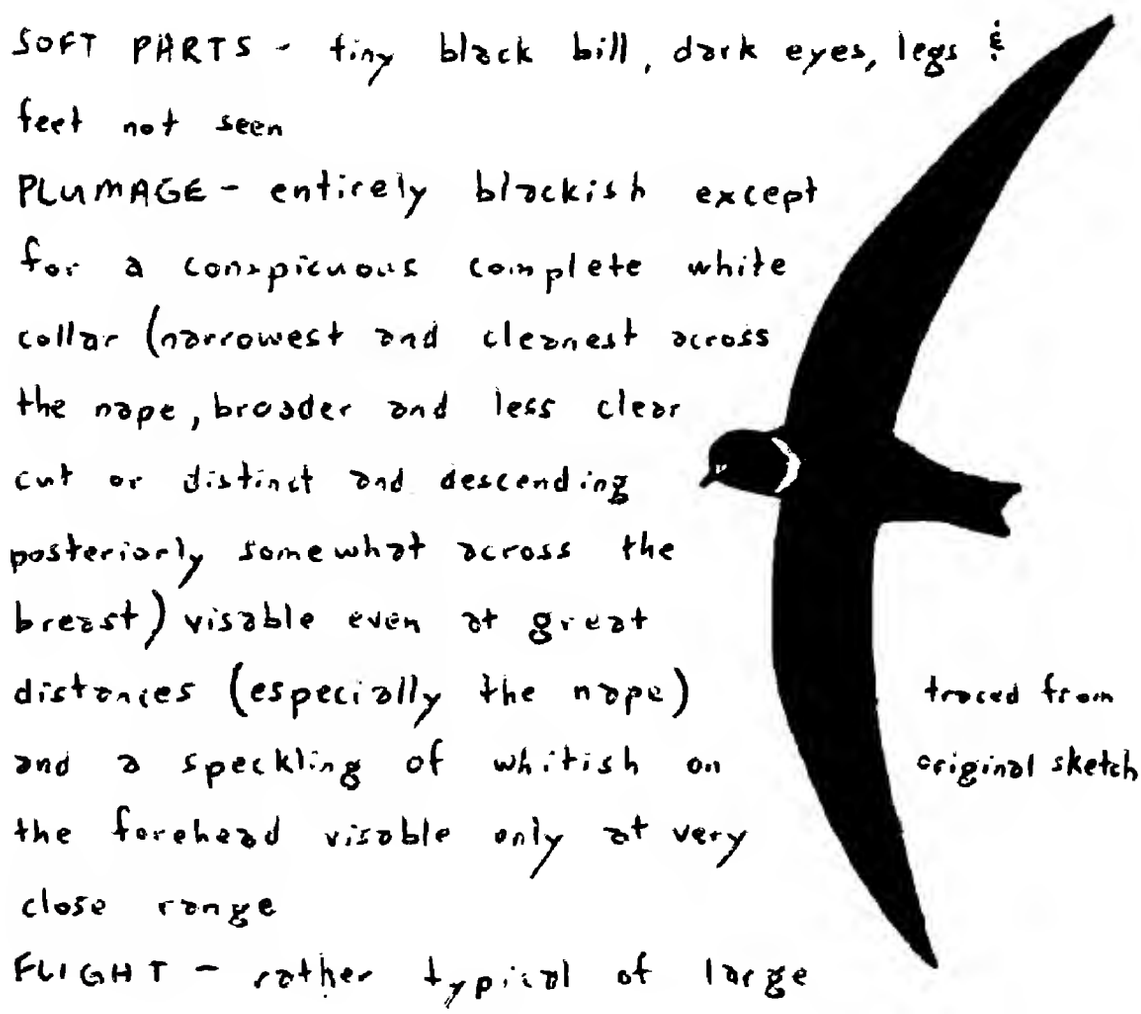


Figure 1. White-collared Swift, Pt. St. George, 21 May 1982.

Sketch by R. A. Erickson

DISTRIBUTIONAL SUMMARY

The White-collared Swift ranges from north-central Mexico (Guerrero, San Luis Potosi, and Tamaulipas) south through Central America to northwestern Argentina and southeastern Brazil and in the Greater Antilles (A.O.U. 1983; Figure 2). Little has been published about its movements, although wandering to Trinidad (especially July-October; Snow 1962, ffrench 1973) and the Lesser Antilles (especially May-October; Bond 1979) has been noted. In the northwestern portion of its range, individuals have been seen in winter north to southern Sinaloa (Morlan 1985, R. W. Stallcup pers. comm., B. E. Daniels pers. comm.).

There are four other records for the White-collared Swift in the United States: two reported on 4 December 1974 at Rockport, Aransas County, Texas (Webster 1975; currently under review by the Texas Bird Records Committee, G. W. Lasley pers. comm.); one found recently dead on 25 January 1981, clinging to a screen door on Perdido Key, Escambia County, Florida (4 miles east of Alabama, Hardy and Clench 1982, specimen at the University of Florida); a young male found dead on 8 March 1983, washed

Figure 2. Approximate breeding range of the White-collared Swift (shaded), locations of other North American records (asterisks), and this record (star).

up on a beach on Padre Island, Kleberg County, Texas (Lasley 1984, specimen Texas A & M Univ.); and one seen flying north on 20 December 1987 near Freeport, Brazoria County, Texas (Lasley and Sexton 1988, Arnold 1988; under review by the Texas Bird Records Committee). Both specimens appear to be *S. z. mexicana* (Hardy and Clench 1982, Lasley 1984).

The Florida and Texas specimens were linked to unusual weather or a favorable jet stream (Hardy and Clench 1982, Lasley 1984), but the California record was not associated with any unusual conditions. The Sinaloa, Florida, and Texas records are for winter, when the species may disperse from breeding colonies. The California bird might have been a spring migration "overshoot," but records are insufficient to explain its occurrence so far north.

SUBSPECIES

Peters (1940) recognized five subspecies of the White-collared Swift. Populations from Honduras to Peru, *S. z. albicincta*, and those from southeast South America, *S. z. zonaris*, have the "forehead sooty black, scarcely if at all different from the color of the crown." *S. z. mexicana* from Mexico to El Salvador and *S. z. pallidifrons* from Cuba, Hispaniola, and Jamaica have the forehead sooty gray or grayish brown, "distinctly different from black of crown." *S. z. pallidifrons* has a white superciliary line on the side of the forehead, lacking in *mexicana* (Ridgway 1911). A highland form from northwestern South America, *S. z. altissima*, is said to have a broader breast band and greener overall coloration (Cory 1918); however, the difference in breast band width between subspecies discussed by Hardy and Clench (1982) is not supported by specimens in the L.S.U. collection (Remsen in litt.), and greenness or blueness of swift feathers is a function of wear and not a useful subspecific character (C. T. Collins in litt.).

IDENTIFICATION SUMMARY

The adult White-collared Swift is distinctive and unlikely to be confused with other species of swifts. The Biscutate Swift *S. biscutata* of southeastern Brazil is the most similar species, but its white collar is not connected at the sides and its tail is square (Hilty and Brown 1986) or only slightly forked (Lack 1956). The Great and Lesser swallow-tailed swifts, *Panyptila sanctihieronymi* and *P. cayennensis*, of Middle and South America, have white throats, white tips to their secondaries, and much more deeply forked tails, which usually appear long and pointed in the field. The White-chested Swift *Cypseloides lemosi*, endemic to Colombia, resembles the Black Swift except for a conspicuous white patch tapering to a point on its chest. It has no white on its nape (Hilty and Brown 1986). The juvenal White-chested Swift usually has some white feathering on its chest but is occasionally all dark like the Black Swift. Eisenmann and Lehmann (1962) noted that a few Black Swifts have one to three partially concealed white chest feathers and originally speculated that the White-chested Swift types might have been partial albino Black Swifts.

The immature White-collared Swift has a reduced white collar, more or less obscured or scaly (Bond 1979, Peterson and Chalif 1973) or interrupted on the sides (Hilty and Brown 1986), and thereby resembles the Biscutate Swift. In some individuals the white collar may be entirely lacking (Ridgely 1976), making them easier to confuse with the Black Swift. Morlan suspects that one unseasonal report of the Black Swift from California (2 November 1974 at Furnace Creek Ranch, Death Valley, Inyo County; Garrett and Dunn 1981) may pertain to this or other similar species, since it had exposed rectrix shafts (disputed by other observers). The White-collared Swift has slightly exposed tips to the rectrix shafts, which the Black Swift never shows even when the rectrices are heavily worn because of its uniquely soft rectrix shafts (Orr 1963). Some immature White-collared Swifts may show a white nape combined with a nearly black breast (Peterson and Chalif 1973), as in the White-naped Swift. If possible, careful size comparisons to adjacent birds, along with a precise description of the tail and rectrix tip shape, may be crucial for field identification of non-adult swifts. However, swifts seldom allow close scrutiny and many potential rarities are best left unidentified.

ACKNOWLEDGMENTS

We thank CBRC members Laurence C. Binford, Jon L. Dunn, H. Lee Jones, Kimball L. Garrett, Paul E. Lehman, Guy McCaskie, Benjamin D. Parmeter, and Richard E. Webster for their helpful comments in reviewing this record; J. V. Remsen, Jr. for his thorough analysis of the L.S.U. specimens and comments on a draft of this article; Brian E. Daniels, Greg W. Lasley, and Richard W. Stallcup for unpublished information; Ned K. Johnson at the Museum of Vertebrate Zoology and Stephen F. Bailey at the California Academy of Sciences for access to collections in their care; and Tim Manolis for the head-note sketch. Charles T. Collins provided additional useful comments on an early draft of this paper.

LITERATURE CITED

American Ornithologists' Union. 1983. Check-List of North American Birds. 6th ed. A.O.U., Washington, D.C.

Arnold, K. A. 1988. The 88th Christmas bird count, regional summaries: Texas. Am. Birds 42: 551-553.

Bond, J. 1979. Birds of the West Indies. 4th ed. Collins, London.

Catley, G. P. 1978. Partially albino Swifts. Br. Birds 71:222.

Collins, C. T. 1967. Partial albinism in the Chestnut-collared Swift in Trinidad. Bull. Br. Ornithol. Club. 87:122-123.

Cory, C. B. 1918. Catalogue of birds of the Americas. Field Mus. Nat. Hist., Zool. Series 13 (part 2, no. 1).

Dickey, D. R., and van Rossem, A. J. 1938. The birds of El Salvador. Field Mus. Nat. Hist., Zool. Series 23:1-609.

Eisenmann, E., and Lehmann, F. C. 1962. A new species of swift of the genus *Cypsloides* from Colombia. Am. Mus. Novit. 2117:1-16

ffrench, R. 1973. A Guide to the Birds of Trinidad and Tobago. Livingston, Wynnewood, PA.

Garrett, K., and Dunn, J. 1981. Birds of Southern California. Los Angeles Audubon Soc., Los Angeles.

Gross, A. O. 1965. The incidence of albinism in North American birds. Bird-Banding 36:67-71.

Hardy, J. W., and Clench, M. H. 1982. First United States specimen of the White-collared Swift. Am. Birds 36:139-141.

Hilty, S. L., and Brown, W. L. 1986. A Guide to the Birds of Colombia. Princeton Univ. Press, Princeton, N.J.

Lack, D. 1956. A review of the genera and nesting habits of swifts. Auk 73:1-32.

Lasley, G. W. 1984. First Texas specimen of the White-collared Swift. Am. Birds 38:370-371.

Lasley, G. W., and Sexton, C. 1988. The winter season: South Texas region. Am. Birds 42:286-292.

Morlan, J. 1985. Eighth report of the California Bird Records Committee. W. Birds 16:105-122.

Orr, R. T. 1963. Comments on the classification of swifts of the subfamily Chaeturinae. Proc. 13th Int. Ornithol. Congr. 1:126-134 (Ithaca, N.Y., 1962).

Peters, J. L. 1940. Check-list of Birds of the World. Vol. 4. Mus. Comp. Zool., Harvard Univ., Cambridge, MA.

Peterson, R. T., and Chalif, E. L. 1973. A Field Guide to Mexican Birds. Houghton Mifflin, Boston.

Ridgely, R. S. 1976. A Guide to the Birds of Panama. Princeton Univ. Press, Princeton, N.J.

Ridgway, R. 1911. The birds of North and Middle America. Bull. U.S. Natl. Mus. 50, part 5.

Ross, C. C. 1963. Albinism among North American birds. Cassinia 47:2-21.

Sharrock, J. T. R. 1978. Partially albino Swifts. Br. Birds 71:222-223.

Snow, D. W. 1962. Notes on the biology of some Trinidad swifts. Zoologica 47:129-139.

Webster, F. S. 1975. The fall migration: South Texas region. Am. Birds 29:84.

Accepted 24 February 1989

Western Field Ornithologists/ Western Bird Banding Association Joint Annual Meeting

October 13, 14, and 15, 1989 University of Nevada, Reno

WFO's 14th annual meeting will be held jointly with the Western Bird Banding Association 13-15 October 1989 at the University of Nevada, Reno. Northwestern Nevada is a land of many contrasts, ranging from sagebrush desert to high mountain peaks. The city of Reno sits at the western edge of the Great Basin desert, near the foothills of the eastern Sierra Nevada. The Truckee River runs through the city, from Lake Tahoe east to Pyramid Lake. The area offers desert shrublands, alkali flats and sinks, piñon-juniper woodlands, pine and fir forests, high mountain meadows, riparian areas, desert lakes, grasslands, marshes and wetlands, agricultural habitat and more. Sage Grouse, Sage Thrashers, and Sage Sparrows make their homes here, as do Brewer's Sparrows, Burrowing Owls, Piñon Jays, Red Crossbills, Clark's Nutcrackers, Mountain Bluebirds, Mountain Quail, waterfowl, shorebirds, raptors, and many more. Come join us in Reno for an exciting weekend of birding, demonstrations, and research reports.

The activities begin with an outdoor barbecue Friday evening at Rancho San Rafael Park, near the University of Nevada campus. The Wilbur D. May Museum and Arboretum will be open for tours. A WFO panel of experts will tackle tricky identification problems later in the evening. Saturday's activities include demonstrations of banding and field techniques in the morning, a deli luncheon at noon, oral research reports in the afternoon, and a banquet in the evening. Field trips will be available Friday, Saturday, and Sunday; destinations include Mt. Rose, Pyramid and Honey lakes, and Stillwater National Wildlife Refuge. Registration forms have been sent to members of WFO and WBBA; if you still need a registration form or would like further information, call Alan Gubanich, 702-851-4092.

NOTES

DIVING TIMES AND BEHAVIOR OF PIGEON GUILLEMOTS AND MARBLED MURRELETS OFF ROSARIO HEAD, WASHINGTON

ASA C. THORESEN, Biology Department, Andrews University, Berrien Springs, Michigan 49104

Data on the times and frequency of dives by Atlantic alcids have been reviewed by Bradstreet and Brown (1983), who pointed out the need for more such information for this family of birds. Scott (1973) presented data on diving times and depths for marine birds, including the Pigeon Guillemot (*Cepphus columba*), observed along the Oregon coast. Carter and Sealy (1984) found Marbled Murrelets (*Brachyramphus marmoratus*) in fish nets set at depths of 8 to 10 m, while Piatt and Nettleship (1985) recorded Black Guillemots (*Cepphus grylle*) caught in nets at 50 m and diving times for that species of up to 112 seconds in water 35 to 45 m deep. They also suggested that diving ability is directly correlated with body size. Scott (1973) timed maximum dives for Pigeon Guillemots along the Oregon coast at 68.8 seconds, close to the average time I have recorded. Black Guillemots in Lancaster Sound of the Canadian Archipelago, while feeding "horizontally" under ice floes, have remained submerged as long as 146 seconds (Bradstreet 1982). This note presents new information about Pigeon Guillemots and Marbled Murrelets observed from Rosario Head, Deception Pass State Park, south of Anacortes, Washington. Comparative data on diving times, depths, and prey species taken are of value for an understanding of the physiology of diving and differences between species in feeding habits. The numbers of times fish were brought to the surface are also indicated.

For one hour on each of eight days during June and July, 1985, I recorded the diving times and frequency of individuals and pairs of both species and noted their feeding behavior. I made my observations between 1430 and 1530 h (n = 6 days). Other behaviors were noted at various times.

Water depth at this location is approximately 12 meters, and the bottom is rocky with patches of mud or sand. The birds were active within the range of normal vision (30-100 m) beyond the outer limit of a dense kelp bed; however, 7 × 50 binoculars were used for details, and a watch with a second hand was used for timing of dives and periods between dives. Calm seas prevailed during all observation periods, and since only individuals or pairs of birds were present there was no confusion as to which bird was being timed.

Of 50 dives recorded for Pigeon Guillemots, time underwater ranged from 15 to 105 seconds, with a mean of 67 seconds (standard deviation [sd] = ±22.5, standard error [se] = 3.15; see Figure 1). Fish were brought to the surface after 8 of the 50 dives. Although some small fish may have been swallowed below the surface, those brought to the surface were a species of blenny (Stichaeidae), indicating that the birds were foraging on the bottom, as is a well-known habit of the Pigeon Guillemot (Drent 1965). During longer dives, the guillemots covered considerable horizontal distance, and though this distance was difficult to determine, on occasions I estimated it to be as great as 75 meters.

Time spent on the surface between dives averaged 24 seconds (n = 31) and ranged between 3 and 175 seconds (sd = ±40.8, se = 7.35; see Figure 2). In two instances

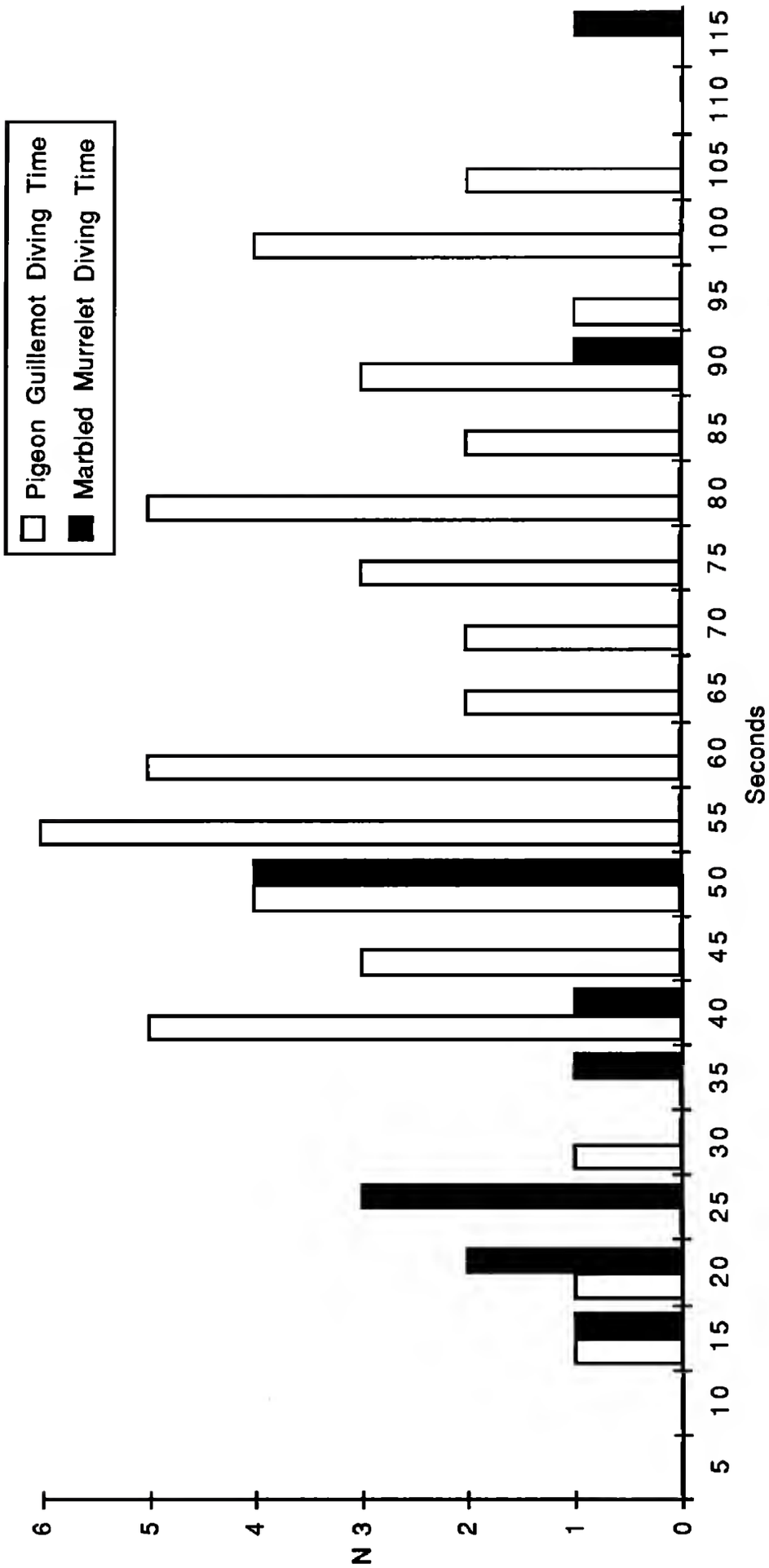


Figure 1. Diving times for Pigeon Guillemots and Marbled Murrelets at Rosario Head, Washington, June and July 1985.

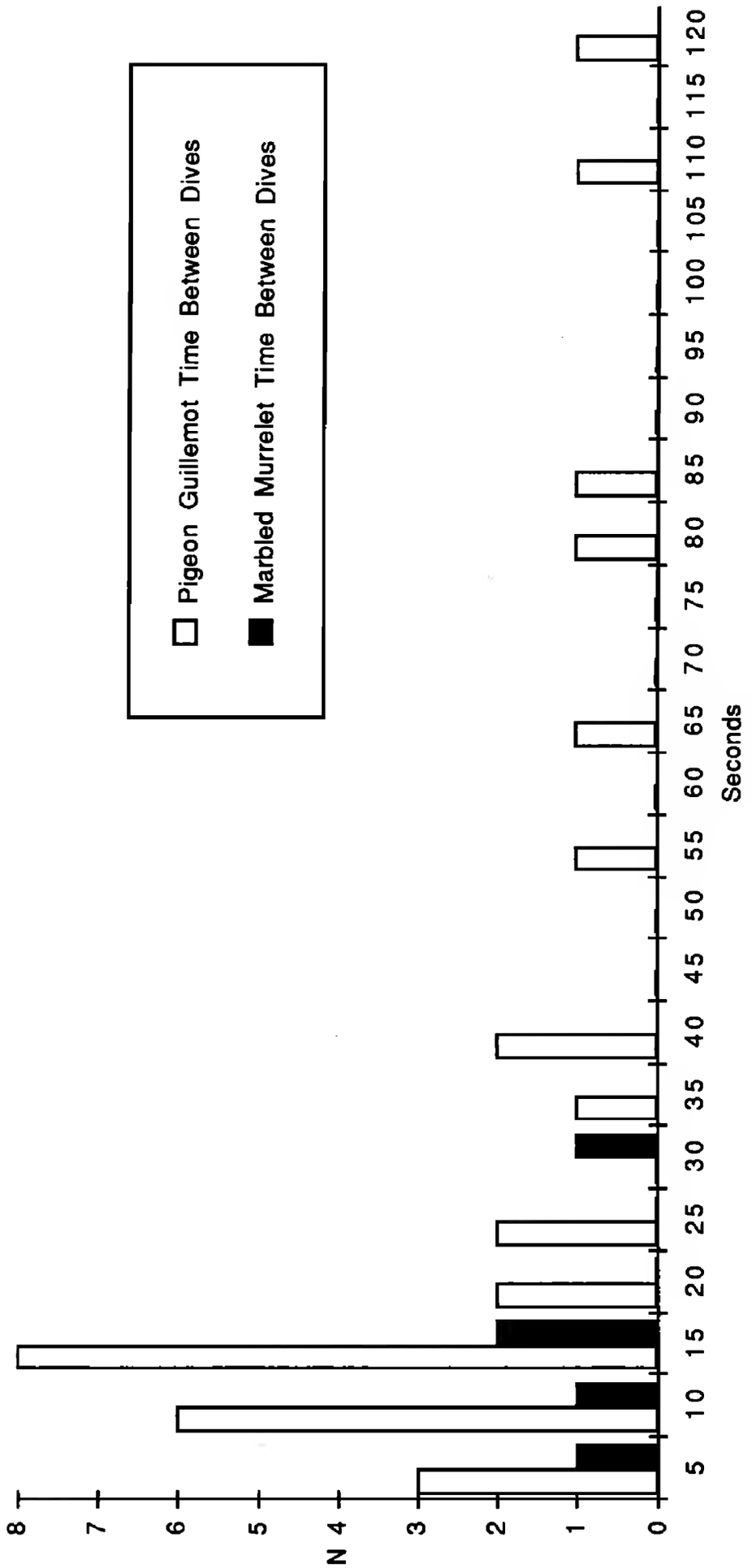


Figure 2. Times between dives for Pigeon Guillemots and Marbled Murrelets, 1985.

when blennies were brought to the surface and swallowed, the birds remained on the surface for 10 minutes before diving again. These were not included in the average. Some catches, held crosswise in the bill, were transported, probably to feed young in locations beyond my line of sight.

Although individual birds were occasionally seen, Marbled Murrelets were usually paired. Of 14 dives recorded, mean time underwater was 44 seconds with a range of 15 to 115 seconds (sd = ± 14.5, se = 4.17; see Figure 1). Of the 14 dives, two were followed by the bird swallowing fish at the surface. In another incident, an individual bird was clearly seen to carry two fish, and in another, three fish. Both birds held these multiple catches crosswise in their bills until they flew with them just at dusk. I followed the birds with binoculars until both were out of sight. Although others have reported Marbled Murrelets with multiple catches (Savile 1972, Cody 1973), Simons (1980) and Carter and Sealy (1987) observed that mostly they transport only single fish.

In addition to the 14 timed dives, on one occasion I noted multiple, quickly repeated, shallow dives by two Marbled Murrelets within an area of one to two square meters. They swirled around just below the surface, each time coming up with a fish which flashed in the sunlight before being swallowed. Apparently, the two birds had located a school of prey just below the surface. Among actively diving birds, times spent on the surface between dives ranged from 5 to 30 seconds with a mean of 15 seconds. (n = 5, sd = ±9.35, se = 4.17, see Figure 2).

During other times of the day (morning and evening) during the summer months, pairs of murrelets spent 30 to 45 minutes on the surface without feeding. They remained within a few meters of each other, occassionally preening and stretching their wings. When actively diving, they were sometimes seen to become separated by a hundred meters or more, after which they immediately called and paddled toward each other. After reuniting, they momentarily billed, circled each other, stretched their wings, and settled to rest on the surface or dived again. When the pair was together on the surface, one murrelet always remained on the alert with the head held high.

I would like to thank the editors and reviewers of *Western Birds*, as well as James Hayward and W. William Hughes, Biology Department, Andrews University, whose comments and suggestions improved this note.

LITERATURE CITED

Bradstreet, M. S. W. 1982. Occurrence, habitat use and behavior of seabirds, marine mammals and arctic cod at the Pond Inlet ice edge. Arctic 35:28-40.

Bradstreet, M. S. W., and Brown, R. G. B. 1985. Feeding ecology of the Atlantic Alcidae, in the Atlantic Alcidae (D. N. Nettleship and T. R. Birkhead, eds.), pp. 263-315. Academic Press, Orlando.

Cody, M. L. 1973. Coexistence, coevolution and convergent evolution in seabird communities. Ecology 54:31-44.

Carter, H.R., and Sealy, S. G. 1984. Marbled Murrelet mortality due to gill-net fishing in Barkley Sound, B.C., in Marine Birds: Their Feeding Ecology and Commercial Fisheries Relationships (D. N. Nettleship, G. A. Sanger, and P. F. Springer, eds.), pp. 212-220. Can. Wildlife Serv. Spec. Publ., Ottawa.

Carter, H. R., and Sealy, S. G. 1987. Fish-holding behavior of Marbled Murrelets. Wilson Bull. 99:289-291.

Drent, R. H. 1965. Breeding biology of the Pigeon Guillemot *Cepphus columba*. Ardea 53:99-160.

Piatt, J. F., and Nettleship, D. N. 1985. Diving depths of four alcids. Auk 102:293-297.

Savile, D. B. O. 1972. Evidence of tree nesting by the Marbled Murrelet in the Queen Charlotte Islands. Can. Field- Nat. 86:389-390.

Scott,J. M. 1973. Resource allocations in four syntopic species of marine diving birds. Ph.D. Thesis, Oregon State University, Corvallis.

Simons, T. R. 1980. Discovery of a ground-nesting Marbled Murrelet. Condor 82:1-9.

Accepted 9 April 1989

Pigeon Guillemot and Marbled Murrelet

Sketch by Narca Moore-Craig

LEAST AUKLET IN CALIFORNIA

STEPHEN F. BAILEY, Department of Ornithology and Mammalogy, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118

During the afternoon of 15 June 1981 a distressed Least Auklet (*Aethia pusilla*) was found on Thornton State Beach in Daly City, San Mateo County, California, the first location southeast of Kodiak, Alaska, where the Least Auklet has been recorded. A park ranger rescued the bird and delivered it to the Peninsula Humane Society in San Mateo. Despite care the auklet died overnight. On 18 June I confirmed the identification and secured the specimen for the Museum of Vertebrate Zoology (MVZ), University of California, Berkeley.

Figure 1 is a ventral photograph of the auklet as frozen, with the head turned in profile and the feet folded forward. Both plumage and soft parts were typical of breeding adults. The bird was not molting. Its measurements were total length 160 mm, extent 338 mm, wing chord 94 mm, tail 26 mm, tarsus 18.7 mm, culmen 9.4 mm, length of bill knob 2.8 mm, height of bill knob 2.6 mm, and bill depth through knob 7.8 mm.

Robert M. Zink prepared the specimen as a study skin and partial skeleton, MVZ168469. It was a male with testes 4 × 2 mm. After freezing it weighed 55.5 g, much lighter than the published averages, 86.3 g (Bedard 1969) and 96 g (Hughes 1970). At preparation emaciation and lack of fat were noted, but otherwise there were no apparent internal or external injuries, diseases, or organ abnormalities. The only visible parasites were a few mallophaga, which were collected. Although the bird likely starved, its temperature of 42.5°C on arrival at the Humane Society (fide Sandi Stadler) suggests that disease or heat stress may have been involved.

The Least Auklet nests in vast colonies on islands in the Bering Sea and the Aleutians. The southeasternmost reported colonies are in the Shumagin and Semidi Islands (American Ornithologists' Union 1983), but Sowl (1979) stated that there was no evidence that Least Auklets nest in the western Gulf of Alaska, and he doubted all previous reports of nesting east of the Aleutians. Apparently most individuals winter near their nesting colonies, but some winter off northwest Pacific coasts southwest as far as northern Japan (American Ornithologists' Union 1983). In the eastern Pacific, conversely, the only previous record east or south of the breeding islands is W. J. Fisher's collection of five at Kodiak during January 1882 (Friedmann 1935, Gabrielson and Lincoln 1959). Kessel and Gibson (1978) indicated no new distributional records, and Roberson (1980) found none for British Columbia, Washington, Oregon, or California. The California record listed by the American Ornithologists' Union (1983) is the one I detail here.

No storms affected the California coast around the time of the auklet's arrival. Rather, the bird appeared in the midst of a long period of record hot, clear, calm weather. Possibly heat stress contributed to the bird's death.

This Least Auklet could not have been an escapee from captivity. The species has been kept only by Sea World of San Diego, which found it difficult to maintain (W. T. Everett pers. comm.). The primaries were faded on their exposed edges and surfaces, but there was no unusual wear as expected in captives. There may be some possibility the bird was transported inadvertently by a ship, as Least Auklets sometimes come aboard at sea (G. V. Byrd pers. comm.), but most seabirds that seem to have been transported by ships appear at naval bases or inside ports, not on ocean beaches. Thornton State Beach receives direct Pacific Ocean surf, which regularly deposits dead and dying seabirds there; it is a likely site for an unaided waif to beach itself.

As most far northern species are thought of as moving south in the winter, both the summer arrival and the alternate plumage might seem unlikely for the first Least Auklet to reach California unaided. However, these fit the pattern recently established

by two other Bering Sea alcids. The Horned Puffin (*Fratercula corniculata*) now reaches California mostly during early summer, often in alternate plumage (Hoffman et al. 1975, Roberson 1980). A Horned Puffin found 29 July 1975 on Ocean Beach, San Francisco (CAS68979 in the California Academy of Sciences) was only 4 km north of the Least Auklet's landfall. Furthermore, on 16 July 1979 a Crested Auklet (*Aethia cristatella*) was found dying on a beach 33 km northwest of Thornton State Beach (Weyman 1980), and on 7 July 1980 another was found near Cedros Island, off Baja California, Mexico (Pitman et al. 1983). Thus I conclude that this Least Auklet was a vagrant. This record was accepted by the California Bird Records Commitee (Binford 1983).

I thank Robert Graf for alerting me to the Least Auklet's occurrence and disposition and Sandi Stadler for providing additional information on the bird's arrival and death at the Peninsula Humane Society. Special thanks go to Robert M. Zink for preparing and dissecting the specimen and for helpful suggestions on an earlier draft of this note. G. Vernon Byrd and Ned K. Johnson also improved the manuscript.

LITERATURE CITED

American Ornithologists' Union. 1983. Check-list of North American Birds, 6th ed. American Ornithologists' Union, [Washington, D.C.].

Bedard, J. 1969. Adaptive radiation in the alcids. Ibis 111:189-198.

Binford, L. C. 1983. Sixth report of the California Bird Records Committee. W. Birds 14:127-145.

Friedmann, H. 1935. The birds of Kodiak Island, Alaska. Bull. Chicago Acad. Sci. 5:13-54.

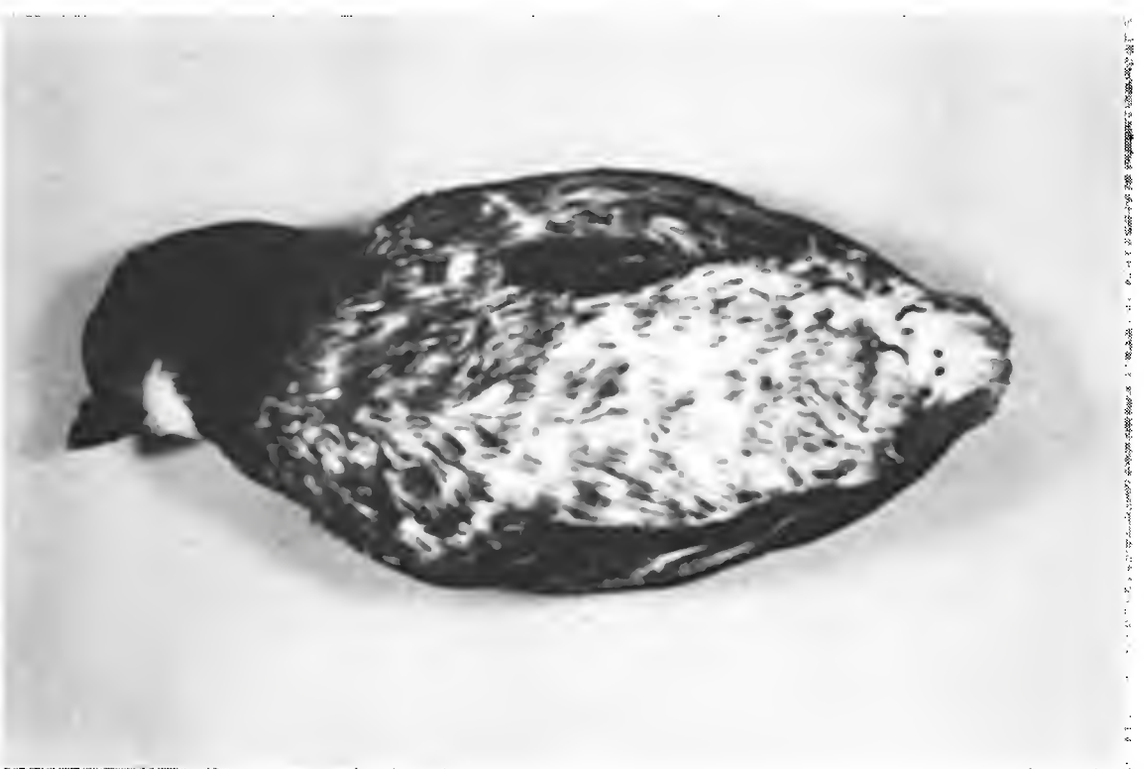


Figure 1. Least Auklet picked up at Daly City, San Mateo Co., California.

Photo by Stephen F. Bailey

Gabrielson, I. N., and Lincoln, F. C. 1959. The Birds of Alaska. Stackpole, Harrisburg, PA.

Hoffman, W., Elliott, W. P., and Scott, J. M. 1975. The occurrence and status of the Horned Puffin in the western United States. W. Birds 6:87-94.

Hughes, M. R. 1970. Relative kidney size in nonpasserine birds with functional salt glands. Condor 72:164-168.

Kessel, B., and Gibson, D. D. 1978. Status and distribution of Alaska birds. Studies Avian Biol. 1.

Pitman, R., Newcomer, M., Butler, J., Cotton, J., and Friedrichsen, G. 1983. A Crested Auklet from Baja California. W. Birds 14:47-48.

Roberson, D. 1980. Rare Birds of the West Coast. Woodcock Publ., Pacific Grove, CA.

Sowl, L. W. 1979. The historical status of nesting seabirds of the northern and western Gulf of Alaska, in Conservation of Marine Birds of Northern North America (J. C. Bartonek and D. N. Nettleship, eds.), U.S. Fish & Wildlife Service, Wildlife Research Rep. 11.

Weyman, F. O. 1980. Crested Auklet found in California. Condor 82:472.

Accepted 9 April 1989

Volume 20, Number 1, 1989

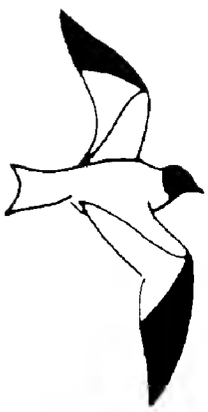
Cover photo © Bruce Webb, of Sacramento, California: Ross' Goose (*Chen rossii*), Sacramento, California, March 1988.

Western Birds solicits papers that are both useful to and understandable by amateur field ornithologists and also contribute significantly to scientific literature. The journal welcomes contributions from both professionals and amateurs. Appropriate topics include distribution, migration, status, identification, geographic variation, conservation, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, and techniques for censusing, sound recording, and photographing birds in the field. Papers of general interest will be considered regardless of their geographic origin, but particularly desired are reports of studies done in or bearing on the Rocky Mountain and Pacific states and provinces, including Alaska and Hawaii, western Texas, northwestern Mexico, and the northeastern Pacific Ocean.

Send manuscripts to Philip Unitt, 3411 Felton Street, San Diego, CA 92104. For matter of style consult the *Suggestions to Contributors to Western Birds* (8 pages available at no cost from the editor) and the *Council of Biology Editors Style Manual* (available for $24 from the Council of Biology Editors, Inc., 9650 Rockville Pike, Bethesda, MD 20814.

Reprints can be ordered at author's expense from the Editor when proof is returned or earlier.

Good photographs of rare and unusual birds, unaccompanied by an article but with caption including species, date, locality and other pertinent information, are wanted for publication in *Western Birds*. Submit photos and captions to Photo Editor.



WESTERN BIRDS

Vol. 20, No. 2, 1989

WESTERN BIRDS

Quarterly Journal of Western Field Ornithologists

Membership dues, for individuals and institutions, including subscription to *Western Birds:* Patron, $1000; Life, $250; Supporting, $50 annually; Contributing, $25 annually; Regular, $14 U.S. ($17 outside U.S.) annually. Dues and contributions are tax-deductible to the extent allowed by law.

Send membership dues, changes of address, correspondence regarding missing issues, and orders for back issues and special publications to the Treasurer. Make checks payable to Western Field Ornithologists.

Back issues of *California Birds/Western Birds:* $15 per volume, $4.00 for single issues. Xerox copies of out of print issues (Vol. 1, No. 1; Vol. 2, Nos. 1 and 4; Vol. 6, No. 2): $4.50 each. *Checklist of the Birds of California:* $2.00 each, 10 or more $1.50 each. *Pelagic Birds of Monterey Bay, California:* $2.50 each, 10 or more $2.00 each, 40 or more $1.50 each. All postpaid.

Published November 15, 1989 ISSN 0045-3897

WESTERN BIRDS ADVERTISING RATES AND SPECIFICATIONS

Full page	4 x 6¾ inches	$60 per issue	$200 per year
Half Page	4 x 3⅜ inches	$40 per issue	$130 per year
Quarter Page	4 x 1 11/16 inches	$30 per issue	$110 per year

Offset printing, one column per page, 4 inches wide. Glossy, black and white photos are acceptable; half-tone screen size: 133 line. Photo-ready copy is requested. If this is not possible, extra charges for typesetting will be made as follows: $15 full page, $10 half page, $5 quarter page. Send copy with remittance to the Treasurer. Make checks payable to Western Field Ornithologists. A 15% commission is allowed for agencies.

WESTERN BIRDS

Volume 20, Number 2, 1989

COSTA'S HUMMINGBIRD: ITS DISTRIBUTION AND STATUS

WILLIAM H. BALTOSSER, Department of Biology and Museum of Southwestern Biology, The University of New Mexico, Albuquerque, New Mexico 87131.

Although Costa's Hummingbird (*Calypte costae*) is a common species of the arid Southwest, its status remains poorly understood or poorly documented in much of its range. This is due in part to the female and young of this species being frequently inseparable in the field by sight from those of Black-chinned (*Archilochus alexandri*), Ruby-throated (*Archilochus colubris*), and, to a certain extent, Anna's (*Calypte anna*) hummingbirds. The problem is further compounded by recent range expansions and by apparent resurgence into some areas of historic occurrence where, until recently, there had been few records since the late 1800s. Aids to identification recently published by Baltosser (1987) and the references cited therein provide sufficient information to identify virtually any bird in the hand and even many seen at close distances. In addition, the call of Costa's Hummingbird is diagnostic (Stiles 1971) and being learned by many observers. In time, therefore, some of the inherent mystery associated with this and similar species may dissipate.

The Check-list of North American Birds (A.O.U. 1983) lists the breeding distribution of Costa's Hummingbird as extending from central California (north to Monterey, Merced, and Inyo counties), southern Nevada, and southwestern Utah (Beaverdam Mountains) south to southern Baja California (including the Channel Islands off California and islands off both coasts of Baja California), Sonora (including Tiburon and San Esteban islands), southern Arizona, and southwestern New Mexico. The same source lists the winter range as southern California and southern Arizona south to Sinaloa, casually north to southwestern British Columbia (Vancouver Island, sight record), western Washington (actual data lacking—assumed to occur), Oregon, central Nevada (Toiyabe Mountains), and northern Utah, and east to central Texas (Hays Co., also sight records east to Aransas Co.). Here I document the status and distribution (including seasonal aspects) of Costa's Hummingbird and report extensions to its known range.

METHODS

The status of Costa's Hummingbird as presented is based on over 500 distinct localities of occurrence (i.e., areas separated by 10-20 km) and on over 1,500 records consisting of three types of data, which I have arranged hierarchically (specimens, photographs, and sight records). Presentation of the data in this way should enable readers to formulate their own opinion regarding the species' status and, I hope, will induce some to fill in gaps or to validate occurrences at more definitive levels.

I have placed the most faith in specimen evidence (museum abbreviations explained in the acknowledgments), which includes study skins or, in some instances, select rectrices plucked and preserved from birds that were subsequently released (e.g., many of the Guadalupe Canyon records from extreme southwestern New Mexico) or voice recordings (e.g., recordings from the San Francisco area by L. F. Baptista). Photographs can occasionally be misleading, so I have not equated them with specimens. The problems associated with sight records have been discussed by Van Tyne (1956) and Zimmerman (1973); sight records suffer primarily from their lack of tangible evidence for subsequent scrutiny. I have therefore relegated them to the least definitive category of verification. Most sight records I include are of adult males, although some of adult females and young males showing metallic purple/violet flecks on their chins or sight records in conjunction with call notes (heard but not recorded) have occasionally been included.

Throughout, I present the most fundamental aspects of the distribution and status of the species first, then discuss peripheral and vagrant occurrences or, in some cases, the apparent resurgence of the species into an area following an absence of decades. Distributional accounts are arranged by state/province and depicted by region and degree of verification. Mapped locations, based on records through 1987, are as accurate as logistically possible, with more than 90% of all localities plotted. The relatively few records not depicted were lumped with adjacent localities (i.e., locations within ca. 10-20 km). Stippling is used to signify the normal range of the species, while occurrences outside shaded areas are of a more peripheral nature. Maps showing seasonal aspects of occurrence (Appendices A-D), while computerized by degree of verification, have not been depicted in this way because it was not feasible on maps of this scale.

BREEDING

The breeding range of Costa's Hummingbird (Figure 1) occupies much of the Lower Sonoran and limited portions of the Upper Sonoran life zones of western North America. The species nests from below sea level (Death Valley, California) to about 2000 m in some desert mountain ranges (Garrett and Dunn 1981). A. W. Anthony's report of nesting to 2,273 m (7500 feet) in the Sierra San Pedro Martir of Baja California Norte, cited by Brewster (1902) and Grinnell (1928), is exceptional if accurate.

Breeding occurs earlier in southern regions such as Baja California Sur, where it extends from late January through March (Brewster 1902). At intermediate latitudes the nesting period is often the same (e.g., many

southern California and southern Arizona records) or slightly delayed (e.g., Monson 1951). At higher latitudes, as from the eastern Mojave Desert and Owens Valley to the lower slopes of the White Mountains, nesting may ex-

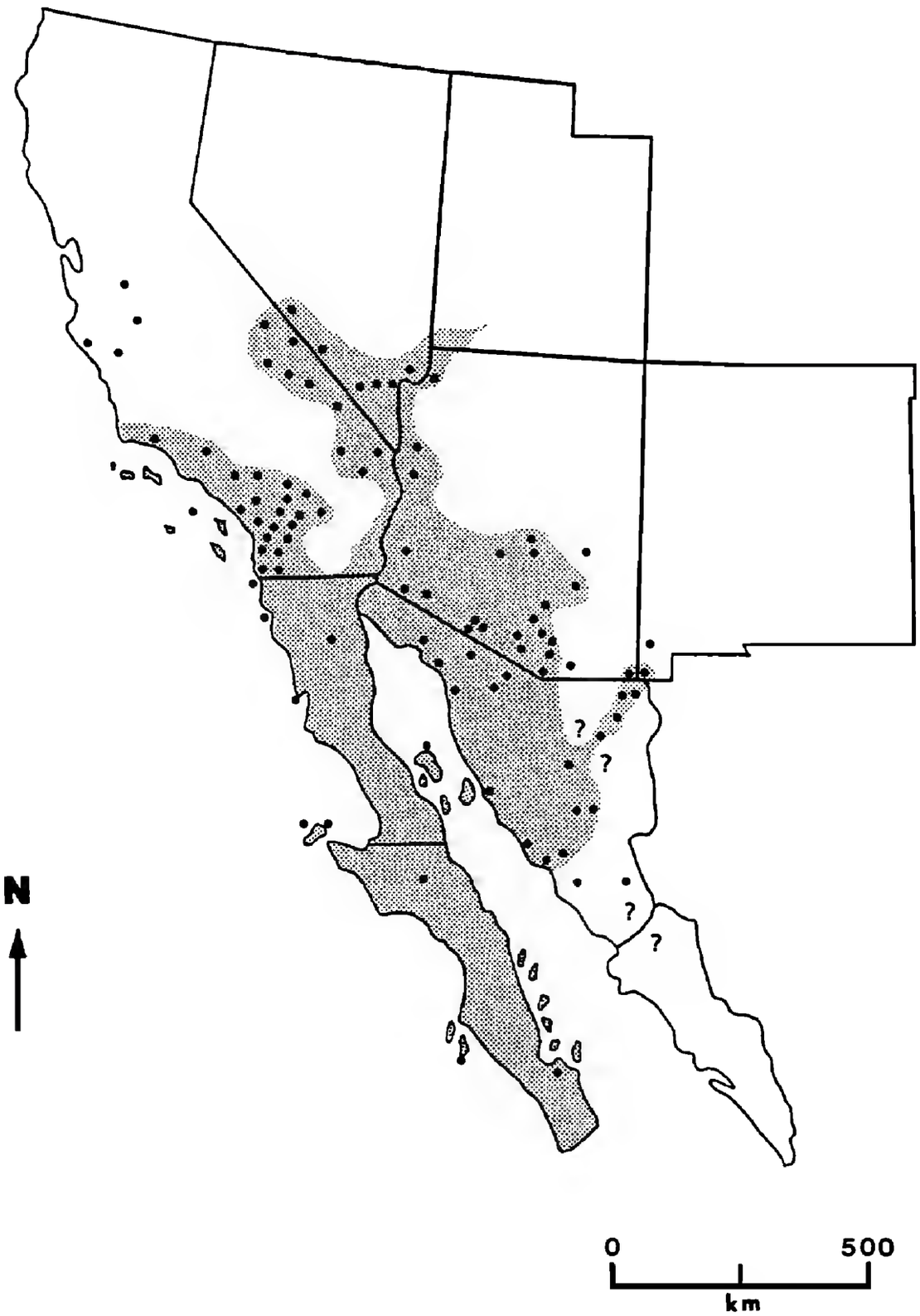


Figure 1. Breeding range of Costa's Hummingbird based on actual evidence (dots) and on extrapolation (shaded areas).

tend from early March through late July (Garrett and Dunn 1981). Extreme dates range from 17 January on Santa Margarita Island in Baja California Sur, where Bryant observed a nest containing large young (Brewster 1902), to early July at Sabino Canyon, Pima Co., southern Arizona (young in nest, Witzeman and Stejskal 1987) and to mid-July at Bixby Canyon, Monterey Co., along the California coast (LeValley and Evens 1981).

Nesting in peripheral areas such as Bixby Canyon is frequently delayed in comparison to that within the normal range of the species. In other areas of peripheral nesting such as Guadalupe Canyon (Cochise Co., Arizona, and Hidalgo Co., New Mexico), nesting extends into early June (Baltosser 1986, 1989). Many if not most nesting attempts after late April I suspect to be second nestings, and thus peripheral nestings perhaps represent attempts after subsequent dispersal to new areas.

DISTRIBUTION

California

Costa's Hummingbird is resident, although during late fall and early winter in relatively low numbers, along the coast from southeastern Santa Barbara County south through San Diego County, with some birds resident in the southern and southeastern desert regions of San Bernardino, Riverside, and Imperial counties (including the Colorado River Valley) (Figure 2). From mid-February to early April the species occurs in all of the former areas (including offshore islands), but by this time numbers have been augmented by birds returning from wintering areas. By mid-April the species is also found in the mountains of the eastern Mojave Desert (Kingston Range, Ivanpah Mountains, New York Mountains, and Providence Mountains) and north to central and northern Inyo County (the Owens Valley and the lower slopes of the White Mountains), with a few birds in these areas lingering into July and perhaps longer.

The status of the species in central and northern California is in a state of flux. In the past, the species was believed to be restricted to the hills along the western edge of the San Joaquin Valley north to Stanislaus County, where it nests (McCaskie el al. 1979). Grinnell and Miller (1944), however, cited records as far northwest as Hayward (1875) and Oakland (1890), Alameda County, and within the last decade many Costa's Hummingbirds have been sighted north of Stanislaus County. Recent records for central and northern California are most frequent during winter (possible sampling bias resulting from Christmas Bird Counts) and spring and cluster around the San Francisco Bay and Monterey areas. There are numerous recent records of spring vagrants, post-breeding vagrants, and winter vagrants along the coast from Santa Cruz County north to Del Norte County and inland as far east as Mariposa, Placer, and Nevada counties and north to Siskiyou County. Costa's Hummingbirds have now been reported from all but 19 of the 58 California counties, being absent from areas in the northeast at the edge of the Great Basin and, with the exception of a single bird in Yosemite National Park, Mariposa County (LeValley and Evens 1983), from the Sierra Nevada. While the nonbreeding range of Costa's Hummingbird in northern California has spread beyond the western edge of the San Joaquin Valley, virtually all

of these records are of vagrants; the species has not yet extended its normal breeding range to the northwest.

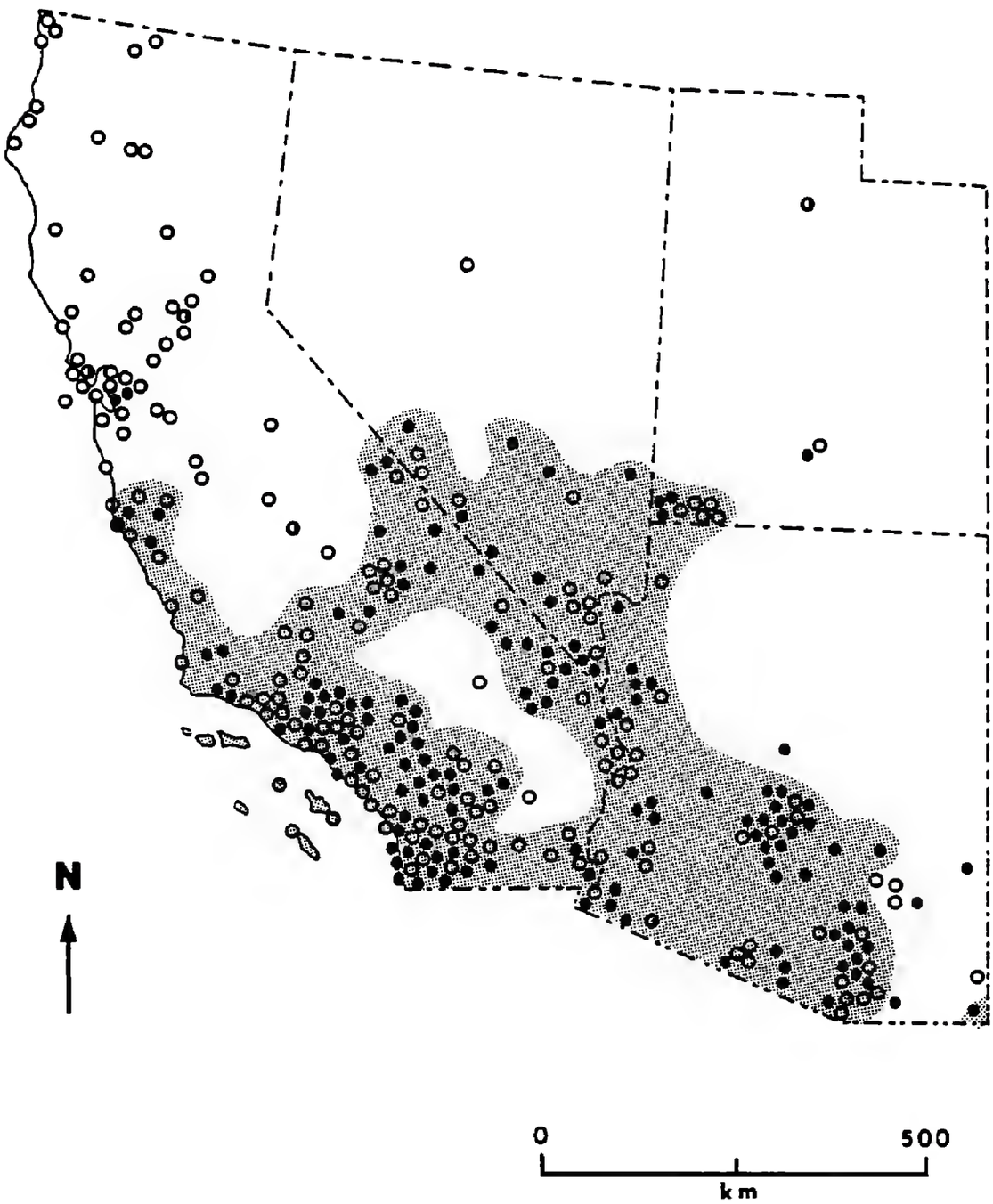


Figure 2. Distribution of Costa's Hummingbird in the southwestern United States showing the normal occurrence of the species, all seasons combined (shaded areas), and its documented presence (dots). Filled circles, specimens; half-filled circles, photographs; open circles, sightings.

Nevada

Costa's Hummingbird is probably not a true winter resident in Nevada, contrary to the A.O.U. (1983), as there are no December or January records. By early February, however, a few individuals arrive, and the species remains at least through June. Records for July, August, and September are few and presumably represent post-breeding vagrants or misidentifications. Reports of Costa's Hummingbirds being common and even abundant in the yellow-pine belt of the Charleston and Sheep mountains between 8000 and 9000 feet (2438 and 2743 m) from July to September (van Rossem 1936) are unsubstantiated. Post-breeding wanderings to such elevations occur, but in no case is this widespread within a population, particularly into September at such a northern latitude. Van Rossem's records from the Charleston and Sheep mountains therefore have not been mapped.

The species is known from at least 22 localities in the southern one-third of the state (Esmeralda, Nye, Clark, and Lincoln counties) and one locality farther north in the Toiyabe Mountains of Lander County (19 June 1930, Linsdale 1936). The documented presence of the species in the late 1800s in many of the same areas where it is still found indicates that the occurrence of Costa's Hummingbirds in southern Nevada is not recent.

Utah

The range of Costa's Hummingbird in Utah is confined primarily to Washington County in the extreme southwest (Behle and Perry 1975, Hayward et al. 1976). In this area, records extend from early March into late May; a few birds undoubtedly linger at least into June. The species also occurs occasionally in adjacent Garfield County, where birds have been reported from the Hell's Backbone area west of Boulder from late March into mid-May (Behle and Perry 1975) and a single post-breeding vagrant was seen on 15 September 1971 (G. Kashin in litt.). The first report of the species for Garfield County (Porter and Bushman 1956), which provided few details, has recently been clarified by W. H. Behle (in litt.). The date of collection is 16 May 1953 and the site is Salt Gulch, 8 miles west of Boulder. The only record from elsewhere in Utah is of a vagrant male in Salt Lake City. This bird appeared at a feeder in October 1974 and, after failing to migrate, was maintained through the winter until 16 March 1975 with the aid of artificial heat (Kingery 1975).

The occurrence of the species in Utah does not appear to be recent at most of the 11 or so localities from which it has been reported. Costa's Hummingbirds were found in May 1891 in the Beaverdam Mountains in the extreme southwestern portion of the state (Hayward et al. 1976), still one of the primary areas where the species is found today.

Arizona

The status of Costa's Hummingbird in Arizona is complicated. The species is resident along the southern border from the Baboquivari Mountains west of Nogales to the California border and north along the Colorado River to the Bill Williams Delta, and there are small resident populations also around

Phoenix and Tucson. From late winter to early summer, the species is common in much of Mohave, La Paz, Yuma, Maricopa, and Pima counties.

Costa's Hummingbird is locally distributed and often uncommon elsewhere in Arizona. The species occurs fairly regularly in Pinal County from Florence west, but only sporadically farther east, as at Superior, in Aravaipa Canyon, and at Oracle. A juvenile male was also taken in 1867 at Old Fort Grant at the junction of Aravaipa Creek and the San Pedro River (A. R. Phillips in litt.). The species is sporadic and localized in Santa Cruz County, with records from Gardner Canyon in the Santa Rita Mountains, Sonoita Creek below Patagonia, Peña Blanca, and from the Nogales area. In Graham County, the species is known from Aravaipa Canyon and the Galiuro Mountains (nests in the latter, G. Monson in litt.). It is rare in Cochise County, but a small population nests in Guadalupe Canyon (Baltosser 1986, 1989), and there is evidence that historically (1890s) it was perhaps more common in or near the Huachuca Mountains (there are at least seven specimens for which the locality is simply Huachuca Mountains). The only other area of occurrence in Cochise County is around Portal. There is at least one locality within Yavapai County, 6 miles southeast of Camp Verde, where the species is known to occur on the basis of two specimens (MNA Z8.2626 and Z8.2627). The species has also been collected in Greenlee County at Clifton (Monson and Phillips 1981).

Costa's Hummingbird is one of the more common species of hummingbird found in the arid regions of Arizona. Even though it is resident in several of these areas, its seasonal abundance fluctuates greatly, and in some areas, such as the Sierra Estrella, Maricopa County, its arrival can also be highly variable (Rea 1983). Relatively few birds winter so few if any individuals are truly sedentary. The number of birds begins to increase in late winter around the first of February, and the species remains relatively common until about the first of May. It is less numerous in June and uncommon to rare from July through September. Adult males have generally dispersed by July and are not seen again until late fall, and even then their numbers are low until January or early February. The status and extent of dispersal of adult female and young birds are not well documented, and from June through September there are relatively few records.

In much of Arizona the occurrence of Costa's Hummingbird has been repeatedly documented since the mid-1800s. In other areas, like eastern Pinal County, records date back to 1867, yet few have been reported from such eastern sites until recently. In still other areas, such as the Huachuca Mountains, the data suggest that the species was perhaps more abundant around the turn of the century than it is at present. For Guadalupe Canyon, in Cochise County and adjacent Hidalgo County, New Mexico, there are only recent records despite fairly extensive earlier sampling efforts. The distribution of Costa's Hummingbird in Arizona is therefore dynamic, exhibiting stability in some areas, a resurgence into historically occupied sites in others, and expansion into previously unoccupied sites in still others.

Baja California

Costa's Hummingbird occurs throughout the Baja California peninsula and on its offshore islands (Figure 3) and is a common, if not abundant, resi-

dent species (Grinnell 1928, Wilbur 1987). Presumably the wintering population is augmented by migrants from the north, although populations in the lower peninsula may contain a greater proportion of truly resident birds than those in the upper peninsula. There is no evidence that populations in the south are ecologically different from those in the north.

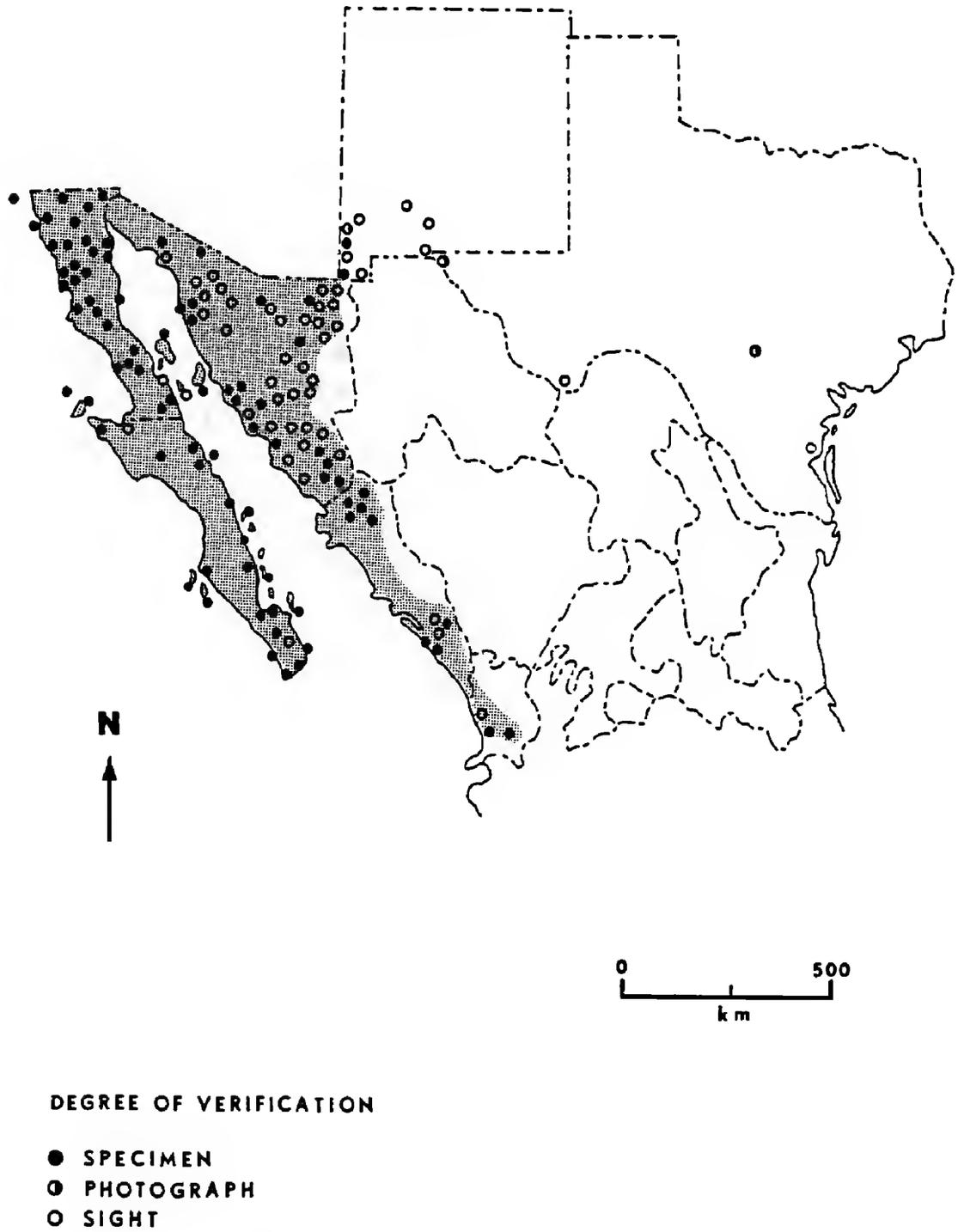


Figure 3. Distribution of Costa's Hummingbird in New Mexico, Texas, and Mexico showing the normal occurrence of the species, all seasons combined (shaded areas), and its documented presence (dots). Filled circles, specimens; half-filled circles, photographs; open circles, sightings.

Sonora

The species is resident in the western and central portions of the state from Guaymas north along the coast to the U.S. border and in the east to Moctezuma. Wintering populations are found in the southern half of Sonora from Guaymas south to El Siari in the extreme southwest (S. M. Russell in litt.) and to Guirocoba in the extreme southeast (MLZOC 4258). With further investigations, however, some populations south of Guaymas may prove to be resident.

In northwestern Sonora and the islands of the Gulf of California, the seasonal occurrence and status of Costa's Hummingbird are similar to those in Baja California. The status of the species is less well understood in southern and eastern Sonora. Both resident and wintering birds probably occur at the more northern sites. The origin of birds occurring during winter in southern areas is unknown because it is only the species, rather than individual birds, that is resident farther north. Van Rossem (1945), however, indicated that during winter there are notable concentrations in the south, which he attributed to the partial withdrawal of birds from the north.

The status of the species in northeastern and perhaps extreme north-central Sonora is changing. In contrast to other areas of Sonora (including the extreme southeast), where there is generally an extended record of occurrence for Costa's Hummingbird, northeast of Nacozari records are relatively recent. The area east of Nogales may also be experiencing change with respect to this species. In this area, a resurgence into previously occupied sites may be inferred if historic and recent records from across the border in Arizona are of Sonoran birds moving north rather than of Arizona birds moving east.

Sinaloa

Costa's Hummingbird winters in Sinaloa, but its status during other seasons is uncertain. The occurrence of a male in heavy molt at Los Leones in northeastern Sinaloa on 28 March 1934 (MLZOC 11607) suggests possible resident status. Collection records from at least ten localities date back to 1925, although a specimen (USNM 25870) supposedly taken at Mazatlan (no other data) and attributed to John Xantus, if correct (validity in doubt, A. R. Phillips and R.L. Zusi in litt.), would document the species back to the mid-1800s.

Nayarit

The 1983 A.O.U. Check-list does not list Costa's Hummingbird as occurring south to Nayarit. The species nevertheless occasionally, perhaps even regularly, winters here. This is not necessarily recent, since two birds were collected 1 mile west of Las Varas in late November 1952 and a third was taken 3 miles southeast of La Galinda in late October 1957 by L. D. Yaeger and A. R. Phillips (DelMNH 18825, 18826, and 18828). A fourth bird was seen near San Blas in late December 1973 (LeValley and Rodrigues 1974).

New Mexico

In New Mexico, Costa's Hummingbird is a rare spring and early summer resident. During this period it is confined primarily to Hidalgo County in the extreme southwest, although occasionally it occurs to the north along the Gila River in Grant County. As a vagrant, the species occurs along the Rio Grande in south-central New Mexico from Dona Ana County (Ligon 1961, Hubbard 1978) north as far as Truth or Consequences in Sierra County (Hubbard 1982).

New Mexico has been included in the range of Costa's Hummingbird for over a century on a basis of a report by Frank Stephens in 1876 of a male constructing a nest near Fort West (Bendire 1895). Stephens' report has been questioned by Hubbard (1976) because males are not known to participate in nest construction and there is some doubt as to Stephens' whereabouts during this period (he may have actually been 30 river miles downstream in Arizona). Not until 66 years later was the species reported for a second time in New Mexico, and only since the early 1970s have Costa's Hummingbirds been reported there with any regularity.

While subsequent sightings in an area do not validate previous reports, I nonetheless believe that the 1876 report may be credible and what is presently occurring in New Mexico is both a resurgence into historically occupied sites and a true range expansion into other areas. The bird that Stephens saw probably had some rather long projecting metallic feathers on its throat or several metallic feathers on its chin. Such characters typify males, but among females appearing to be quite old (extremely polished and worn bills), an occasional bird has extensive metallic feathering. The bird Stephens observed was perhaps such a female, and as for the date, Stephens himself was not sure ("about the end of May").

Texas

Of the eight records of this irregular vagrant, those from Rockport, Aransas County, in 1956 and 1957 (Webster 1957, 1958) have been questioned since first reported. Few details were provided, and the presence of four adult males, as reported for 1956, seemed unlikely. Fueling the confusion was also a prevailing belief that Costa's Hummingbirds were not particularly prone to wandering. While it does seem unlikely that four vagrants would end up at the same place at the same time, recent extralimital records indicate that the species is probably more nomadic than previously thought. Such are the problems associated with sight records, and thus the two reports from Rockport should, if cited, be listed as hypothetical. Localities for Costa's Hummingbird in other areas of Texas through 1987 are the El Paso area (late July and late August 1958, Monson 1958, 1959, and March 1975, Williams 1975), Big Bend National Park (August and December 1966, Wauer 1973), and San Marcos, Hays County (adult male, February 1974, Webster 1974).

Oregon

Only recently have Costa's Hummingbirds been noted in Oregon (Figure 4), where the status of the species is complicated and changing. As a whole, Costa's Hummingbird is only a vagrant to Oregon, but recurrences at the

same locations (e.g., Bend, Deschutes Co.) for 3 or 4 consecutive years suggest that some individuals return to a site annually, in an incipient regular migration.

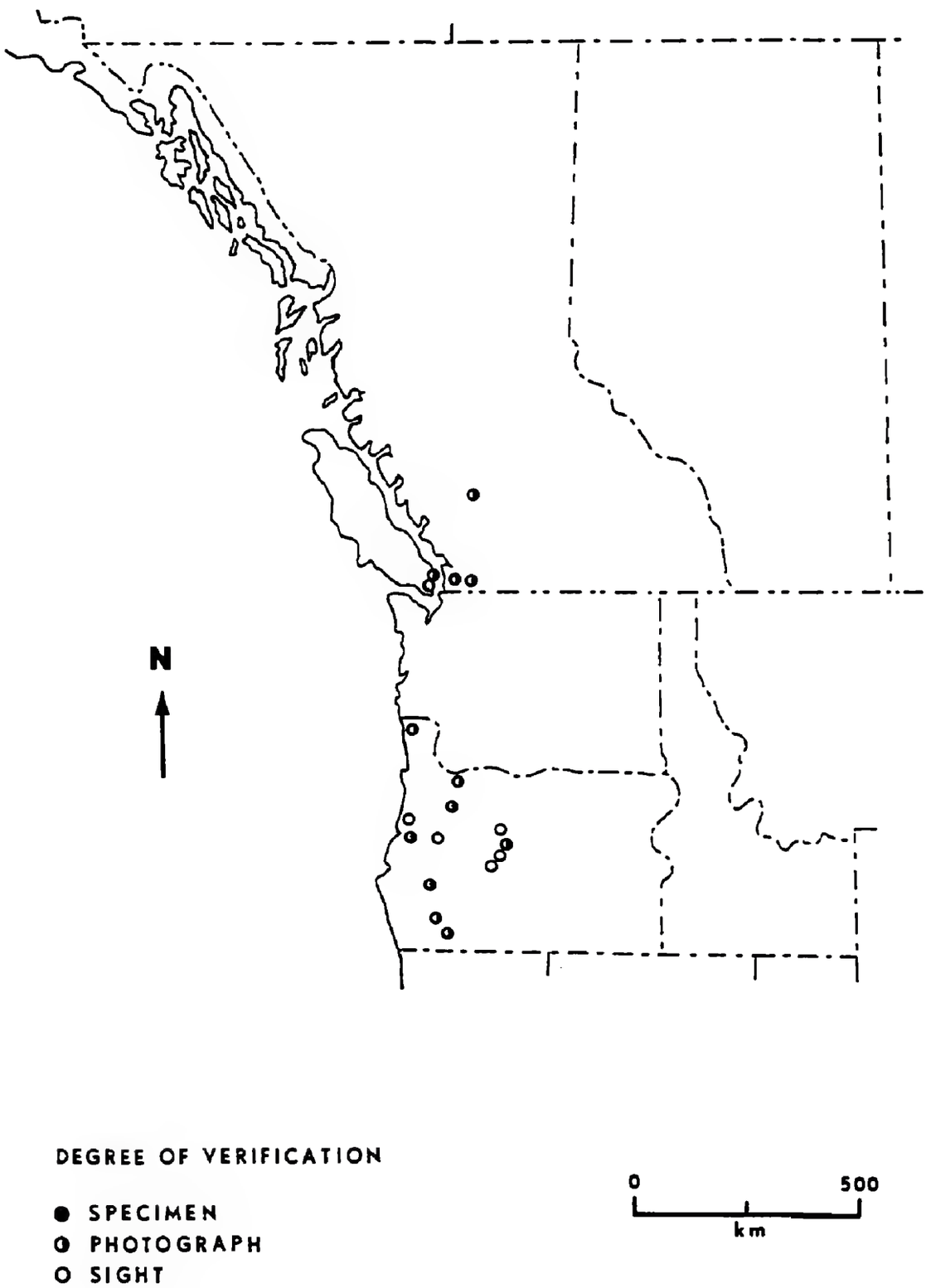


Figure 4. Distribution of Costa's Hummingbird in the northwestern United States and southern Canada based on its documented presence (dots). Filled circles, specimens; half-filled circles, photographs; open circles, sightings.

There have been at least 21 sightings, many of which are supported by photographs, of Costa's Hummingbird for Oregon through 1987. Six of these are from the 1970s; the remainder are from the 1980s. The first was of an adult male in Astoria, Clatsop County, from 5 to 20 April 1972 (Crowell and Nehls 1972), followed by another male at Eugene, Lane County, from 12 to 16 April 1974 (Crowell and Nehls 1974). Additional records during the 1970s were from Portland, Multnomah County, in 1977 (Mattocks and Hunn 1978), Roseburg, Douglas County, in 1977 (C. Watson in litt. and Roberson 1980), Molalla, Clackamas County, in 1979 (Tweit et al. 1979), and Florence, Lane County, in 1979 (Mattocks and Hunn 1980, Hunn and Mattocks 1980).

Oregon reports of the species to date have been from coastal areas and both the eastern and western flanks of the Cascade Range. Of particular interest is the seasonality of occurrences: the only months for which there are no reports are just August and September. From March through June, which in many other areas is the breeding season, there are Oregon records along the coast from Florence north to Astoria, west of the Cascades from Ashland, Jackson County, north to Molalla, and east along the east slope of the Cascades north to Bend. Post-breeding records for July include reports from Bend, Molalla, and Medford (Jackson Co.). October through February records, all west of the Cascades, are from Portland, Roseburg, Florence, and Newport (Lincoln Co.).

British Columbia

As elsewhere in the Pacific Northwest, the occurrence of Costa's Hummingbird in British Columbia, based on sightings and photographs of adult males, is recent. The five universally accepted records (R. W. Campbell, R. Howie, and W. C. Weber in litt.) are as follows: 14-17 April 1972 at Cadboro Bay (Mackenzie-Grieve and Tatum 1974), 3 July 1984 at Nanaimo (Campbell 1984), 17 May 1986 at Pitt Meadows (Mattocks 1986), 17-19 May 1987 at Lillooet (Mattocks and Tweit 1987), and 20 May - 1 June 1987 at Burnaby (Mattocks and Tweit 1987, Tweit and Mattocks 1987). Sightings from West Vancouver (Shepard 1974, the basis for the statement in the 1983 A.O.U. Check-list that Costa's Hummingbird winters casually north to Vancouver Island) and from Gabriola Island in Whaler Bay (Campbell 1985), if cited, should be listed as hypothetical since there are no supporting details (W. C. Weber in litt.).

DISCUSSION

"*Calypte costae*, collected by Neboux, described by Bourcier, named in honor of Costa, and based on a specimen from 'California,' has long been shrouded in mystery. . . ," so Palmer (1918) began his paper aimed at clarifying the early history of this species. Palmer did much to rectify various misconceptions, but more than 70 years later there is still considerable confusion and even mystery associated with this species.

The expansion and contraction of the range of a species at its periphery is natural. When these fluctuations serve to isolate populations or when they

bring previously isolated populations into contact, however, the relevance of documenting the range of a species and the subsequent study of the underlying causes of these shifts take on added meaning and biological importance. Such fundamental aspects of the biology of a species as breeding status, distribution, and seasonal occurrence are also important if one is to study and interpret other biological questions pertaining to a given taxon.

Biogeographical considerations are a natural outgrowth of distributional studies. The discovery of new areas of occupancy does not necessarily imply that a species has acquired a new adaptation nor that the newly occupied areas have changed from their former state. Conversely, absence from previously occupied sites does not necessarily imply change in the organism or modification of the site. Such discoveries may simply be artifacts of past and present sampling efforts.

There can be no denying that there is an ever-growing number of more highly skilled observers, given the increased popularity of birdwatching and the universal availability of numerous excellent guides to bird identification. Perhaps the most tangible result of this is the increased frequency with which vagrant birds are detected. Collectors in the late 1800s and throughout the first half of the present century were nonetheless very adept and in many areas few species went undetected. The decision as to whether an observed shift in the range of a species is real or simply the result of sampling bias requires careful study and the evaluation of various factors.

Growing human populations and the subsequent cultivation of exotic flowering plants, coupled with the widespread use of feeders for the last 40–45 years, have allowed the numbers of hummingbirds in urban areas to increase tremendously. The effects of urbanization were well documented by Zimmerman (1973) for Anna's Hummingbird, and similar expansions may be anticipated among other species. The cultivation of exotic plants and the use of feeders is nonetheless generally restricted to areas of human habitation.

Extensive tracts of sparsely inhabited land remain throughout the range of Costa's Hummingbird. While feeders and residential plantings provide satisfactory explanations for the maintenance of the species once it reaches new areas such as northern California and the Pacific Northwest, an explanation of what sustains birds between urban centers and thus facilitates their reaching new areas is still needed.

Information from throughout the species' range is lacking, but I have investigated the ecology of Costa's Hummingbird in southeastern Arizona and southwestern New Mexico. The recent establishment of non-native Tree Tobacco (*Nicotiana glauca*), a nectar-rich and often perpetually flowering species, throughout much of northern and eastern Sonora appears to be having a major impact on local hummingbird populations. Increased densities of Broad-billed (*Cynanthus latirostris*) and Violet-crowned (*Amazilia violiceps*) hummingbirds in northern Sonora seem to be especially tied to the widespread establishment of Tree Tobacco (Baltosser 1983). Costa's Hummingbirds in eastern and northern Sonora are also feeding in Tree Tobacco and presumably responding similarly, though an increase is hard to measure since the number of Costa's Hummingbirds in these areas is much less than that of the other species.

The recent occurrence of Costa's Hummingbirds in southeastern Arizona and southwestern New Mexico is presumably linked to a certain degree to the widespread establishment of large stands of Tree Tobacco just to the south in Sonora. The propensity of Tree Tobacco to occupy disturbed soils as along highways is well known (Goodspeed 1954, Stiles 1973). Agricultural practices and the completion of highways in central and northeastern Sonora during the last 30 years have been followed by the spread of Tree Tobacco, which is unpalatable to goats and cattle. Large and continuous stands now extend, for example, in central Sonora as far north as Arizpe and Nacozari, areas in which Tree Tobacco was formerly less common to absent (Goodspeed 1954). Large stands of Tree Tobacco do not yet, and may never, form a continuous link with areas such as Guadalupe Canyon in extreme southeastern Arizona and extreme southwestern New Mexico, but natural north-south routes of dispersal in Mexico have been greatly enriched. Densities of 57, 13, and 7 birds per hectare for Broad-billed, Violet-crowned, and Costa's hummingbirds, respectively (Baltosser 1983), would not be maintained for extended periods in central and northeastern Sonora on the relatively meager nectar supplies produced by native vegetation. The density and perhaps even the occurrence of various hummingbirds in many of the former areas is therefore probably dependent upon Tree Tobcacco.

Hummingbirds in Baja California, southern California, southern Arizona, and southern Texas appear to be responding similarly to the establishment and proliferation of Tree Tobacco. There are numerous anecdotal references in the literature to the use of Tree Tobacco by various species of hummingbirds. Occasionally, these indicate that the presence of a species that was formerly absent or rare is perhaps linked to the presence of this flowering plant, e.g., Howell and Cade (1954) regarding *Calypte anna,* or that its seasonal occurrence and abundance is correlated with the occurrence of Tree Tobacco, e.g., Unitt (1984) regarding *Calypte costae*.

The continued influence of man upon this and other species of southwestern hummingbirds, many of which are closely related, will undoubtedly produce additional oscillations in their ranges. The ultimate effects are hard to predict, but through time it will be interesting to note the extent of increased hybridization, if any (hybrids are known for various species), and the extent to which other isolating mechanisms and competition play a role in the structuring of the various populations.

ACKNOWLEDGMENTS

For discussions and extended correspondence over the years regarding this species I thank J. P. Hubbard, G. Monson, and A. R. Phillips, who in addition to T. L. Best, R. J. Raitt, and D. A. Zimmerman, commented on an earlier draft of the manuscript. Special appreciation is extended to S. M. Russell for providing over 150 records from Sonora and for reviewing the manuscript. The manuscript has benefited greatly from the editorial comments of P. Unitt, R. A. Erickson, and P. Lehman. Assistance provided by V. R. Baltosser, C. G. Schmitt, and the Magoffin and Hadley families of southeastern Arizona and southwestern New Mexico is sincerely appreciated. For providing specimen and other related museum data on Costa's Hummingbird I thank F. B. Gill, M. B. Robbins, and K. Matthew (Academy of Natural Sciences of Philadelphia), L. L. Short and J. Bull (American Museum of Natural History), L. F. Baptista,

S. F. Bailey, and J. Schonewald (California Academy of Sciences), K. C. Parkes and J. Loughlin (Carnegie Museum of Natural History), D. M. Niles and G. Hess (Delaware Museum of Natural History [DelMNH]), E. Webb and C. Chase III (Denver Museum of Natural History), J. W. Fitzpatrick and D. E. Willard (Field Museum), K. L. Garrett (Los Angeles County Museum of Natural History), J. V. Remsen (Louisiana State University), T. J. Merkel and J. Scott (Museum of Northern Arizona [MNA]), R. C. Banks and R. L. Zusi (National Museum of Natural History [USNM]), R. J. Raitt (New Mexico State University), J. C. Hafner (Moore Laboratory of Zoology, Occidental College [MLZOC]), E. H. Stickney (Peabody Museum of Natural History), A. M. Rea, G. McCaskie, and S. Liston (San Diego Natural History Museum), D. M. Power and J. A. Hamber (Santa Barbara Museum of Natural History), K. A. Arnold (Texas A & M University), S. M. Russell and T. Huels (University of Arizona), N. K. Johnson (Museum of Vertebrate Zoology, University of California), M. J. Mengel, R. M. Mengel, and P. C. Rasmussen (University of Kansas), R. W. Storer (Museum of Zoology, University of Michigan), and W. H. Behle and A. Hanniball (University of Utah and Utah Museum of Natural History). Other individuals that contributed in important ways through correspondence include J. G. Evens, F. R. Gehlbach, R. R. Howie, G. Kashin, H. E. Kingery, W. D. Koenig, D. Kragh, P. W. Mattocks, G. S. Mills, T. H. Rogers, C. Watson, W. C. Weber, F. S. Webster, F. C. Williams, and J. Witzeman. For the privilege of collecting and banding birds I thank the Arizona Game and Fish Department, the New Mexico Department of Game and Fish, and the U.S. Fish and Wildlife Service. Logistical support at the present time has been provided by J. D. Ligon, T. L. Yates, and W. L. Gannon of the University of New Mexico. Earlier segments of this study were supported indirectly by the New Mexico State University Department of Biology, the New Mexico Department of Game and Fish (contract 519-68-06), and Chapman Memorial grants (61462, 84472, and 110115) from the American Museum of Natural History.

LITERATURE CITED

American Ornithologists' Union. 1983. Check-List of North American Birds. 6th ed. Am. Ornithol. Union, Washington, D.C.

Baltosser, W. H. 1983. Nesting ecology of sympatric hummingbirds in Guadalupe Canyon. Ph.D. dissertation, New Mexico State Univ., Las Cruces.

Baltosser, W. H. 1986. Nesting success and productivity of hummingbirds in southwestern New Mexico and southeastern Arizona. Wilson Bull. 98:353-367.

Baltosser, W. H. 1987. Age, species, and sex determination of four North American hummingbirds. N. Am. Bird Bander 12:151-166.

Baltosser, W. H. 1989. Nectar availability and habitat selection by hummingbirds in Guadalupe Canyon. Wilson Bull., in press.

Behle, W. H., and Perry, M. L. 1975. Utah Birds: Guide, Check-List and Occurrence Charts. Utah Mus. Nat. Hist., Univ. Utah, Salt Lake City.

Bendire, C. 1895. Life histories of North American birds. U.S. Natl. Mus. Spec. Bull. 3.

Brewster, W. 1902. Birds of the cape region of Lower California. Bull. Mus. Comp. Zool. 41:1-241.

Campbell, R. W. 1984. Wildlife atlases progress report: Fall 1984. Br. Columbia Nat. 22:6-7, 19.

Campbell, R. W. 1985. Wildlife atlases progress report: Summer 1985. Br. Columbia Nat. 23:6-7.

Crowell, J. B., Jr., and Nehls, H. B. 1972. The spring migration: Northern Pacific Coast Region. Am. Birds 26:797-801

Crowell, J. B., Jr., and Nehls, H. B. 1974. The spring migration: Northern Pacific Coast Region. Am. Birds 28:840-845.

Garrett, K., and Dunn, J. 1981. Birds of Southern California. Los Angeles Audubon Soc., Los Angeles.

Goodspeed, T. H. 1954. The Genus *Nicotiana*: Origins, Relationships, and Evolution of its Species in the Light of Their Distribution, Morphology, and Cytogenetics. Chronica Botanica, Waltham, MA.

Grinnell, J. 1928. A distributional summation of the ornithology of Lower California. Univ. Calif. Publ. Zool. 32:1-300.

Grinnell, J., and Miller, A. H. 1944. The distribution of the birds of California. Pac. Coast Avifauna 27.

Hayward, C. L., Cottam, C., Woodbury, A. M., and Frost, H. H. 1976. Birds of Utah. Great Basin Nat. Memoir 1.

Howell, T. R., and Cade, T. J. 1954. The birds of Guadalupe Island in 1953. Condor 56:283-294.

Hubbard, J. P. 1976. Frank Stephens: A century-ago birder in New Mexico. N.M. Ornithol. Soc. Bull. 4:13-17.

Hubbard, J. P. 1978. Revised check-list of the birds of New Mexico. N.M. Ornithol. Soc. Publ. 6.

Hubbard, J. P. 1982. The spring migration: Southwest Region. Am. Birds 36:882-884.

Hunn, E. S., and Mattocks, P. W., Jr. 1980. The spring migration: Northern Pacific Coast Region. Am. Birds 34:807-810.

Kingery, H. E. 1975. The winter season: Mountain West Region. Am. Birds 29:720-724.

LeValley, R., and Evens, J. 1981. The nesting season: Middle Pacific Coast Region. Am. Birds 35:973-977.

LeValley, R., and Evens, J. 1983. The nesting season: Middle Pacific Coast Region. Am. Birds 37:1022-1026.

LeValley, R., and Rodrigues, B. 1974. 74th Christmas Bird Count: Count #1035—San Blas, Nayarit, Mexico. Am. Birds 28:549-550.

Ligon, J. S. 1961. New Mexico Birds and Where to Find Them. Univ. New Mexico Press, Albuquerque.

Linsdale, J. M. 1936. The birds of Nevada. Pac. Coast Avifauna 23.

Mackenzie-Grieve, R. C., and Tatum, J. B. 1974. Costa's Hummingbird, a new bird for Canada. Can. Field-Nat. 88:91-92.

Mattocks, P. W., Jr. 1986. The spring migration: Northern Pacific Coast Region. Am. Birds 40:514-518.

Mattocks, P. W., Jr., and Hunn, E. S. 1978. The fall migration: Northern Pacific Coast Region. Am. Birds 32:245-250.

Mattocks, P. W., Jr., and Hunn, E. S. 1980. The winter season: Northern Pacific Coast Region. Am. Birds 34:299-302.

Mattocks, P. W., Jr., and Tweit, B. H. 1987. The spring migration: Northern Pacific Coast Region. Am. Birds 41:478-482.

McCaskie, G., DeBenedictis, P., Erickson, R., and Morlan, J. 1979. Birds of Northern California: An Annotated Field List. Golden Gate Audubon Soc., Berkeley.

Monson, G. 1951. Winter season: Southwest Region. Aud. Field Notes 5:219-222.

Monson, G. 1958. Nesting season: Southwest Region. Aud. Field Notes 12:432-433.

Monson, G. 1959. Fall migration: Southwest Region. Aud. Field Notes 13:53-55.

Monson, G., and Phillips, A. R. 1981. Annotated Checklist of the Birds of Arizona. Univ. Arizona Press, Tucson.

Palmer, T. S. 1918. Costa's Hummingbird: Its type locality, early history and name. Condor 20:114-116.

Porter, R. D., and Bushman, J. B. 1956. Bird records from Utah. Wilson Bull. 68: 152-153.

Rea, A. M. 1983. Once A River: Bird Life and Habitat Changes on the Middle Gila. Univ. Arizona Press, Tucson.

Roberson, D. 1980. Rare Birds of the West Coast of North America. Woodcock Publ., Pacific Grove, CA.

Shepard, M. G. 1974. British Columbia birds: Winter season 1973-1974. Discovery 3:4-11.

Stiles, F. G. 1971. On the field identification of California hummingbirds. Calif. Birds 2:41-54.

Stiles, F. G. 1973. Food supply and the annual cycle of the Anna Hummingbird. Univ. Calif. Publ. Zool. 7:1-109.

Tweit, B. H., and Mattocks, P. W., Jr. 1987. The nesting season: Northern Pacific Coast Region. Am. Birds 41:1478-1480.

Tweit, B. H., Mattocks, P. W., Jr., and Hunn, E.S. 1979. The nesting season: Northern Pacific Coast Region. Am. Birds 33:890-893.

Unitt, P. 1984. The birds of San Diego County. San Diego Soc. Nat. Hist. Memoir 13.

Van Rossem, A. J. 1936. Birds of the Charleston Mountains, Nevada. Pac. Coast Avifauna 24.

Van Rossem, A. J. 1945. A distributional survey of the birds of Sonora, Mexico. Occas. Pap. Mus. Zool., La. State Univ. 21:1-379.

Van Tyne, J. 1956. What constitute scientific data for the study of bird distribution? Wilson Bull. 68:63-67.

Wauer, R. H. 1973. Birds of Big Bend National Park and Vicinity. Univ. Texas Press, Austin.

Webster, F. S., Jr. 1957. Fall migration: South Texas Region. Aud. Field Notes 11:38-43.

Webster, F. S., Jr. 1958. Fall migration: South Texas Region. Aud. Field Notes 12:41-44.

Webster, F. S., Jr. 1974. The winter season: South Texas Region. Am. Birds 28:661-663.

Wilbur, S. R. 1987. Birds of Baja California. Univ. Calif. Press, Berkeley.

Williams, F. 1975. The winter season: Southern Great Plains Region. Am. Birds 29:707-711.

Witzeman, J., and Stejskal, D. 1987. The nesting season: Southwest Region. Am. Birds 41:1470-1473.

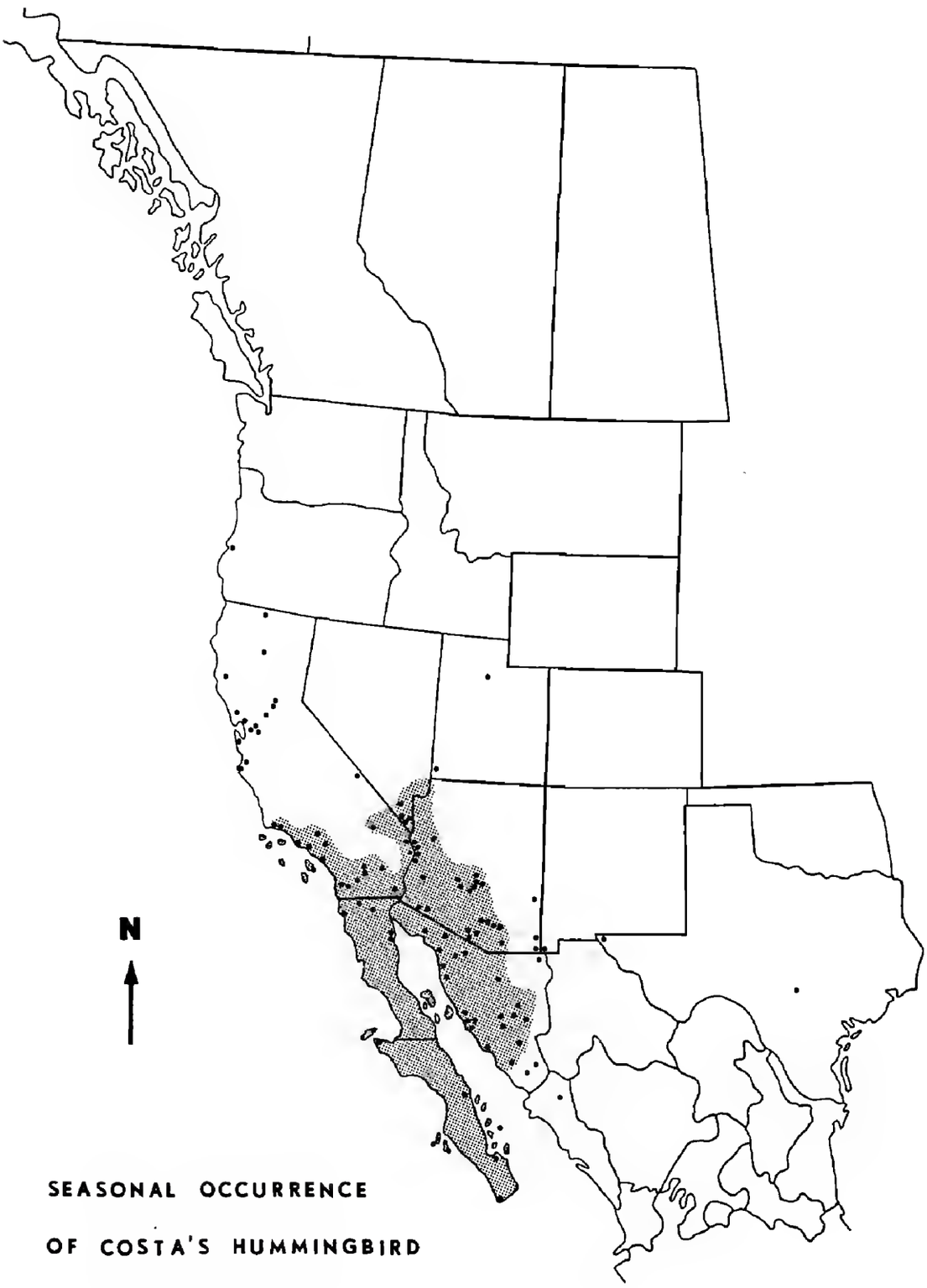
Zimmerman, D. A. 1973. Range expansion of Anna's Hummingbird: An inquiry into the extent, chronology, and possible causes of a striking recent phenomenon in distribution. Am. Birds 27:827-835.

Accepted 5 July 1989

Costa's Hummingbird *Photo by Alan B. Meyerfeld*

APPENDIX A

Seasonal occurrence of Costa's Hummingbird between January 6 and March 15, showing the normal distribution of the species (shaded areas) and its documented presence (dots) during this period.



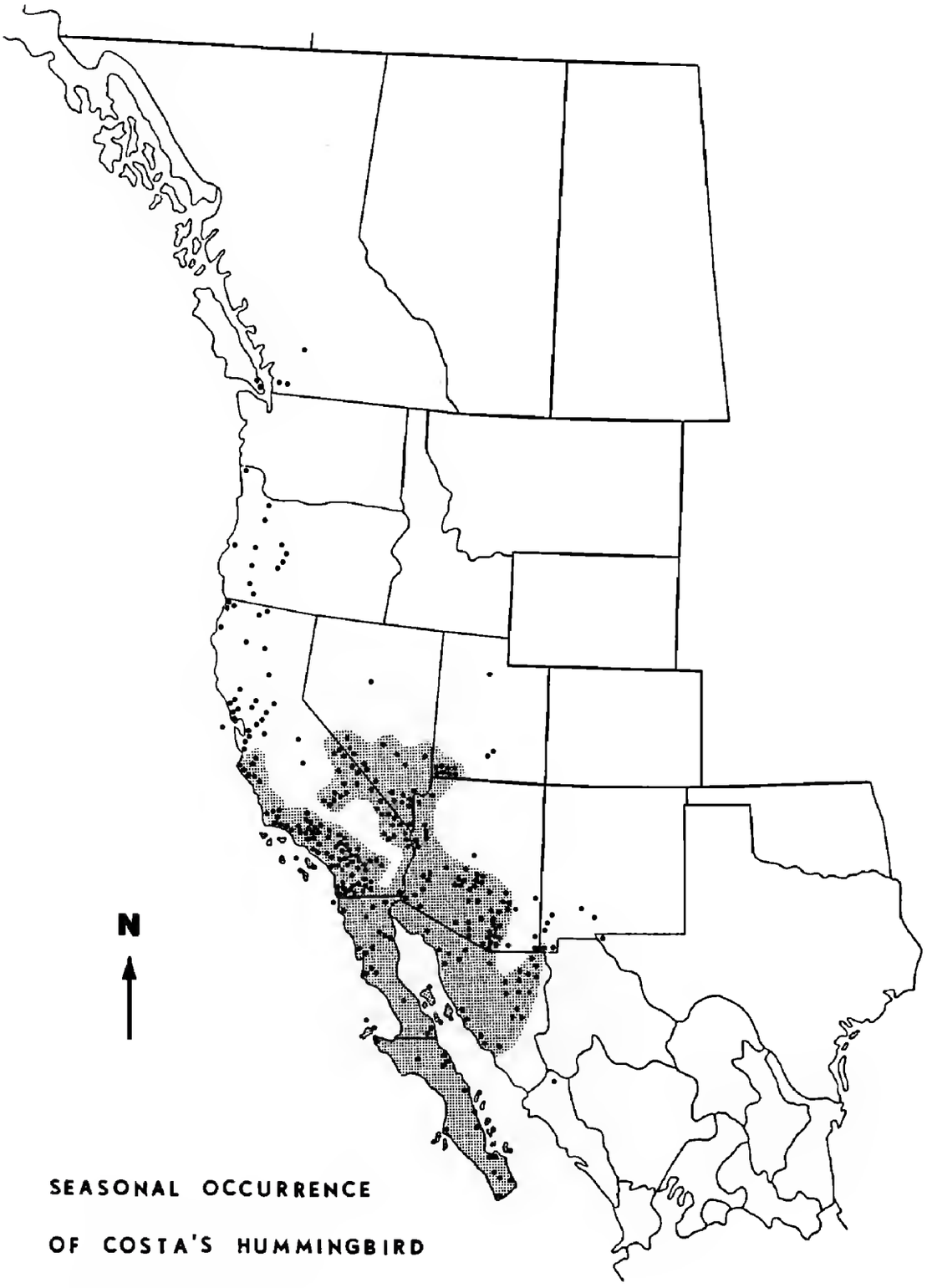
SEASONAL OCCURRENCE

OF COSTA'S HUMMINGBIRD

JANUARY 6 - MARCH 15

APPENDIX B

Seasonal occurrence of Costa's Hummingbird between March 16 and June 30, showing the normal distribution of the species (shaded areas) and its documented presence (dots) during this period.



SEASONAL OCCURRENCE

OF COSTA'S HUMMINGBIRD

MARCH 16 - JUNE 30

APPENDIX C

Seasonal occurrence of Costa's Hummingbird between July 1 and October 31, showing the normal distribution of the species (shaded areas) and its documented presence (dots) during this period.

SEASONAL OCCURRENCE

OF COSTA'S HUMMINGBIRD

JULY 1-OCTOBER 31

APPENDIX D

Seasonal occurrence of Costa's Hummingbird between November 1 and January 5, showing the normal distribution of the species (shaded areas) and its documented presence (dots) during this period.

SEASONAL OCCURRENCE
OF COSTA'S HUMMINGBIRD
NOVEMBER 1 - JANUARY 5

FIRST RECORD OF THE TEREK SANDPIPER IN CALIFORNIA

ERIKA M. WILSON, 1400 S. Barton St. #421, Arlington, Virginia 22204
BETTIE R. HARRIMAN, 5188 Bittersweet Lane, Oshkosh, Wisconsin 54901

On 28 August 1988, while birding at Carmel River State Beach, Monterey County, California (36°32' N, 121°57' W), we discovered an adult Terek Sandpiper (*Xenus cinereus*). We watched this Eurasian vagrant between 1110 and 1135 PDT; we saw it again, along with local birders, between 1215 and 1240 as it foraged on the open beach. Wilson observed the bird a third time on 5 September 1988 between 1000 and 1130; others saw it regularly until 23 September 1988.

During our first observation a light overcast sky resulted in good viewing conditions, without glare or strong shadows. The weather was mild with a slight breeze and some offshore fog. We found the Terek Sandpiper feeding in the Carmel River's shallow lagoon, separated from the Pacific Ocean by sand dunes. Its long, upturned bill, quite out of keeping with any small wader with which we were familiar, immediately attracted our attention. We moved closer and tried unsuccessfully to photograph it. Shortly thereafter all the birds present took to the air. The sandpiper flew out over the dunes but curved back and landed out of sight on the open beach. We telephoned Robin Roberson, and half an hour later she, Brian Weed, Jan Scott, Bob Tintle, and Ron Branson arrived, the latter two armed with telephoto lenses. We quickly relocated the Terek Sandpiper on the beach, foraging at the surf line.

The following description is based on our field notes, with color names taken from Smithe (1975). Our bird was a medium-sized sandpiper resembling a winter-plumaged Spotted Sandpiper (*Actitis macularia*) but distinguished by bright yellow-orange legs and an upturned bill (Figure 1). The evenly curved, dark horn bill, 1.5 times the length of the bird's head, had a fleshy orange base. Narrow white rings encircled the dark eyes. Above the dark lores there was a broad white supercilium; it narrowed over and behind the eye. The dark loral line extended behind the eye as a thin, dark eye stripe. The rest of its head, including the crown, nape, and cheeks, was smoke gray to drab gray; its chin and throat were white. Its upperparts were the same smoke gray, with six black-tipped scapulars on each side forming two lines down the back. The scapulars and coverts were worn and lacked bright edgings (Figure 2).

The underparts were pure white from vent to breast. The upper breast was washed evenly with drab gray, dark near the shoulder and pale near the center. When the bird was standing, its wingtips were even with the end of its tail. In flight its tail was rounded, and both tail and rump were smoke gray. On the upper wing, its primaries, primary coverts, and outer lesser coverts were black. The inner wing was drab gray, but the secondaries were broadly tipped with white (Figure 3). This contrasting wing pattern was not so bold as in a Willet (*Catoptrophorus semipalmatus*) but was striking nonetheless. The wing linings were white.

When first located the Terek Sandpiper was picking items off the surface of the water and adjacent mud. It moved quickly back and forth along the shore and occasionally went back to rework the same area. During our second observation it was picking items from the beach surface, working close to the surf line along with two Sanderlings (*Calidris alba*). On 5 September 1988 Wilson saw it foraging in the same area of the lagoon where we first found it, as well as out on the beach and even farther out on the rocks.

Others who submitted field notes to the California Bird Records Committee recorded the bird feeding or roosting in a variety of habitats. It foraged in the lagoon's shallow waters, along the upper beach, on wet sand, among seaweed-fringed rocks, and out on the floating kelp beds behind the breakers. It foraged alone, although often close to other waders using the same substrate. It took flies from the surface of the kelp and the beach, captured a small crab and various invertebrates, and probed deeply into wet sand. It rested and preened on the beach, along the edge of the lagoon, atop large rock outcrops, and on the kelp beds. The sandpiper's behavior was well documented on video by Neal Williams.

The flight of the Terek Sandpiper consisted of rapid, stiff wingbeats, deeper than those of Spotted Sandpiper, although, like the latter, it did not raise its wings above the horizontal. It flew in loose zigzags and in straight lines, often high overhead, in contrast to the low-over-the-water

Figure 1. Terek Sandpiper, Carmel Beach State Park, 28 August 1988. Note the evenly upturned bill, bright yellow-orange legs, and the black edging at the bend of the folded wing.

Photo by Peter LaTourette

Figure 2. Terek Sandpiper, Carmel Beach State Park, 2 September 1988. Note the black tips on the scapulars and the flesh-colored base of the bill.

Photo by Greg W. Lasley

Figure 3. Terek Sandpiper, Carmel Beach State Park, 6 September 1988. Note the broad white trailing edge of the secondaries and the contrasting black primaries.

Photo by Don Roberson

flights of the Spotted Sandpiper. The Terek Sandpiper almost always curved down on set wings to land.

The only vocalization we heard from the Terek Sandpiper was a single, thin call note as it flew past us along the beach. Most other observers reported that it was silent, but Jon Dunn heard it give a "ringing three-note whistle on one pitch" on several occasions.

This first documented California record was unanimously accepted by the California Bird Records Committee on its first circulation. In addition to field notes from sixteen observers, the documentation includes video footage, color slides, and prints. It is estimated that several hundred birders from sixteen states, Canada, and England saw the Terek Sandpiper between 28 August and 18 September 1988, the last date for which there is a first-hand report (D. Roberson pers. comm.).

DISTRIBUTIONAL SUMMARY

The Terek Sandpiper breeds from Finland, northern Russia, and northern Siberia south to central Russia, Lake Baikal, and Anadyrland. It winters from the Persian Gulf, southern Red Sea, southeast Asia, and Hainan south to South Africa, Madagascar, India, Sri Lanka, the Andaman Islands, the East Indies, New Guinea, and Australia (A. O. U. 1983).

Vagrants have occurred widely in Europe and North Africa (Cramp and Simmons 1983) and in New Zealand (Hayman et al. 1986). Pugnali et al. (1988) recorded one in January 1988 in Buenos Aires Province, Argentina. Roberson (1980) summarized the documented North American occurrences, at that time restricted to Alaska's islands and coast. He also cited two records outside of Alaska, an unconfirmed report from Dungeness, Clallam County, Washington, and from Alberta, Canada (the latter is probably an error, referring to the Manitoba sighting below, Roberson pers. comm.). There is a Canadian sight record from Churchill, Manitoba, for 13 July 1972 (A. O. U. 1983, Godfrey 1986). The first photographic documentation of the Terek Sandpiper outside of Alaska was of a breeding-plumaged adult near Sooke, on Vancouver Island, British Columbia, between 21 July and 6 August 1987 (Tweit and Mattocks 1987, Zurowski 1987, Goodwill and Goodwill 1988).

Records in Alaska have almost tripled since 1980 (Gibson 1983, 1984, 1985, 1986, Gibson et al. 1987, 1988). Taken with the previously cited records, these occurrences now extend from late spring to early fall (Figure 4). Cramp and Simmons (1983) indicated that spring migration ends by mid-June, with egg-laying and hatching being most common in mid-to-late June, and fall migration beginning by the first of July for non-nesting birds.

IDENTIFICATION SUMMARY

Terek Sandpipers are easy to identify. The strongly upturned bill, medium size, and yellow-orange legs distinguish this species in all plumages. The bill is more strongly and evenly upturned than that of any

other sandpiper, including yellowlegs and their allies (*Tringa*) and godwits (*Limosa*). Terek Sandpiper has an unusual upperwing pattern of black primaries, primary coverts, and outer lesser coverts, coupled with broadly white-tipped secondaries, that is not shared with any North American species. Many waders have white stripes across the wing, but these are due to white-based flight feathers, white-tipped coverts, or a combination of these two patterns, rather than white-tipped secondaries. The Willet has white-tipped secondaries, but the white extends into the bases of its primaries.

In structure and posture this bird reminded us of an oversized Spotted Sandpiper. It teetered like *Actitis* as it foraged, although not so consistently, and maintained a horizontal body posture. The Terek Sandpiper combined feeding strategies seen in both species of yellowlegs (daintily picking from the water surface and making rapid, erratic dashes), but it used a much wider variety of substrates (quiet lagoon, open beach, rocky shores, and kelp beds) than do most waders. Winkler (1980) noted some of these same foraging techniques in his study. He found that Terek Sandpipers usually began a feeding bout by picking items from the surface but then turned to deep probing as their main foraging strategy.

Determining the age of waders in fall migration requires close observation of feather wear, feather markings, and overall plumage pattern. Our first impression was of an adult because we saw black scapular lines on the back and did not see cinnamon-fringed brown scapulars or buff-fringed brown coverts that would have indicated a juvenile. Examination of the slides and photographs of this Terek Sandpiper showed that its scapulars and wing coverts were heavily worn.

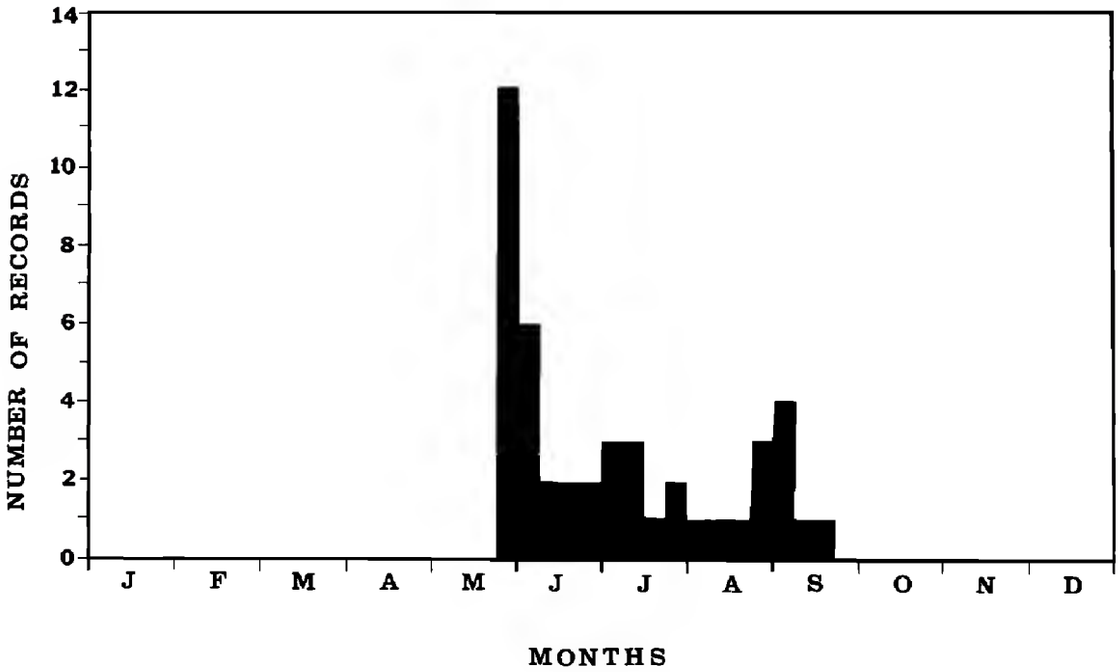


Figure 4. Records of Terek Sandpiper in North America. Birds present for more than one quarter/month are indicated for each quarterly period.

The scapulars were brownish gray with dark shafts and whitish fringes, although the fringes were so worn that they were easily overlooked. The black scapular lines consisted of feathers with black shafts and black, downward-pointing wedges near the heavily worn tips. Cramp and Simmons (1983) stated that some individuals begin their post-breeding molt before leaving the nesting areas but that most begin molting during halts on migration from late July onward. On the basis of the plumage and dates, we judge that our bird was an adult.

ACKNOWLEDGMENTS

We thank California Bird Records Committee members J. L. Dunn, J. Morlan, and D. Roberson for their helpful comments when reviewing this record, D. R. Paulson and C. P. Wilds for critical comments on the manuscript, and the other observers, especially N. Williams, who submitted documentation to the committee.

LITERATURE CITED

American Ornithologists' Union. 1983. Check-list of North American Birds, 6th ed. Am. Ornithol. Union, Washington, D.C.

Cramp, S., and Simmons, K. E. L., eds. 1983. The Birds of the Western Palearctic. Vol. III. Oxford University Press, Oxford.

Gibson, D. D. 1983a. The autumn migration. Alaska region. Am. Birds 37:213.

Gibson, D. D. 1983b. The spring migration. Alaska region. Am. Birds 37:902–903.

Gibson, D. D. 1984. The nesting season. Alaska region. Am. Birds 38: 1053.

Gibson, D. D. 1985. The spring migration. Alaska region. Am. Birds 39:339.

Gibson, D. D. 1986. The nesting season. Alaska region. Am. Birds 40:1243.

Gibson, D. D., Tobish, T. G. Jr., and Isleib, M. E. 1987. The nesting season. Alaska region. Am. Birds 41:1476.

Gibson, D. D., Tobish, T. G. Jr., and Isleib, M. E. 1988a. The autumn migration. Alaska region. Am. Birds 42:120.

Gibson, D. D., Tobish, T. G. Jr., and Isleib, M. E. 1988b. The nesting season. Alaska region. Am. Birds 42:1330.

Godfrey, W. E. 1986. The Birds of Canada (revised edition). National Museums of Canada, Ottawa.

Goodwill, M. E., and Goodwill, J. E. V. 1988. Terek Sandpiper in British Columbia, Canada. Am. Birds 42:177.

Hayman, P., Marchant, J., and Prater, T. 1986. Shorebirds: An identification guide to the waders of the world. Houghton Mifflin, Boston.

Pugnali, G., Blanco, D., and Rodriguez G., H. 1988. A record of the Terek Sandpiper, *Xenus cinereus* (Aves, Scolopacidae), at Punta Rasa, on the Atlantic coast of Buenos Aires Prov., Argentina. Not. Faunisticas 13:1–2. (Spanish, with English summary).

Roberson, D. 1980. Rare Birds of the West Coast of North America. Woodcock Publ., Pacific Grove, CA.

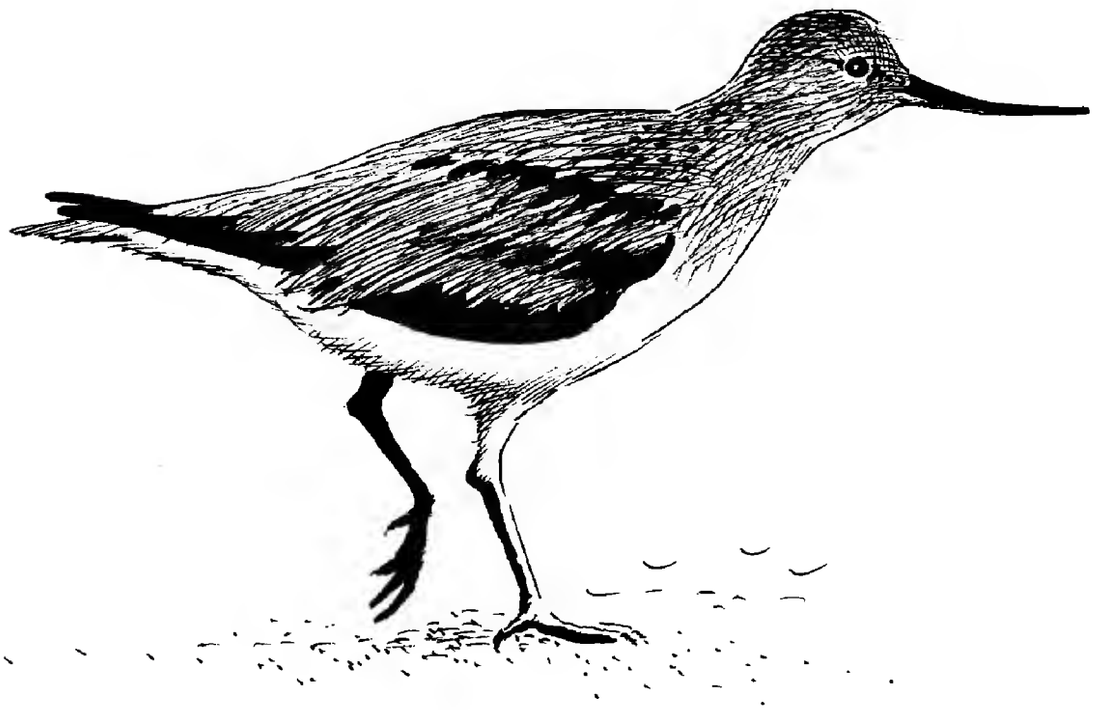
Smithe, F. B. 1975. Naturalist's Color Guide. Am. Mus. Nat. Hist., New York.

Tweit, B., and Mattocks, P. W. Jr. 1987. The nesting season. Northern Pacific coast region. Am. Birds 41:1479.

Winkler, H. 1980. Food acquisition of the Terek Sandpiper (*Xenus cinereus*) in its winter habitat. Egretta 23:56–60. (German, with English summary).

Zurowski, T. 1987. Regional reports pictorial highlights, summer 1987. Am. Birds 41:1385.

Accepted 11 July 1989



Terek Sandpiper *Sketch by Rae Johnson*

Elf Owl *Photo by Alan B. Meyerfeld*

STATUS AND DISTRIBUTION OF THE ELF OWL IN CALIFORNIA

MARY D. HALTERMAN, Department of Biological Sciences, California State University, Chico, California 95929

STEPHEN A. LAYMON, Department of Forestry and Resource Management, 145 Mulford Hall, University of California, Berkeley, California 94720

MARY J. WHITFIELD, Department of Biological Sciences, California State University, Chico, California 95929

In California, the Elf Owl (*Micrathene whitneyi*) has been found only in riparian habitats and scattered stands of Saguaro (*Carnegiea gigantea*) along the lower Colorado River and at a few desert oases (Grinnell and Miller 1944). Although the species has never been numerous in California, there has apparently been a population decline. Surveys in 1978 and 1979 located 11 and 6 pairs of Elf Owls, respectively, at two locations along the lower Colorado River (Cardiff 1978, 1979). Cardiff's (1978) complete record of the 28 Elf Owl sightings made in California prior to 1978 identified eight locations where the species has been found. We gathered 10 additional records made since 1979 (Table 1). All recent records were for either Soto Ranch or near Water Wheel Camp. Since 1979, habitat destruction has continued, resulting in the loss of much of the remaining cottonwood-willow and mesquite bosques (C. Hunter and B. Anderson pers. comm.). This loss is due to the proliferation of tamarisk (*Tamarix chinensis*), agricultural clearing, bank stabilization projects, urbanization, and recent sustained flooding (Laymon and Halterman 1987). This loss and its potential effect on Elf Owls prompted this survey during the spring of 1987.

The objectives of this study were to (1) identify and survey areas where Elf Owls had been reported during and since the 1979 survey, (2) identify and survey other areas of potential Elf Owl habitat, (3) determine the size and distribution of the breeding population of Elf Owls in California, (4) describe the physiographic features and vegetation of the sites surveyed, (5) assess the condition of the sites, including potential threats, and (6) develop recommendations to halt and possibly reverse the decline of Elf Owls in California.

STUDY AREA AND METHODS

We selected the survey sites by using four sources of information: sites identified by Cardiff (1978, 1980), sites identified by the California Department of Fish and Game, sites identified by other field biologists, and sites identified by us during previous field work along the Colorado River. We identified potential Elf Owl habitat as patches of cottonwoods (*Populus fremontii*), Red Willow (*Salix gooddingii*), Honey Mesquite (*Prosopis juliflora*), Screwbean Mesquite (*Prosopis pubescens*), palo verde (*Cercidium floridum*), and Saguaros old enough to contain nest cavities and extensive enough to provide foraging areas. Also, the patches must experience only limited human disturbance, e.g., little or no use by off-road vehicles (ORV).

We conducted the field surveys between 6 April and 8 May 1987 in all areas with suitable habitat to which we had access. From historical records,

Table 1 Sightings of Elf Owls in California, 1903-1986

Date	Site	Number of individuals	Reference[a]
17 May 1903	Imperial Dam	2	Brown (1904)
23 April 1910	Imperial Dam	1	Grinnell (1914)
Apr 1915	Bard	2	Kimball (1922)
6 May 1946	Cottonwood Spring	2	Miller (1946)
Apr 1959	Cottonwood Spring	2	AFN 13:401
7 May 1959	Cottonwood Spring	2	AFN 13:401
Summer 1959	Cottonwood Spring	2	AFN 13:456
11 May 1962	Cottonwood Spring	2	G. McCaskie (pers. comm.)
27 Apr 1963	Cottonwood Spring	2	G. McCaskie (pers. comm.)
11 May 1963	Cottonwood Spring	2	G. McCaskie (pers. comm.)
8 Jun 1963	Cottonwood Spring	2	G. McCaskie (pers. comm.)
25 Apr 1964	Cottonwood Spring	2	G. McCaskie (pers. comm.)
Spring 1967	Cottonwood Spring	2	AFN 21:605
13 Apr 1969	Cottonwood Spring	1	AFN 23:626
31 May 1969	Soto Ranch	1	SBCM 4263
7 Apr 1970	Soto Ranch	4	AFN 24:625
18 Apr 1970	Cottonwood Spring	1	G. S. Suffel (pers. comm.)
18 Mar 1972	Corn Spring	1	AB 26:809
May 1972	Corn Spring	2	AB 26:809
23 Jun 1972	Soto Ranch	2	G. McCaskie (pers. comm.)
20 Apr 1973	Desert Center	2	Small (1974)
25 Apr 1975	Corn Spring	1	AB 29:909
10 Apr 1976	Soto Ranch	2 & juveniles	AB 30:892
23 Apr 1976	Corn Spring	1	AB 30:892
25 Apr 1976	Corn Spring	1	AB 30:892
6 Aug 1976	Wiley's Well	2	BLM unpubl. data
Aug 1976	Coon Hollow	2	R. McKernan (pers. comm.)
29 Apr-12 Jun 1977	Soto Ranch	6 & juveniles	AB 31:1190
Apr-Jun 1978	Soto Ranch	10 pairs	Cardiff (1978)
10 Jun 1978	Water Wheel Camp	1	Cardiff (1978)
May-Jun 1979	Soto Ranch	5 pairs	Cardiff (1979)
May-Jun 1979	Water Wheel Camp	1	Cardiff (1979)
12 Apr 1980	Soto Ranch	2	AB 34:897
26 Jun 1982	Soto Ranch	2 & juveniles	AB 36:1016
16 Apr 1983	Soto Ranch	6	AB 37:1028
21 Apr 1983	Water Wheel Camp	1	AB 37:1028
24 Apr 1984	Soto Ranch	1	AB 38:1062
Summer 1985	Soto Ranch	4-6	AB 39:962

[a] AB, *American Birds;* AFN, *Audubon Field Notes;* SBCM, San Bernardino County Museum; BLM, Bureau of Land Management.

we identified this period as the optimum survey time. We surveyed sites between sunset and midnight. During the day we visited the sites to describe and classify habitat quality and structure.

Information gathered for all sites included name, location, survey results, general comments, comments on health and vigor, extent (ha), dates surveyed, and habitat type. On the basis of this information and previously published data on the Elf Owl's habitat preferences (Cardiff 1978, 1979), we ranked sites into four categories of predicted habitat suitability: (1) excellent; (2) good; (3) marginal; and (4) poor (Table 2). We ranked the sites on the basis of habitat data collected on the sites before the Elf Owl surveys were conducted.

All areas except two were surveyed once, and most areas of good or excellent habitat were surveyed twice, as were several of the areas of marginal or poor habitat. We did not conduct nocturnal surveys at two areas of extremely poor habitat. Repeat surveys were conducted 2-3 weeks after the inital surveys.

We conducted surveys by automobile, foot, and boat. Nocturnal surveys consisted of stopping every 50-100 m at the sites and listening for Elf Owls. If few or no Elf Owls were heard, we played a tape of a male Elf Owl's territorial call to stimulate a response. The taped call was played 5-10 times with 1-minute pauses between calls at each station. We could hear the taped call 160 m away. We mapped the responses on U.S.G.S. 7½-minute topographic maps. At many sites two researchers "leap-frogged," working 100 m apart with one or both playing tape-recorded calls.

Fifty-two sites were surveyed during this study; 31 were checked twice. Sites were numbered sequentially from north to south (Figure 1).

RESULTS

We located 15 to 25 Elf Owls at 10 sites. The 42 sites at which Elf Owls were not found are listed in Appendix 1. The information on the individual sites is arranged by site name, location, survey results and discussion, habitat description, extent, dates surveyed, comments, and habitat quality rating.

(5) Soto Ranch, 12 km N of Needles, One to three Elf Owls at 2 locations on the first visit and 2-4 Elf Owls at 3 new locations on the second visit. This represents a total of 5-7 Elf Owls at 5 sites, resulting in an estimated population of 5 pairs. Mature mesquite bosque with a few cottonwood snags; 64 ha; 13 and 29 April 1987; excellent quality. This population has apparently remained stable since 1979. Soto Ranch contains the most extensive tract of mesquite bosque along the Colorado River in California. The removal in 1986 of 0.5 ha of bosque that included several large cottonwood snags indicates that the habitat is in danger as the landowner clears additional farmland.

(11) Head of Clear Bay, 7 km N of Havasu Landing. One Elf Owl possibly heard on the first visit. Mixed-age tamarisk-mesquite-palo verde; 2 ha; 16 April and 2 May 1987; light ORV use; good quality. This small patch of high-quality habitat is relatively undisturbed. It is probably too small to support more than one breeding pair, and the bird possibly heard there may have been a migrant.

Table 2 Variables for Ranking Habitats Surveyed for Elf Owls along the Lower Colorado River during 1987

Habitat variable	Habitat quality category			
	Excellent	Good	Marginal	Poor
Extent of habitat (ha)	>8	2-8	0.5-2	<0.5
Type of habitat	Mature cottonwood-willow-mesquite	Cottonwood-willow willow-mesquite palo-verde	Young cottonwood-willow-mesquite	Small patches of trees
Extent of closed-canopy habitat (ha)	2	>1	None	None
Number of potential nest sites	>10	2-10	1-2	0-1
Extent of area free of human disturbance (ha)	>2 1-2	<1	Near 0	
Severity of human disturbance	Infrequent human presence	Intermittent human presence	Intermittent ORV use	Constant ORV use
Presence of tamarisk	<50%	<50-75%	>75%	Near 100%

(13) Mouth of Chemehuevi Wash, 1 km S of Havasu Landing. One Elf Owl was possibly heard on the first visit; we were too far from the response to identify it positively. Scattered mature mesquite-tamarisk-palo verde; 8 ha; 16 April and 1 May 1987; heavy ORV use; good quality.

(15) Desilt Wash, 2 km SW of Parker Dam. One Elf Owl may have been heard on the second visit; noise from Desilt Creek made positive identifica-

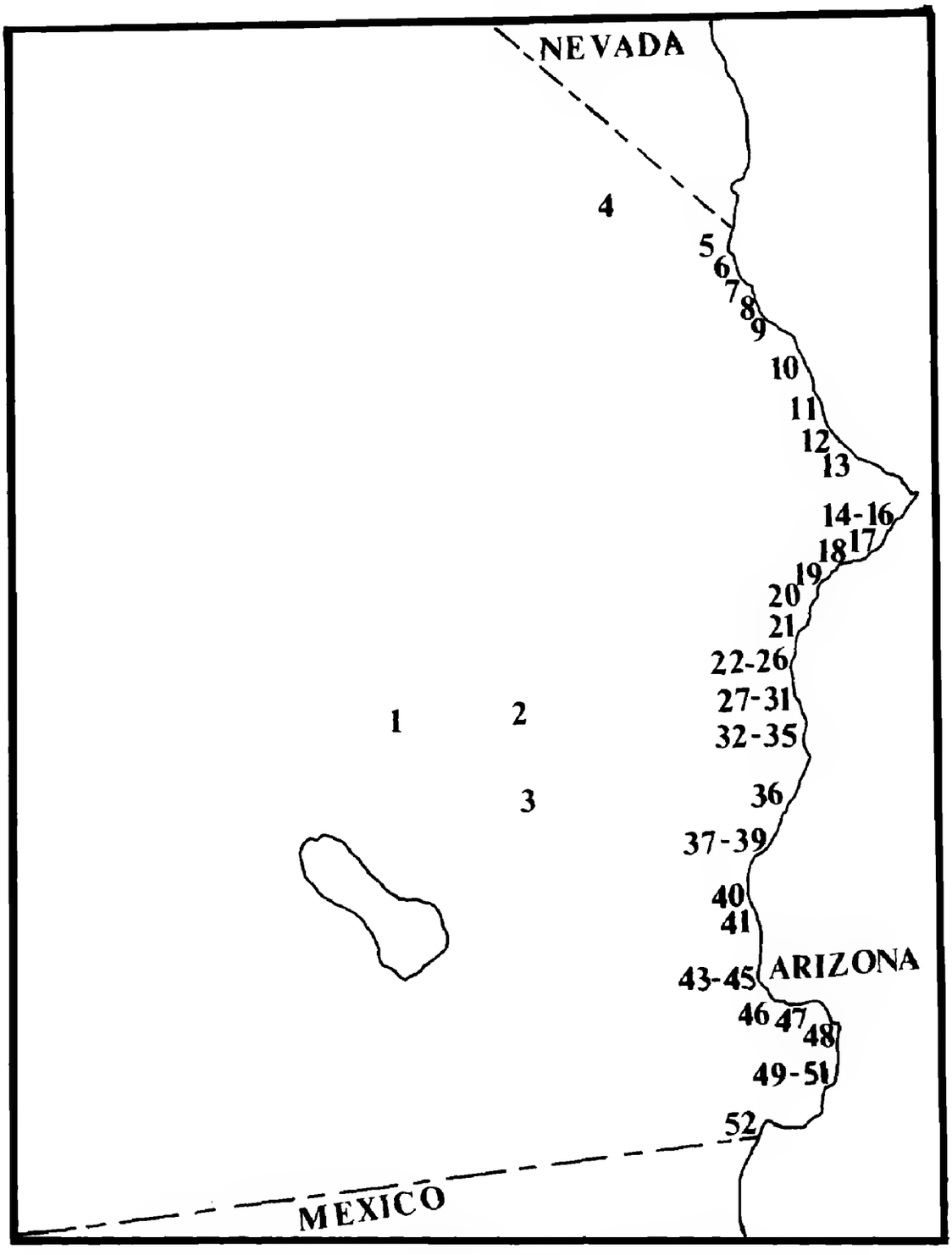


Figure 1. Lower Colorado River study area, showing sites surveyed for Elf Owls in 1987. Numbers correspond to those used in text and appendix.

tion difficult. This impressive but small stand of cottonwoods could be cleared; mature patches of cottonwood-willow; 2-4 ha; 12 and 28 April 1987; good quality.

(18) Headgate Rock Dam, 2.5 km ENE of Earp. Two Elf Owls seen and heard on the first visit. Patchy mature mesquite-tamarisk-cottonwood-willow; 3-4 ha; 12 and 28 April 1987; heavy human disturbance; good quality. There are several potential nest trees. While clearing is unlikely, use by man is inhibiting natural regeneration in the area. Much of this habitat is in scattered clumps and experiences heavy human disturbance. These birds may represent a nesting pair even though they did not respond on our second visit.

(20) Wilson Road, 2 km E of Highway 95. One Elf Owl was heard on the first visit, and two responded on the second visit. Scattered patches of mature mesquite-palo verde; 15 ha; 11 and 26 April 1987; good quality. There appears to be little to distinguish this site from many other similar areas where we did not detect Elf Owls. There is minimal human disturbance at this site, but there is a possibility that agriculture or ORV use may threaten the area.

(26) South end of Water Wheel Camp, 21 km N of Blythe. Two to five Elf Owls on the first visit representing 2-3 pairs. Large, dense, and undisturbed patches of mature tamarisk-mesquite, 60% tamarisk; 130 ha; 11 and 25 April 1987; good quality. Several roads run through the area and they are probably used by ORVs and dove hunters. This area is surrounded by agriculture and could be cleared for that purpose.

(29) Aha Quin trailer park, S end of Hall Island, 18 km N of Blythe. Two Elf Owls, representing 1-2 pairs, responded to the tape on the second visit; there are numerous nest sites. Scattered patches of dense, mature cottonwood-willow with tamarisk-willow-mesquite understory; 8 ha; 10 and 24 April 1987; good quality. Approximately 4 ha in the middle has been cleared for an airstrip, and new ORV trails are being bulldozed. This patch of habitat is in need of protection through either a management agreement or purchase.

(36) Goose Flats, backwater 3 km downstream from I-10 freeway bridge. One Elf Owl heard on the first visit was probably a migrant; there are large cottonwoods in this area, but they are widely scattered and separated by much open ground. Patchy cottonwood-willow; 96 ha; 70% tamarisk, 3% cottonwood, 2% willow; 8 and 22 April 1987; marginal quality. Most of the trees were killed by fires and floods in the early 1980s. We feel that the openess of the habitat made it inadequate for breeding.

(41) Walter's Camp, 0.5 km S of Three-finger Lake. Three Elf Owls were heard on the first visit. Mature mesquite-tamarisk-palo verde; 65 ha; 9 and 21 April 1987; heavy ORV use; good quality. This area has large tracts of mesquite interspersed with more open areas of palo verde. More habitat could be cleared for expansion of nearby trailer parks. There are many potential nest trees. We believe that the site is adequate for breeding.

We estimated a total population of 10-17 pairs from the results of the survey. Elf Owls were probably breeding at five locations and may have been breeding at four additional locations. Three of the probable and four of the possible breeding sites were at locations where Elf Owls had not previously

been found. A few more pairs may breed at some of the good or better sites where we surveyed and did not find Elf Owls.

Only one of the 42 sites where we did not detect Elf Owls was in the excellent habitat suitability category. This site, number 43, at the mouth of Julian Wash, consisted of 65 ha of mesquite, tamarisk, ironwood, and palo verde closed to ORVs. There appeared to be sufficient nest sites to accommodate several pairs of Elf Owls. Unfortunately, because of difficult access we were only able to survey this site once, which may explain why no Elf Owls were detected.

Seventeen sites where we did not detect Elf Owls were in the good habitat suitability category. Many of these sites were not extensive enough or were too patchy to be considered excellent.

The marginal habitats are mostly small remnants of higher-grade habitats. Many of these areas have been degraded through habitat loss from flooding, clearing for agriculture, and the establishment of tamarisk.

We found no Elf Owls in poor habitats. These usually consisted of tamarisk patches or areas with only a few cottonwoods in trailer parks.

The proportion of sites at which Elf Owls were found declined with habitat quality. Elf Owls were found at 50% of the excellent sites, 32% of the good sites, 8% of the marginal sites, and none of the poor sites (Table 3).

DISCUSSION

Why did we not find Elf Owls in many areas of good to excellent habitat? Possibly our criteria for habitat ranking are incorrect or oversimplified. Factors that we did not recognize or measure may have been important in determining occupancy. Factors other than habitat suitability may be limiting the population: the population of Elf Owls in California is so low and most sites are so small that stochastic events may prevent the owls from occupying all suitable sites every year. This could be tested by multi-year studies to determine occupancy of sites over a series of years. Elf Owls may ingest persistent pesticides, such as DDT, on their wintering grounds, resulting in eggshell thinning and reduced reproduction and keeping the population below the carrying capacity of the habitat. Collection and measurement of eggshell fragments could help answer this question.

Table 3 Site Habitat Quality and Elf Owl Occupancy along the Lower Colorado River in 1987

Habitat quality	Occupied by Elf Owls	No Elf Owls found
Excellent	1	1
Good	8	17
Marginal	1	11
Poor	0	11
Total	10	40[a]

[a] Two additional sites of poor quality were not surveyed at night because of poor access.

Until the factors controlling the California Elf Owl population are understood, the first step toward protecting the species must be habitat protection. All nine sites where Elf Owls were located and may breed are in some danger of destruction from flooding, clearing for agriculture or development, or disturbance by ORVs. Almost all of these sites could be protected by management agreements, conservation easements, or fee title purchase by state or federal agencies or conservation organizations. Preservation of the fragments of existing habitat probably will not be enough to prevent the extirpation of the species from California; ultimately there must be efforts to restore suitable habitats by removing tamarisk, reforesting with mesquite, cottonwoods, and willows, and excluding disturbing activities. Many other endangered species of this devasted river system will also benefit from these measures. Only by such means will the numbers of Elf Owls currently in California increase. Without this management it seems unlikely that the Elf Owl, and many other species dependent on the Colorado River ecosystem, will be able to maintain their tenuous foothold in California.

ACKNOWLEDGMENTS

This study was supported by the California Department of Fish and Game Contract No. C-1981. Bertin W. Anderson, William C. Hunter, and Brian Walton provided information on potential Elf Owl habitat. Patty Young of California Department of Fish and Game in Blythe provided logistical support. Jeannie Anderson provided housing while we were in Blythe. Gordon Gould of the California Department of Fish and Game provided information on historical Elf Owl locations and optimum timing of surveys and supervised the contract. Thanks to Sallie Hejl, Phillip Lefever, and Karen Seaman for assistance in the field.

LITERATURE CITED

Brown, H. 1904. The Elf Owl in California. Condor 6:45-47.

Cardiff, S. W. 1978. Status of the Elf Owl in California. California Dept. Fish and Game. Job Progress Rep., Project W-54-R-10, Job III-10.

Cardiff, S. W. 1979. Status and distribution of Elf Owls in California. State of California, Dept. Fish and Game. Admin. Rep., Project E-W-3, Job IV-1.0 (January 1980).

Grinnell, J. 1914. An account of the mammals and birds of the Lower Colorado River Valley. Univ. Calif. Publ. Zool. 12:129.

Grinnell, J., and Miller, A. H. 1944. The distribution of the birds of California. Pac. Coast Avifauna 27.

Kimball, H. H. 1922. Bird records from California, Arizona, and Guadalupe Island. Condor 24:96.

Laymon, S. A., and Halterman, M. D. 1987. Can the western subspecies of the Yellow-billed Cuckoo be saved from extinction? W. Birds 18:19-25.

Miller, L. 1946. The Elf Owl moves west. Condor 48:284-285.

Small, A. 1974. Western bird photographers. W. Birds 5:101-110.

Accepted 5 July 1989

APPENDIX 1. Survey sites where Elf Owls were not detected along the Colorado River during 1987. Numbers refer to localities numbered in Figure 1.

(1) Cottonwood and Cotton Springs, Joshua Tree National Monument; approximately 10 mature cottonwoods; 0.2 ha; 5 April and 8 May 1987; poor quality.

(2) Ironwood-palo verde area 5 kn N of Desert Center; scattered, mature ironwood-palo verde; 120 ha; 8 May 1987; poor quality.

(3) Corn Springs, 12 km SW of Desert Center; palm oasis, approximately 100 fan palms (*Washington filifera*); 0.2 ha; BLM has placed nest boxes; 6 April 1987; poor quality.

(4) Fort Piute Wash-Piute Spring; scattered mature cottonwood-willow; 2 ha; a riparian strip 15-50 m wide and 2.5 km long; 14 April 1987; good quality.

(6) Fort Mojave Indian Reservation; a narrow strip of habitat along the Colorado River approximately 9 km N of Needles; scattered mixed-age tamarisk-mesquite; 24 ha; 13 April 1987; poor quality.

(7) Mouth of Piute Wash, 7 km N of Needles; scattered uneven-aged mesquite-tamarisk-palo verde; 24 ha; snags present; 13 and 30 April 1987; good quality.

(8) Needles sewage disposal site; scattered young willow-tamarisk with some mesquite; 16 ha; 15 and 30 April 1987; marginal quality.

(9) Beal Lake in Topock Marsh; mixed, occasionally dense, tamarisk-willow-mesquite; 64 ha; 15 and 30 April 1987; good quality.

(10) Topock Gorge; uneven-aged tamarisk-mesquite-palo verde; 8 ha at 10 sites; 90% tamarisk; 1 May 1987; not surveyed because of poor access; marginal quality.

(12) Catfish Bay, 3 km N of Havasu Landing; scattered uneven-aged tamarisk-mesquite-palo verde; 1.5 ha; 1 May 1987; marginal quality.

(14) Saguaros in the Whipple Mountains, 7 km WNW of Parker Dam; 20 mature Saguaros along 5 km of road, with one 2-ha clump of 8 Saguaros; 28 April 1987; some Saguaros have been damaged; poor quality.

(16) Copper Basin Wash; mature patchy mesquite-palo verde-tamarisk; 3 ha; 12 and 28 April 1987; moderate ORV use; marginal quality.

(17) Mouth of Bennett Wash, along Parker strip; scattered mesquite-tamarisk; 1 ha; 12 and 27 April 1987; marginal quality.

(19) Vidal Wash, 12 km S of Parker; dense, mixed-age mesquite-tamarisk; 6 ha; there are a few cottonwoods and willows; 11 and 26 April 1987; good quality.

(21) Mesquite area N of Lost Lake Trailer Park; dense, mixed-age mesquite-tamarisk; 16 ha; several roads bisect site; 6 May 1987; good quality.

(22) Lost Lake Resort, 20 km S of Parker; trailer park with many planted cottonwoods; 8 ha; 11 and 26 April 1987; marginal quality.

(23) Burned area 2 km S of Lost Lake Resort, E of Highway 95; extensive tamarisk with mesquite and tamarisk snags; 125 ha; 11 and 26 April 1987; area burned in 1985 in preparation for agricultural clearing; poor quality.

(24) North end of Water Wheel Camp, 22 km N of Blythe; 4 small clumps of mature cottonwoods surrounded by agricultural fields; minimal understory; 11 and 25 April 1987; poor quality.

(25) Cottonwoods at south end of Water Wheel Camp; 10 large cottonwoods; 6 May 1987; marginal quality.

(27) Shaggy Tree trailer park, 19 km N of Blythe; several large cottonwoods and mesquites; 11 April 1987; poor quality.

(28) Red Rooster trailer park, 19 km N of Blythe; 20 mature cottonwoods; unsuitable for owls because of human disturbance; 11 April 1987; poor quality.

(30) Twin Palms Camp, 14 km N of Blythe; 20 mature cottonwoods, 5 mature willows; 10 April 1987; poor quality.

(31) 3 km N of Blythe Boat Club; young cottonwood-willow; 8 ha; and scattered patches of tamarisk-mesquite-willow; 26 ha; 10 and 24 April 1987; the habitat could be cleared; good quality.

(32) Mayflower County Park, 9 km N of Blythe; mature Honey Mesquite; 6 ha; no understory (campground), all dead branches removed; 11 and 23 April 1987; marginal quality.

(33) 200 m S of 6th Avenue Trailer Park; young, dense tamarisk-mesquite, 75% mesquite; 4 ha; 7 and 23 April, 1987; marginal quality.

(34) 2 km W of 6th Avenue Trailer Park; dense, old Honey Mesquite-*Baccharis*; 16 ha; 7 and 23 April, 1987; good quality.

(35) Big Hole, 5 km NE of Blythe; scattered, mature cottonwood-willow-mesquite, 40 ha; cottonwoods in narrow strips; young cottonwood-mesquite; 40 ha; marshy; 7 and 23 April, 1987; marginal quality.

(37) 1 km N of McIntire County Park; mature cottonwood-willow; 60 cottonwoods in a 1-km strip; 8 and 22 April, 1987; marginal quality.

(38) H. Miller County Park, 18 km S of Blythe; scattered tamarisk-cottonwood-willow; 0.5 ha; 9 April, 1987; poor quality.

(39) Arizona State University revegetation site, 11 km S of Palo Verde; planted in 1979, park-like cottonwood-willow; 16 ha; 9 and 21 April, 1987; good quality.

(40) 2 km W of Walter's Camp, Cibola National Wildlife Refuge; scattered palo verde-mesquite-smoke tree; 190 ha; 21 April, 1987; good quality.

(42) Across from Lighthouse Rock; dense, patchy tamarisk-mesquite-palo verde; 4 ha; 5 May 1987; not surveyed at night because of poor access; poor quality.

(43) Mouth of Julian Wash; open ironwood-palo verde; 65 ha; mature, scattered mesquite-tamarisk; 65 ha; 5 May 1987; area closed to ORV use; excellent quality.

(44) Unnamed washes between Julian and Para Washes; scattered mesquite-tamarisk-palo verde; 8 ha; scattered palo verde-ironwood; 8 ha; 5 May 1987; good quality.

(45) Mouth of Para Wash, 5 km N of Picacho State Recreation Area; scattered dense clumps mesquite-tamarisk-palo verde; 8 ha; open ironwood-palo verde-mesquite; 4 ha; 19 April and 3 May 1987; good quality.

(46) Taylor Lake and White Wash and Picacho State Recreation Area; dense tamarisk-palo verde-mesquite; 4 ha; 19 April and 3 May 1987; good quality.

(47) Main campground, Picacho State Recreation Area; open with clumps of palo-verde-mesquite-tamarisk; 4 ha; 19 April and 3 May 1987; good quality.

(48) Between Imperial and Laguna dams; occasionally dense tamarisk-mesquite-palo verde; 230 ha; mostly tamarisk, there is also one 2-ha patch of mature willow-cottonwood-tamarisk; 18 April and 2 May 1987; good quality.

(49) Along the All-American Canal; 11 km NE of Yuma; patchy tamarisk-mesquite-palo verde; 24 ha; interspersed with roads and agricultural patches; 17 April and 4 May 1987; good quality.

(50) Along the All-American Canal; 12 km NE of Yuma; mature cottonwood-willow-tamarisk; 2 ha; 17 April, 2 and 4 May 1987; good quality.

(51) Along the All-American Canal, 2 km N of Picacho State Recreation Area turn-off; occasionally dense palo verde-mesquite-tamarisk; 64 ha; tamarisk-palo verde-mesquite; 64 ha; 20 April 1987; area not revisited; good quality.

(52) Araz Wash, 5 km W of Winterhaven; young palo verde-mesquite-tamarisk; 2 ha; dense mesquite-palo verde; 1 ha; 20 April, 1987; marginal quality.

The following article is the fifth in a series on California rarities edited by Morlan and Roberson. It is based on materials submitted to the California Bird Records Committee (CBRC). The description and circumstances were drawn from the accounts of the observer and have been reviewed by him. Roberson prepared the distributional summary; Morlan prepared the identification summary. In this way we hope much important information accumulated in CBRC files will become widely available.

White-winged Crossbills *Sketch by Tim Manolis*

FIRST RECORD OF THE WHITE-WINGED CROSSBILL IN CALIFORNIA

PHIL GORDON, 4634 Mira Loma, Castro Valley, California 92546
JOSEPH MORLAN, 417 Talbot Ave., Albany, California 94706
DON ROBERSON, 282 Grove Acre Ave., Pacific Grove, California 93950

In the afternoon of 1 September 1978, Phil Gordon and his son Geoffrey were fishing near their camp at Mosquito Lake in the Salmon-Trinity Alps Wilderness Area, Trinity County, California. This area is at an elevation of 6600 feet (2010 m), about 7 miles west of the Scott Mountain summit on county highway 3. The 20-acre lake is in a small glacial cirque basin below a crest that divides Siskiyou and Trinity counties. It is surrounded by scattered Ponderosa *Pinus ponderosa* and Western White *P. monticola* pines, Red Fir *Abies magnifica,* Incense Cedar *Libocedrus decurrens,* and Mountain Hemlock *Tsuga mertensiana.* A canary-like twittering drew the Gordons' attention to a flock of finches perched quietly, seemingly feeding in the top of a fir. The birds then flew one by one to another fir 70 to 80 feet away. The Gordons watched the flock of 12 birds several times that afternoon. The birds moved restlessly from branch to branch, sometimes at distances of several hundred yards, but once they came as close as 75 to 80 feet. Although the birds stayed mostly in the tops of the firs, they descended to within 15 feet of the ground on one occasion. Viewing conditions were poor and backlit at first, but later the birds allowed a fairly close study for 4 or 5 minutes.

The birds seemed to be crossbills, but the tight twitter or trill of three or four phrases at different pitches was unlike the calls of Red Crossbills *Loxia cur-*

virostra that Gordon knew from the Sierra Nevada. With better views, two white wingbars became conspicuous, and Pine Siskins *Carduelis pinus* and Pine Grosbeaks *Pinicola enucleator* became considerations. However, the three red birds in the flock ruled out siskins, and the small size and slender long bill eliminated the Pine Grosbeak. Gordon identified them as White-winged Crossbills *Loxia leucoptera*.

When Gordon and his son returned home from the camping trip three days later, they wrote descriptions on the CBRC's report form. Gordon wrote short, succinct notes, which he has expanded into sentences as follows:

> These were small finches the size of a sparrow or of a House Finch *Carpodacus mexicanus* but seemed chunkier than a House Finch. The tail was short with a deep notch. Three birds were reddish on the head, neck, throat, breast and sides; the other nine were overall greenish gray. The lower belly and sides of the birds, especially the greenish ones, were streaked with dark. The darkish wings of both forms showed two bright white wingbars, which were unmistakable on all of the birds.
>
> The lighting and position (perched on upper surface of branches) made observation of the "crossed bill" difficult. One male had a thin, down-curved upper mandible projecting beyond the lower mandible, but I did not see it cross. Otherwise the bill was small and conical. The exact bill color was not noted but seemed to be medium dark.

Geoffrey Gordon's notes were briefer:

> Males were bright red with black wings. Females were greenish with no outstanding characters. Each had a white wingbar with a smaller wingbar above that was almost reduced to a white dot.

Both observers drew rough sketches showing the location of wingbars and basic bill shape (rather long and thin); Geoffrey's sketch emphasized the reduced extent of the upper wingbar.

This record of the White-winged Crossbill was unanimously accepted as a first for California by the CBRC after three circulations (Luther et al. 1983). In early circulation, a dissenter raised the possibility of Pine Grosbeaks, noting that this species has a disproportionately small bill with a downcurved culmen and behaves much in the way these birds were described (feeding slowly at the tips of branches, then moving one by one to the next tree). Furthermore, the "bright red" or "reddish" color seemed to be less pink than some members expected, and the birds were seen mostly at substantial distances. In the end, though, even the dissenter voted to accept, persuaded by the birds' small size (about that of House Finch, but chunkier), the reduced upper wingbar, and especially by the streaking on the lower belly. Some members noted that the twittering calls were appropriate for the White-winged Crossbill and pointed out that the species had occurred in numbers in British Columbia and Washington (outside of its usual haunts) in the summer and fall of 1978 (but little into Oregon; see more under "Distributional Summary"). One noted that Godfrey (1966) described the color of males as "bright scarlet or vermilion in summer, dull and pinkish in winter." Also persuasive was Gordon's prior experience with the Pine Grosbeak, which has never occurred in northwestern California. The Pine Grosbeak in California is a sedentary resident in the Sierra Nevada. Richard A. Erickson visited Mosquito Lake ten days later but was unsuccessful in finding any crossbills.

DISTRIBUTIONAL SUMMARY

The White-winged Crossbill is a Holarctic species of boreal forests, particularly spruce, fir, or larch (A.O.U. 1983). In North America it ranges from western Alaska to Labrador and south in the Cascades to Washington, in the Rockies to Wyoming (and irregularly to northern Utah, central Colorado, and northern New Mexico), and in the East to Maine (A.O.U. 1983; Figure 1). It often winters within its breeding range but is irruptive following cone crop failures (Bock and Lepthien 1976). During such invasions it has occurred as far south as Nevada, New Mexico, Texas, and Florida (DeSante and Pyle 1986), where it feeds on cones of other trees and the fruit of the Sweetgum *Liquidambar styraciflua* (George 1968). In October 1971, two rode a trans-Atlantic passenger ship from Newfoundland to Ireland (Abramson 1974). Irruptions in the Northwest can be impressive. Jewett et al. (1953) wrote of a "remarkable incursion" during the winter of 1908-09 throughout the Puget Sound area of Washington. Prior to 1940, however, the species was known in Oregon only from two specimens collected 12 July 1938 on the upper

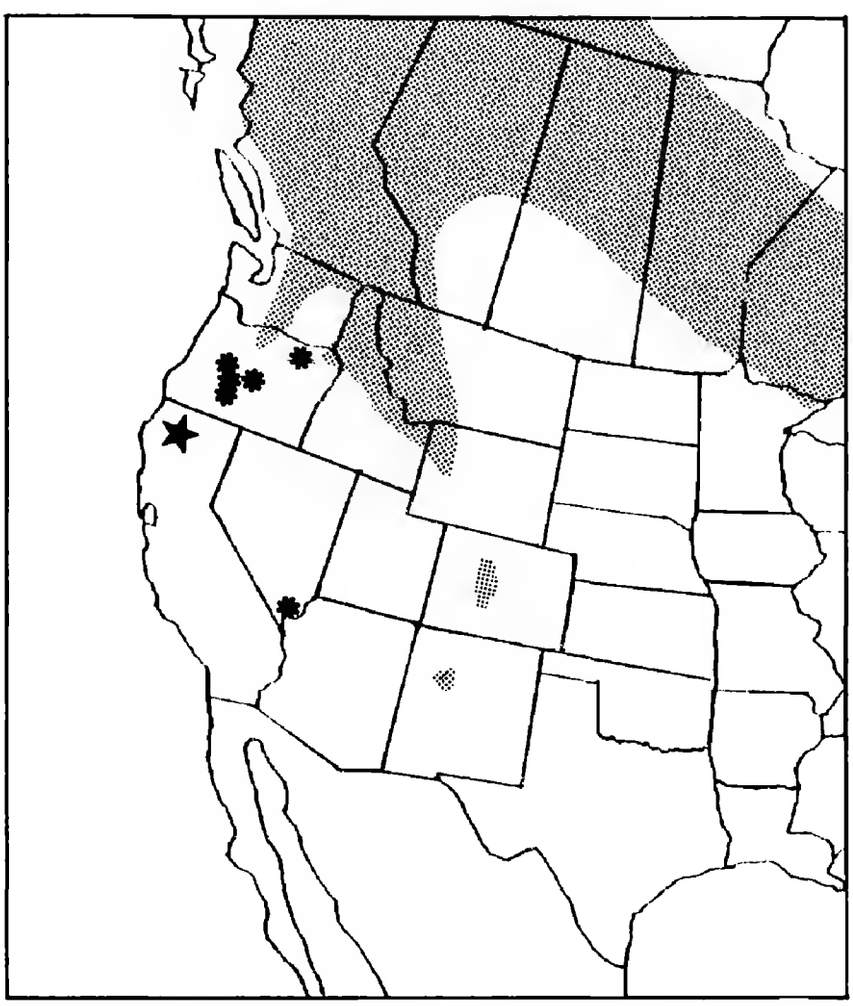


Figure 1. Approximate breeding range of the White-winged Crossbill in western North America (shaded), with extralimital records mentioned in the text (asterisks), and location of this record (star).

Lostine River, Wallowa County, and a 19th-century sight record in Washington County (Gabrielson and Jewett 1940).

More recent irruptions in the Casades north of California occurred in 1974, 1978, 1981, and 1985. These typically began during late July, and flocks often spread south or toward the coast during the fall, usually tapering off by mid-October. The 1974 movement was largely limited to the mountains of southern British Columbia and Washington (Crowell and Nehls 1975), with a lone Oregon occurrence at La Grande in the northeast (Rogers 1975). In 1978, the year of the California sighting, the species "appeared abruptly and in large numbers" throughout the Washington Cascades and Olympic Mountains in August (Harrington-Tweit et al. 1978) and continued as a "great surge" through the Casades to Mt. Hood, Oregon, with one as far south as Bend, Deschutes County, in central Oregon, on 24 November (Rogers 1979). In 1981, an irruption sent birds south during early September to Gold and Waldo lakes, Lane County, in the Oregonian central Cascades (Hunn and Mattocks 1982). In the summer of 1984, an irruption in the Great Basin resulted in a record for Las Vegas, Nevada, the second for that state (Kingery 1984). However, the most impressive movements occurred in 1985, when an August-September incursion brought flocks of up to 60 birds south in the central Cascades to high elevations in Lane, Douglas, Deschutes, and northwestern Klamath counties (Summers 1986, Hunn and Mattocks 1986). These sites are only about 100 miles north of the California border. Each recent irruption has seemingly sent flocks farther south than previously (though this might be a function of increased observer coverage). The species should again be looked for in northern California, especially at higher elevations during the late summer and fall of the next irruption.

SUBSPECIES

In contrast to the Red Crossbill, which exhibits an enormous amount of geographic variation and may consist of several cryptic species (Groth 1988), the White-winged Crossbill exhibits very little variation. Only three subspecies have been described (Howell et al. 1968). *L. l. leucoptera,* breeding in North America, is smaller and smaller-billed than *L. l. bifasciata* of Eurasia (Witherby et al. 1943). North American birds have been reported from Europe and recently from extreme eastern Siberia (Tomkovich and Sorokin 1983), but Eurasian birds have not been reported in North America. A third, larger-billed subspecies, *L. l. megaplaga* (Riley 1916), is confined to the island of Hispaniola, where nesting was confirmed in 1971 (Kepler et al. 1975). On geographic grounds, the California birds may be presumed to have been *L. l. leucoptera,* although the described small bill also suggests this race.

IDENTIFICATION SUMMARY

Although the Pine Grosbeak is substantially larger than any crossbill, size may be difficult to judge without direct comparison. Furthermore, the California population of the Pine Grosbeak, *P. e. californica,* which is resident in the Red Fir belt of the Sierra Nevada, averages smaller and its bill is shallower and narrower than in all other races (Adkisson 1977). Pine Grosbeaks never show

streaking on the underparts, characteristic of female and immature White-winged Crossbills. Even adult male White-winged Crossbills usually show blurry but fairly distinct streaking on their flanks.

White-winged Crossbills can be identified by their distinct flight calls (Adkisson 1980). Russell (1976) described two distinct flight notes: "a nasal, querulous *cheit-cheit-cheit* (not at all sweet), and a very dry, rapid *chut-chut-chut,*" like a fast redpoll chatter, very different from the well-spaced flight calls of the Red Crossbill, whose vocalizations vary depending on the populations involved (Groth 1988, pers. comm.). The chatter call of the White-winged is common in flying birds and diagnostic.

Russell (1976) also pointed out that the shapes of the two crossbills are different, with the heavier bill and larger head of the Red Crossbill imparting a "front-heavy" appearance. The White-winged Crossbill is more slender and has a longer tail, producing a shape similar to that of the Purple Finch *Carpodacus purpureus*. This difference may not be as obvious, however, in the small-billed subspecies of the Red Crossbill.

Occasionally, Red Crossbills may show conspicuous white wing bars. This variation seems to be most frequent in immatures and especially in males. The Red Crossbill can be identical in color to the White-winged Crossbill, and both can show prominent whitish tertial edgings (van den Berg and Blankert 1980). In Europe, Berthold and Schlenker (1982) found prominent pale wing bars on one or two Red Crossbills of every thousand examined. Phillips (1977) suggested that this condition may be more frequent in European Red Crossbills. In American Red Crossbill specimens, Phillips found broad wing bars only on juvenal feathers, and also found them particularly rare among the smaller subspecies of the Red Crossbill, which are the ones most likely to be confused with the White-winged Crossbill. Such Red Crossbills have narrower (less than 2.5 mm), less defined wing bars (Pyle et al. 1987, Svensson 1984). The stronger definition of the wing bars on the White-winged Crossbill arises, in part, from the much blacker ground color of its wing coverts. The White-winged Crossbill also has blacker scapulars, tail, and uppertail coverts than does the Red Crossbill, and adult males usually show a more obvious black band across the lower back.

Occasionally, crossed bills may be seen on other species as a deformity. Tallman and Zusi (1984) described an apparent hybrid between a Red Crossbill and a Pine Siskin that had some field characters of the White-winged Crossbill, including streaked underparts and wing bars. The latter were quite faint and narrower than in the siskin, the mandibles were not crossed, and the uppertail coverts were olive, not blackish as in the White-winged Crossbill.

ACKNOWLEDGMENTS

We thank CBRC members David DeSante, Benjamin D. Parmeter, Arnold Small, Paul Lehman, R. A. Erickson, Kimball Garrett, Jon Dunn, Phil Unitt, Guy McCaskie, H. Lee Jones, L. C. Binford, and John Luther for their comments in evaluating this record. Stephen F. Bailey provided Morlan's access to specimens at the California Academy of Sciences. Jeff Groth reviewed an earlier version of this note and provided useful comments. Tim Manolis graciously drew the headnote sketch.

LITERATURE CITED

Abramson, I. J. 1974. Three records of interest. Am. Birds 28:881-882.

Adkisson, C. S. 1977. Morphological variation in North American Pine Grosbeaks. Wilson Bull. 89:380-395.

Adkisson, C. S. 1980. Specific distinctiveness in the vocal repertories of North American crossbills (*Loxia*). Proc. Int. Ornithol. Congr. 17:1348.

American Ornithologists' Union. 1983. Check-List of North American Birds. 6th ed. A.O.U., Washington, D.C.

Berthold, P., and Schlenker, R. 1982. Crossbills with pale wing-bars: A brief review. Dutch Birding 4:100-102.

Bock, C. E., and Lepthien, L. W. 1976. Synchronous eruptions of boreal seed-eating birds. Am. Nat. 110:559-571.

Crowell, J. B. Jr., and Nehls, H. 1975. The fall migration: Northern Pacific Coast region. Am. Birds 29:105-112.

DeSante, D., and Pyle, P. 1986. Distributional Checklist of North American Birds. Vol. 1. Artemisia Press, Lee Vining, CA.

Gabrielson, I.N., and Jewett, S. G. 1940. Birds of Oregon. Oregon State College, Corvallis.

George, W. G. 1968. The association of invading White-winged Crossbills with a southern tree. Wilson Bull. 80:496-497.

Godfrey, W. E. 1966. The Birds of Canada. Natl. Mus. Canada Bull. 203.

Groth, J. G. 1988. Resolution of cryptic species in Appalachian Red Crossbills. Condor 90:745-760.

Harrington-Tweit, B., Mattocks, P. W. Jr., and Hunn, E. S. 1978. The breeding season: Northern Pacific Coast region. Am. Birds 32:1199-1203.

Howell, T. R., Paynter, R. A. Jr., and Rand, A. L. 1968. Carduelinae, in Check-List of Birds of the World, Vol. 14 (R. A. Paynter, Jr., ed.), pp. 207-306. Mus. Comp. Zool., Cambridge, MA.

Hunn, E. S., and Mattocks, P. W. Jr. 1982. The autumn migration: Northern Pacific Coast region. Am. Birds 36:208-211.

Hunn, E. S., and Mattocks, P. W., Jr. 1986. The autumn migration: Northern Pacific Coast region. Am. Birds 40:321-324.

Jewett, S. A., Taylor, W. P., Shaw, W. T., and Aldrich, J. W. 1953. Birds of Washington State. Univ. of Washington, Seattle.

Kepler, A. K., Kepler, C. B., and Dod, A. 1975. First nest record of the White-winged Crossbill in Hispaniola. Condor 77:220-221.

Kingery, H. E. 1984. The nesting season: Mountain West region. Am. Birds 38:1004-1047.

Luther, J., McCaskie, G., and Dunn, J. 1983. Fifth report of the California Bird Records Committee. W. Birds 14:1-16.

Phillips, A. R. 1977. Sex and age determination of the Red Crossbill (*Loxia curvirostra*). Bird-Banding 48:110-117.

Pyle, P., Howell, S. N. G., Yunick, R. P., and DeSante, D. F. 1987. Identification Guide to North American Passerines. Slate Creek Press, Bolinas, CA.

Riley, J. H. 1916. Three remarkable new species of birds from Santo Domingo. Smithsonian Misc. Coll. 66(15):1-2.

Rogers, T. H. 1975. The fall migration: Northern Rocky Mountain-Intermountain region. Am. Birds 29:89-93.

Rogers, T. H. 1979. The autumn migration: Northern Rocky Mountain-Intermountain region. Am. Birds 33:196-199.

Russell, W. 1976. Field identification notes. Birding 8:92-95.

Summers, S. 1986. Fieldnotes: eastern Oregon, August-November 1985. Ore. Birds 12:129-132.

Svensson, L. 1984. Identification Guide to European Passerines. Br. Trust for Ornithol., Tring, England.

Tallman, D. A., and Zusi, R. L. 1984. A hybrid Red Crossbill-Pine Siskin (*Loxia curvirostra* × *Carduelis pinus*) and speculation on the evolution of *Loxia*. Auk. 101:155-158.

Tomkovich, P. S., and Surokin, A. G. 1983. The bird fauna of eastern Chukotka. Moscow Univ. Zool. Muzei Sbornik Trud. 21:77-159 [Russian with English summary].

van den Berg, A. B., and Blankert, J. J. 1980. Crossbills (*Loxia curvirostra*) with prominent double wing-bar. Dutch Birding 2:33-35.

Witherby, H. F., Jourdain, F. C. R., Ticehurst, N. F., and Tucker, B. W. 1943. The Handbook of British Birds. Vol. 1. Witherby, London.

Accepted 5 July 1989

Laysan Albatross and chick, Guadalupe Island

Photo by Eric Lichtwardt

NOTES

NOTES FROM ISLA GUADALUPE

THOMAS A. OBERBAUER, 3739 Oleander, San Diego, California 92106
CATHY CIBIT, P.O. Box 82041, San Diego, California 92138
ERIC LICHTWARDT, P.O. Box 985, National City, California 92050

In March of 1988, we visited Isla Guadalupe, Baja California, for three days. On the 28th, we camped under the Guadalupe Cypress (*Cupressus guadalupensis*) grove in the central highlands of the island and another group camped at the spring in the upper portion of the large crater in the northern part of the island. On the 29th, we visited the pines and palms in the northwestern part of the island. On the 30th, the group landed at the south end of the island. Visitation to the island is restricted by the Mexican government and allowed only with proper permits. A new graded but steep and rugged road extends from the northeast anchorage past the cypress grove and the newly surfaced airstrip to the village near Melpomene Cove at the southern end of the island. Feral goats, cats, and dogs are common. The goats and cats have decimated the biota of the island (Lindsay 1966; Howell and Cade 1954), especially in the northern parts.

The avifauna of Guadalupe Island was summarized by Jehl and Everett (1985). They reviewed all previous reports of the island's birds.

We identified the following species during our visit:

Laysan Albatross (*Diomedea immutabilis*). We observed six Laysan Albatross nests near Melpomene Cove, on the shoulder of the mesa above a weather station. Five nests had half-grown chicks and one contained a single egg. Ten adults were observed flying in the area of the cove. Courtship activities were observed in which birds approached one another and tipped their heads back and then pointed them at the ground in unison. The constant wind of the site facilitates easy take-off and landing for these birds. Pitman (1988) and Dunlap (1988) discussed the range extension of these birds here and to the Alijos Rocks and Isla San Benedicto. The Guadalupe colony was not present in this site when Oberbauer last visited this area in January of 1981.

Storm petrels. We heard calls of storm petrels of unknown identity before dawn at Pilot Rock Beach on the north end of the island.

Xantus Murrelet (*Synthliborampus hypoleucus*). Two pairs of wings were found on the mesa at the south end of the island.

American Kestrel (*Falco sparverius*). One was observed on the ridgetop of Mount Augusta at the north end, another at the south end of the island.

Mourning Dove (*Zenaida macroura*). Several were observed in the upper area of the north end.

Burrowing Owl (*Athene cunicularia*). Reported by a member of the party near the spring near the north end. We found pellets at the south end near an abandoned navigational tower.

Anna's Hummingbird (*Calypte anna*). Three observed in the Tree Tobacco (*Nicotiana glauca*) at lower elevations, north end of the island.

Northern Flicker (*Colaptes auratus*). One observed and heard in cypress forest at the north end. We could not distinguish whether the bird was a migrant from the mainland or the endemic *C. a. rufipileus*, now believed probably to be extinct.

Rock Wren (*Salpinctes obsoletus*). The most common bird on the island, having benefited greatly from denudation by goats. A nest hole was seen in a bank of the northeastern road, and a nest with three eggs was found above the upper end of the pines on the north end of the island.

European Starling (*Sturnus vulgaris*). Three were observed in the cypresses at the north end.

Dark-eyed Junco (*Junco hyemalis*). The Guadalupe race (*J. h. insularis*) is common in the cypress forest and pines. It was not as common at lower elevations as one of us noted in April 1979 and January and May 1981.

House Finch (*Carpodacus mexicanus*). Common from lowest elevations to cypress forest. Vocalizations prevalent and continuous in the cypress forest, especially in the morning.

We looked for Ruby-crowned Kinglets (*Regulus calendula*) in the northern grove of cypress and pines but saw none. The status of the endemic subspecies *R. c. obscurus* is unknown (Jehl and Everett 1985). We listened for nocturnal calls from potentially nesting sea birds in the cypress forest but heard none; however, the cypress forest is large enough that we did not survey it completely.

We thank Captain Eddie McEwen and Margie Stinson of the *Pacific Queen* and Carlos de Alba of the Officina de Pesca, Ensenada for transportation to Isla Gualalupe and arranging for permits to land there. We thank Philip Unitt and William T. Everett for reviewing an early draft of this article.

LITERATURE CITED

Dunlap, E. 1988. Laysan Albatross nesting on Guadalupe Island, Mexico. Am. Birds 42:180-181.

Howell, T. R., and Cade, T. J. 1954. The birds of Guadalupe Island in 1953. Condor 56:283-294.

Jehl, J. R. Jr., and Everett, W. T. 1985. History and status of the avifauna of Isla Guadalupe, Mexico. Trans. San Diego Soc. Nat. Hist. 20:313-336.

Lindsay, G. 1966. Guadalupe Island. Pac. Discovery 19:2-11.

Pitman, R. L. 1988. Laysan Albatross breeding in the eastern Pacific—and a comment. Pac. Seabird Group Bull. 15:52.

Accepted 20 August 1989

SUNBATHING IN THE BROWN CREEPER

CHARLES LECK, Department of Biological Sciences, Rutgers University, P.O. Box 1059, Piscataway, New Jersey 08855-1059

On 22 August 1988 at Henry Cowell Redwoods State Park, Santa Cruz County, California, I observed a Brown Creeper (*Certhia americana*) move into a sunlit portion of a trunk of a Redwood (*Sequoia sempervirens*) and subsequently go through a sunbathing sequence. During this period the creeper spread its wings and tail, maximizing exposure to the bright sunbeam (Figure 1). Previously the bird had been foraging on well-shaded areas of the trees; when sunbathing it frequently kept its eyes closed as if it had difficulty adapting to the intensity of the direct sunlight. After a few minutes of sunbathing it did some preening, and then resumed foraging on trunks nearby.

Sunbathing of this species has not been previously reported according to a worldwide review (Kennedy 1969). A summary of this type of maintenance behavior (Mueller 1972) mentions temperature regulation (i.e., heat conservation) as one of its important functions. It is well known that the Brown Creeper exhibits other ther-

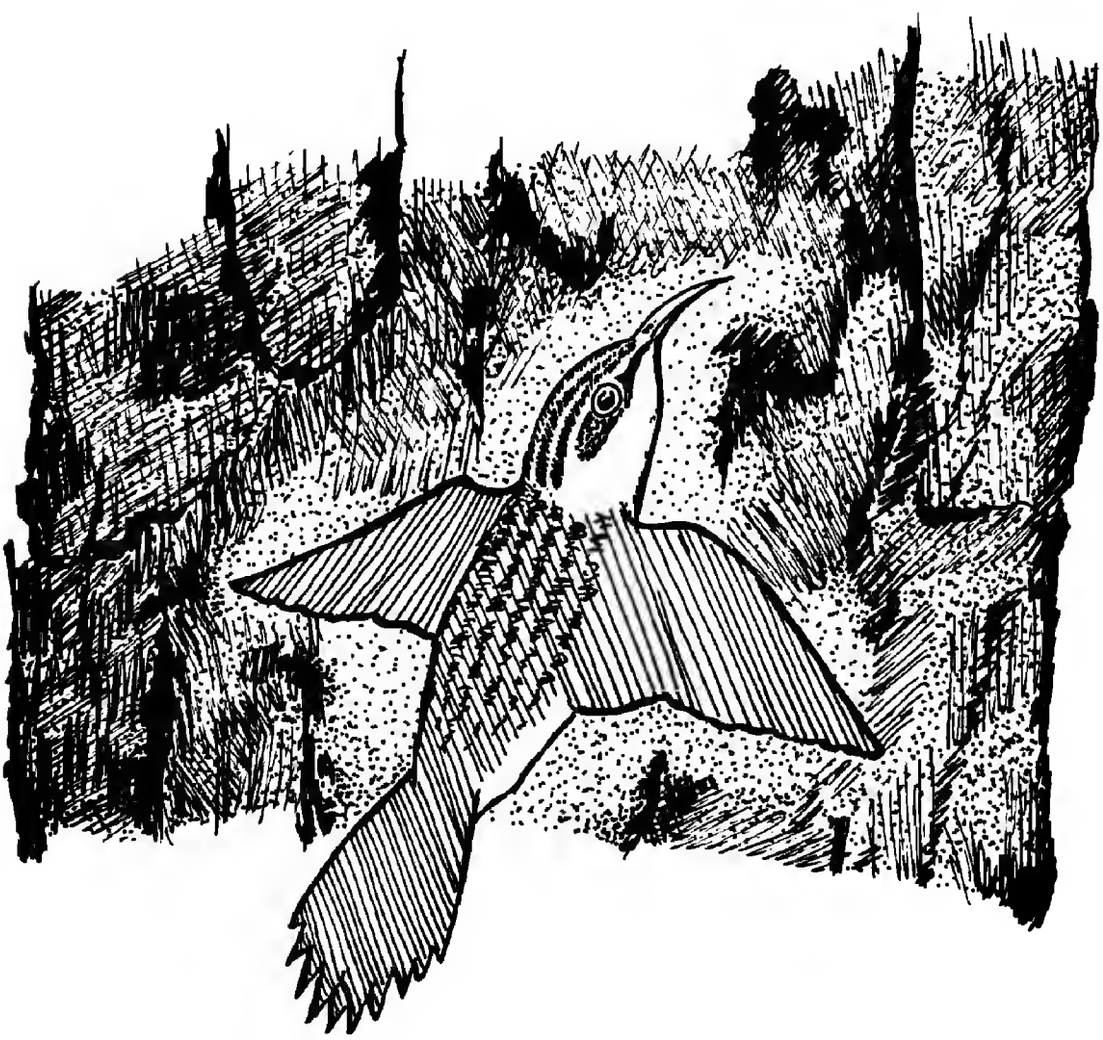


Figure 1. Sunbathing posture of the Brown Creeper on a small sunlit patch of bark of a Redwood.

Sketch by Charles Leck

moregulatory behaviors such as tight communal roosting (Ehrlich et. al. 1988) and temperature-selective foraging (Webber 1986). In the cool shadows of the coastal redwoods it is quite possible that the behavior both helps warm the creeper and aids in ectoparasite removal as suggested by the subsequent preening (Terres 1980).

LITERATURE CITED

Ehrlich, P., Dobkin, D., and Wheye, D. 1988. The Birder's Handbook. Simon & Schuster, New York.

Kennedy, R. 1969. Sunbathing behavior of birds. Br. Birds 62:249-258.

Mueller, H. 1972. Sunbathing in birds. Z. Tierpsychol. 30:253-258.

Terres, J. 1980. The Audubon Society Encyclopedia of North American birds. Knopf, New York.

Webber, D. 1986. Foraging site selection of the Brown Creeper (*Certhia americana*) in relation to temperature in central Iowa. Proc. Iowa Acad. Sci. 93:22-23.

Accepted 15 January 1989

FIRST RECORD OF CHUCK-WILL'S-WIDOW IN CALIFORNIA

STEPHEN F. BAILEY, Department of Ornithology and Mammalogy, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118

On the evening of 16 October 1986 Mr. William Levett of 460 Fairway Drive, Half Moon Bay, San Mateo County, California, found a strange bird hopping and fluttering in the road on his block. He took it to the wildlife rehabilitation department of the Peninsula Humane Society in San Mateo on 17 October. There Sandi Stadler tentatively identified it as a Chuck-will's-widow (*Caprimulgus carolinensis*). That afternoon, I confirmed the identification and photographed the live bird in the hand, using direct sunlight and Ektachrome 400 film (Figures 1 and 2).

This bird had a superficial but seemingly not serious wound on its wing. Its health seemed to improve but its weight dropped from 83 to 78 g, despite force feeding and other care. Late on 19 October it looked "listless," and it was found dead in the cage on the morning of 20 October. I obtained the frozen carcass on 21 October.

Lise Thomsen prepared the specimen (CAS83955, California Academy of Sciences) as a study skin plus body skeleton on 30 October. A female, the bird's ovary was 6 × 4 mm, granular, and yellowish ivory. The stomach was full of mealworms from the force feeding. The kidneys and intestines were gray, and Lise considered their appearance to be abnormal. The bird's weights during captivity were 30.6-34.8% below the 119.6-g "normal" mean of 12 breeding-season birds, and even below the 86.7-g weight of an "emaciated" bird (Rohwer and Butler 1977).

The large size, dark ochraceous plumage colors, and lack of white in the wings and tail combine to eliminate all other species of *Caprimulgus*, worldwide (Hartert 1892, Ridgway 1914, Fry et al. 1988). Also very distinctive are the Chuck-will's-widow's rictal bristles, which have lateral filaments on their basal portions (Figure 1). The neotropical Rufous Nightjar (*Caprimulgus rufus*) is the most similar species, but it lacks these lateral filaments and is smaller (wing 176-194 mm, Ridgway 1914). The California specimen's wing chord of 203 mm is at the small end of the range for this species (201-225 mm, Ridgway 1914, Oberholser 1974), but nevertheless it is long enough to eliminate all other American species of the genus. Among Eurasian caprimulgids the species most likely to reach California is the Jungle Nightjar (*Caprimulgus indicus*), which has been recorded on the Aleutians (Day et al. 1979). The Jungle Nightjar is about the same length as Chuck-will's-widow but has a smaller head, longer body, and shorter tail. Figure 2 shows the Chuck-will's-widow to have been about 28 cm long in life, with at least 50% of this length being tail and about 30% being "head," as measured to the end of the nape feathers. In the Jungle Nightjar, the male has a white bar across the primaries but the female has a subdued buffy bar, obvious only in the hand. No such bar is present on the Half Moon Bay specimen, which instead matches the female Chuck-will's-widows in the CAS collection. The Jungle Nightjar is also grayer and lacks lateral filaments on its rictal bristles. The California Bird Records Committee (CBRC) unanimously accepted this record on its first circulation.

This species' breeding range extends west to central Kansas, Oklahoma, and Texas (Johnsgard 1979, Oberholser 1974). Sutton (1967) listed a 2 September 1963 record from extreme western Oklahoma. The American Ornithologists' Union Check-list (1983) includes no record farther west. A specimen picked up under a telephone line crossing the Desert Wildlife Range, Clark Co., Nevada, 12 June 1984 (Kingery 1984) provided the first record for western North America (DeSante and Pyle 1986). The bird reported here represents the first record of Chuck-will's-widow for California, the second for western North America, and the westernmost for this species.

Figure 1. Head of Chuck-will's-widow picked up at Half Moon Bay, San Mateo Co., California. Note lateral filaments on rictal bristles.

Photo by Stephen F. Bailey

Figure 2. Chuck-will's-widow picked up at Half Moon Bay, San Mateo Co., California.

Photo by Stephen F. Bailey

It is my pleasure to thank Sandi Stadler and the Peninsula Humane Society for providing a first California record specimen for the second time! (The first was Least Auklet.) An anonymous reviewer and the members of the CBRC improved the manuscript.

LITERATURE CITED

American Ornithologists' Union. 1983. Check-list of North American Birds, 6th ed. Am. Ornithol. Union, [Washington, D.C.].

Day, R. H., Knudtson, E. P., Woolington, D. W., and Schulmeister, R. P. 1979. *Caprimulgus indicus, Eurynorhynchus pygmeus, Otus scops,* and *Limicola falcinellus* in the Aleutian Islands, Alaska. Auk 96:189-190.

DeSante, D., and Pyle, P. 1986. Distributional Checklist of North American Birds, Vol. I: United States and Canada. Artemisia Press, Lee Vining, CA.

Fry, C. H., Keith, S., and Urban, E. K., eds. 1988. The Birds of Africa, Vol. III. Academic Press, London.

Hartert, E. 1892. Catalogue of the Birds in the British Museum, Volume XVI. British Museum (Natural History), London.

Johnsgard, P. A. 1979. Birds of the Great Plains: Breeding Species and Their Distribution. Univ. of Nebraska Press, Lincoln.

Kingery, H. E. 1984. The nesting season. Mountain West Region. Am. Birds 38:1044-1047.

Oberholser, H. C. 1974. The Bird Life of Texas. Univ. of Texas Press, Austin.

Ridgway, R. 1914. Birds of North and Middle America, Part VI. Bull. U.S. Natl. Mus. 50.

Rohwer, S., and Butler, J. 1977. Ground foraging and rapid molt in the Chuck-will's-widow. Wilson Bull. 89:165-166.

Sutton, G. M. 1967. Oklahoma Birds. Univ. of Oklahoma Press, Norman.

Accepted 9 April 1989

BIRD RECORDS COMMITTEES

Please send detailed descriptions and photographs documenting rare bird sightings to the addresses below.

Arizona: Janet Witzeman, 4619 E. Arcadia Lane, Phoenix, AZ 85018
California: Don Roberson, 282 Grove Acre Ave., Pacific Grove, CA 93950
Colorado: CFO Records Committee, Denver Museum of Natural History, City Park, Denver, CO 80205
Idaho: Dr. C.H. Trost, Department of Biological Sciences, Campus Box 8007, Idaho State University, Pocatello, ID 83209
New Mexico: John P. Hubbard, 2016 Valle Rio, Santa Fe, NM 87501
Oregon: Oregon Bird Records Committee, P.O. Box 10373, Eugene, OR 97440
Utah: Utah Ornithological Society, Ella D. Sorensen, 3868 Marsha Dr., West Valley City, UT 84120
Vancouver, British Columbia: Wayne C. Weber, 303-9153 Saturna Dr., Burnaby, B.C. V3J 7K1
Washington: Phil Mattocks, 915 E. Third Ave., Ellensburg, WA 98926

Volume 20, Number 2, 1989

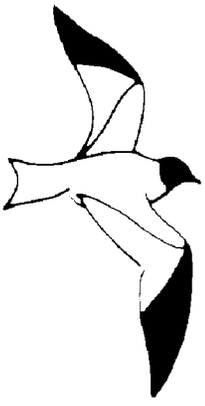
Cover photo by © Jules Evens, of Bolinas, California: Lesser Golden Plover, (*Pluvialis dominica*), Meade River, Alaska, 14 June 1979.

Western Birds solicits papers that are both useful to and understandable by amateur field ornithologists and also contribute significantly to scientific literature. The journal welcomes contributions from both professionals and amateurs. Appropriate topics include distribution, migration, status, identification, geographic variation, conservation, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, and techniques for censusing, sound recording, and photographing birds in the field. Papers of general interest will be considered regardless of their geographic origin, but particularly desired are reports of studies done in or bearing on the Rocky Mountain and Pacific states and provinces, including Alaska and Hawaii, western Texas, northwestern Mexico, and the northeastern Pacific Ocean.

Send manuscripts to Philip Unitt, 3411 Felton Street, San Diego, CA 92104. For matter of style consult the *Suggestions to Contributors to Western Birds* (8 pages available at no cost from the editor) and the *Council of Biology Editors Style Manual* (available for $24 from the Council of Biology Editors, Inc., 9650 Rockville Pike, Bethesda, MD 20814.

Reprints can be ordered at author's expense from the Editor when proof is returned or earlier.

Good photographs of rare and unusual birds, unaccompanied by an article but with caption including species, date, locality and other pertinent information, are wanted for publication in *Western Birds*. Submit photos and captions to Photo Editor.



WESTERN BIRDS

Vol. 20, No. 3, 1989

WESTERN BIRDS

Quarterly Journal of Western Field Ornithologists

Membership dues, for individuals and institutions, including subscription to *Western Birds:* Patron, $1000; Life, $250; Supporting, $50 annually; Contributing, $25 annually; Regular, $14 U.S. ($17 outside U.S.) annually. Dues and contributions are tax-deductible to the extent allowed by law.

Send membership dues, changes of address, correspondence regarding missing issues, and orders for back issues and special publications to the Treasurer. Make checks payable to Western Field Ornithologists.

Back issues of *California Birds/Western Birds:* $15 per volume, $4.00 for single issues. Xerox copies of out of print issues (Vol. 1, No. 1; Vol. 2, Nos. 1 and 4; Vol. 6, No. 2): $4.50 each. *Checklist of the Birds of California:* $2.00 each, 10 or more $1.50 each. *Pelagic Birds of Monterey Bay, California:* $2.50 each, 10 or more $2.00 each, 40 or more $1.50 each. All postpaid.

Published March 16, 1990 ISSN 0045-3897

WESTERN BIRDS ADVERTISING RATES AND SPECIFICATIONS

Full page	4 x 6¾ inches	$60 per issue	$200 per year
Half Page	4 x 3⅜ inches	$40 per issue	$130 per year
Quarter Page	4 x 1 11/16 inches	$30 per issue	$110 per year

Offset printing, one column per page, 4 inches wide. Glossy, black and white photos are acceptable; half-tone screen size: 133 line. Photo-ready copy is requested. If this is not possible, extra charges for typesetting will be made as follows: $15 full page, $10 half page, $5 quarter page. Send copy with remittance to the Treasurer. Make checks payable to Western Field Ornithologists. A 15% commission is allowed for agencies.

WESTERN BIRDS

Volume 20, Number 3, 1989

DISTRIBUTION AND SEASONAL MOVEMENTS OF BENDIRE'S THRASHER IN CALIFORNIA

A. SIDNEY ENGLAND, Department of Wildlife and Fisheries Biology, University of California, Davis, California 95616

WILLIAM F. LAUDENSLAYER, JR., U. S. D. A. Forest Service, Forestry Sciences Laboratory, 2081 E. Sierra Avenue, Fresno, California 93710

The ecology and distribution of Bendire's Thrasher (*Toxostoma bendirei*) have been little studied and are poorly understood. Garrett and Dunn (1981:280) classified the species as a "fairly common but very local summer resident on the Mojave Desert" in southern California. California breeding populations are known primarily from the eastern Mojave Desert and scattered locations in and around Joshua Tree National Monument in the southern Mojave Desert (Johnson et al. 1948, Miller and Stebbins 1964, Garrett and Dunn 1981), areas frequently visited by bird watchers and naturalists. However, records from other parts of the Mojave and Colorado deserts suggest that breeding populations of Bendire's Thrasher may be more widely distributed than currently recognized. Also, the preferred breeding habitat in California is relatively widespread. This habitat is typically described as Mojave desert scrub with either Joshua Trees (*Yucca brevifolia*), Spanish Bayonet (*Y. baccata*), Mojave Yucca (*Y. schidigera*), cholla cactus (*Opuntia acanthocarpa*, *O. echinocarpa*, or *O. ramosissima*), or other succulents (Grinnell and Miller 1944, Bent 1948, Garrett and Dunn 1981).

Remsen (1978) considered the total California breeding population of Bendire's Thrasher to be under 200 pairs, and the species has been placed on the list of Bird Species of Special Concern by the California Department of Fish and Game (Remsen 1978). It was placed on this list because populations are small and locally distributed and believed to be threatened by off-road vehicle use, overgrazing, and harvesting of Joshua Trees and other species of yucca.

In this paper, we report the results of a 2-year study of the breeding-season distribution and movement patterns of Bendire's Thrasher in California. Our findings are based on a review of historical records and field surveys designed to (1) document more accurately the extent of

known breeding populations in the eastern and southern Mojave Desert, (2) reinvestigate the presence of breeding populations at sites suggested by historical records, (3) locate previously undocumented breeding locations, and (4) characterize seasonal movement patterns in California.

METHODS

Review of Historical Records

We compiled over 350 distribution records of Bendire's Thrashers from four primary sources: (1) Middle and Southern Pacific Coast regional reports in *Audubon Field Notes/American Birds*, volumes 1–42, (2) Vertebrate Species Distribution Data and museum records on file with the California Desert District Office of the Bureau of Land Management (BLM), Riverside, (3) published scientific literature on Bendire's Thrasher, and (4) field notes of several ornithologists including ourselves. BLM data were gathered by employees and contractors working on the California Desert Plan Program between 1975 and 1979, and most of these observations have never been published. These BLM records also include data transcribed from labels on specimens and egg sets in major ornithological collections in California. We have not personally examined documentation for most published and unpublished records and some could be erroneous. However, most are by reliable observers and have previously been accepted by regional editors of *American Birds*, Garrett and Dunn (1981), or peer-reviewed journals, and fit within patterns for the species.

Breeding-Season Survey Techniques

We established 44 transects along existing roads during 1986 and 1987 (Figure 1); 23 transects were surveyed both years of our field study, and the other 21 transects were surveyed only one year (see Appendix). The location and distribution of our transects were designed to maximize coverage of areas we considered to represent potentially suitable breeding habitat. We concentrated our efforts in relatively diverse plant communities dominated by Joshua Trees, Mojave Yucca, Spanish Bayonet, and cholla cactus. We conducted only a few surveys at lower elevations where breeding Bendire's Thrashers would be extremely unlikely. Detailed maps and descriptions of each transect are on file with the California Department of Fish and Game, Sacramento.

Individual transect surveys were conducted on days with wind <15.0 km/hr, began approximately one-half hour after sunrise, and usually continued until mid-afternoon. We covered our routes by vehicle, with stops at 0.4- to 4.8-km intervals. Within a transect, the distance between stops was variable and depended on vegetation characteristics, local topography, and whether we detected Bendire's Thrashers at nearby stops. Sample points were placed closer together in apparently suitable habitat with Joshua Trees, yuccas, and cholla and in areas not previously known to support Bendire's Thrashers. Such adjustments allowed extensive coverage of large areas.

At each stop, we recorded time and weather conditions, and noted dominant plants, presence or absence of wash vegetation, and types of human disturbance. The location of the point was marked on a U.S. Geological Survey topographic map (scale 1:24,000 or 1:62,500), and

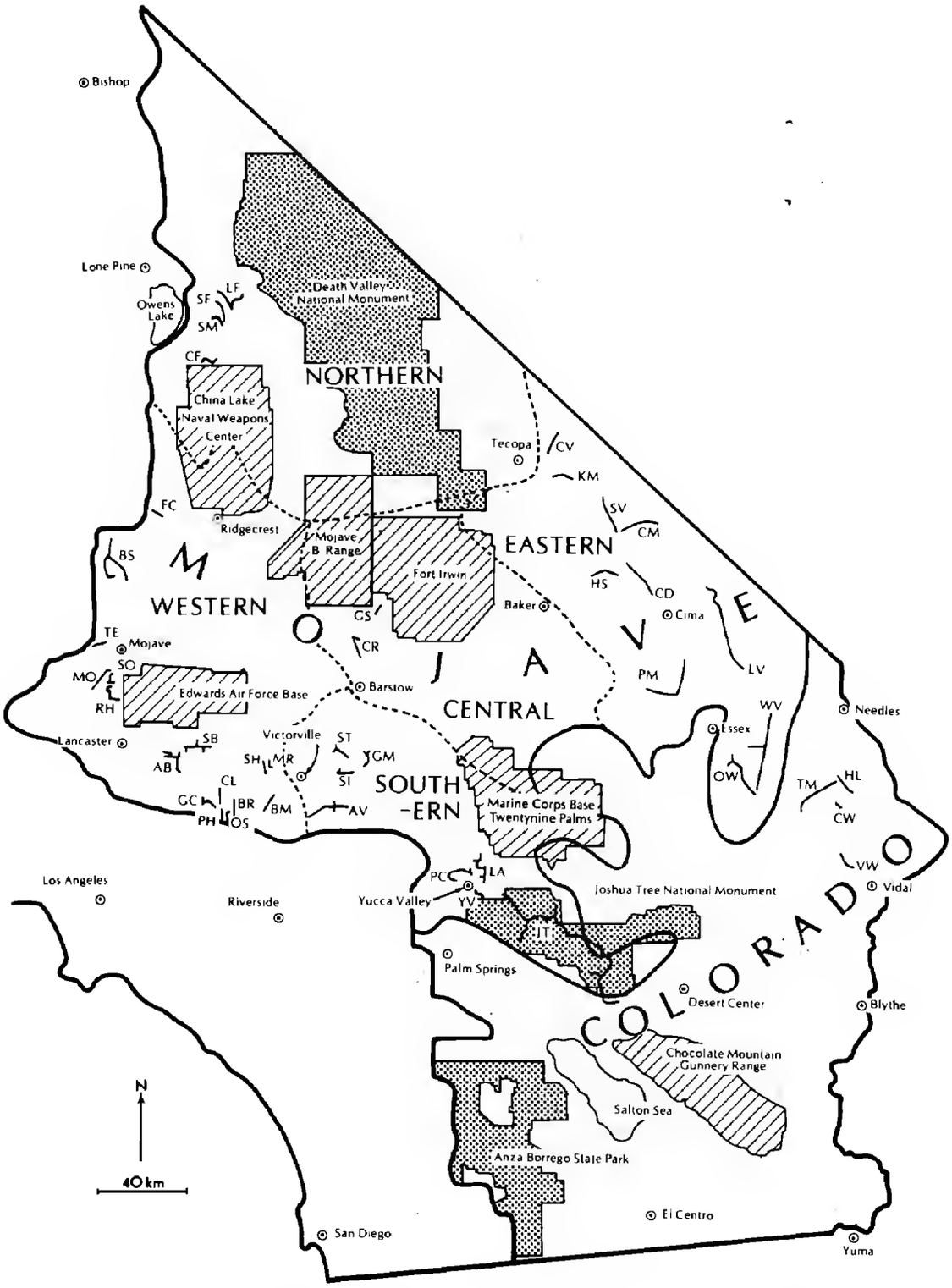


Figure 1. Locations of Bendire's Thrasher transects surveyed in 1986 or 1987. Transects are identified with two-letter initials that correspond to abbreviations in Table 5. Solid line, the Mojave–Colorado Desert boundary; dashed lines, subdivisions of the Mojave Desert.

Table 1 Historical Breeding-Season (mid-March through July) Observations and Specimen Records of Bendire's Thrashers in the Mojave and Colorado Deserts[a,b]

Date	Locality	Number	Reference[c]
Eastern Mojave Desert[d]			
24 Mar 1976	Granite Mtns., SB	1	JVR (AB 30:892, 1976)
11 Apr 1977	Wash on S side Granite Pass, SB	1 pair	SWC (BLM)
11 Apr 1977	Cottonwood Wash, Granite Mtns., SB	1 adult	SWC (BLM)
22 Apr 1977	Cottonwood Wash, Granite Mtns., SB	1 adult	SWC (BLM)
24 Apr 1978	Cottonwood Wash, Granite Mtns., SB	2	KJ *fide* SWC (pers. comm.)
16 May 1976	Shadow Valley, SB	1	JVR (BLM)
24 May 1975	Salt Creek, 25.0 mi. N Baker, SB	1	SWC (pers. comm.)
29 May 1978	Powerline Rd. N of Clark Mtn., SB	1+1 singing male	PM (pers. comm.)
Early June	Near Clark Mtn., SB	1	GMc (AFN16:448, 1962)
14 Jun 1976	Granite Pass, SB	1 adult w/food	Cardiff (BLM)
14 Jun 1976	Granite Pass, SB	1 adult	Cardiff (BLM)
11 Jul 1977	Halloran Summit, SB	1 adult	SWC (BLM)
Southern Mojave Desert			
Apr 1974	Around Yucca Valley, SB	2 pairs	ASm, GSS (AB 28:950, 1974)
13 Apr 1974	Salton View, JTNM, RIV	1 singing male	JM (AB 28:950, 1974)
May 1896	Warren's Well, Yucca Valley, SB	fairly common	Heller (1901)
May 1975	JTNM, RIV	2	USFWS BBS
May 1984	Near Pioneertown, SB	1	TMe (pers. comm.)
7 May 1916	Near Victorville, SB	1 adult male	MVZ 54556; Pierce (1919)
10 May 1981	Near Cottonwood Spring, JTNM, RIV	2	RMc (pers. comm.)
13 May 1973	Near Cottonwood Spring, JTNM, RIV	1	AB 27:821, 1973
22 May 1969	Near Victorville (Stoddard Mtn.), SB	1 w/food	GSS (AFN 23:627, 1969)
25 Mar 1978	JTNM, RIV	1	DZ (AB 32:1056, 1977)
6 Jun 1981	Near Pioneertown, SB	1	EAC (AB 35:979, 1981)
Jun–Jul 1975	Near Yucca Valley, SB	6	FH (AB 29:1034, 1975)
8 Jul 1986	Near Lucerne Valley, SB	3	RMc (AB 40:1256, 1986)

Table 1 (Continued)

Date	Locality	Number	Reference[c]
Central Mojave Desert			
1 Apr–20 May 1981	Superior Valley N of Barstow, SB	5 singing males	ASE
Western Mojave Desert			
4 Apr 1981	California City, KE	1	GWP (AB 35:864, 1981)
7 Apr 1979	Near Lancaster, LA	1 singing male	JD (pers. comm.; AB 33:806, 1979)
18 Jun 1982	Kelso Valley, KE	1 singing male	BrE (AB 36:1017, 1982)
Northern Mojave Desert			
23 May 1970	Oasis Ranch, Fish Lake Valley, MON	1	GMc (AB 24:645, 1970)
23 May 1977	Mesquite Springs, DVNM, INY	1	GMc (AB 31:1048, 1977)
28 May 1977	Furnace Creek Ranch, DVNM, INY	1	KG (AB 31:1048, 1977)
1 Jun 1974	Stovepipe Wells, DVNM, INY	1	JVR (AB 28:853, 1974)
Colorado Desert			
14 Mar 1952	Hwy. 95 8.0 mi. N Vidal Jct., SB	1	GMo (pers. comm.)
19 Mar 1953	Lake Havasu Rd. 5.0 mi. E Hwy. 95, SB	1	GMo (pers. comm.)
19 Mar 1983	Palm Spring, SD	1	EAC (AB 37:913 1983)
31 Mar 1953	Hwy. 95 8.0 mi. N Vidal Jct., SB	1	GMo (pers. comm.)
8 Apr 1885	Palm Springs, RIV	1	Stephens (1919)
16 Apr 1980	Mouth of Whitewater Canyon, RIV	1	RMc (AB 34:816, 1980)
18 Apr 1950	Between Vidal Jct. and Lake Havasu Rd., SB	2	GMo (pers. comm.)
25 Apr 1974	Near Twentynine Palms,SB	2 pairs	GLB (AB 28:950, 1974)
26 Apr 1952	Between Vidal Jct. and Lake Havasu Rd., SB	1	GMo (pers. comm.)
27 Apr 1951	Between Vidal Jct. and Lake Havasu Rd., SB	2	GMo (pers. comm.)
30 Apr 1972	Brock Ranch, IMP	1 singing male	AB 26:812, 1972
6 May 1980	Cholla Garden, JTNM, RIV	2	RMc (pers. comm.)
7 May 1984	W of Dale Dry Lake, SB	1	RMc (pers. comm.)
7 May 1984	Clarks Pass E of 29 Palms, SB	2	RMc (pers. comm.)
9 May 1947	Hwy. 95 <8.0 mi. S of Lake Havasu Rd., SB	1	GMo (pers. comm.)

Table 1 (Continued)

Date	Locality	Number	Reference[c]
12 May 1984	Twentynine Palms, SB	1	RMc (pers. comm.)
17 May 1951	Hwy. 62 E of Vidal Jct., SB	1	GMo (pers. comm.)
22 May 1897	Whitewater, RIV	1	EH (Grinnell 1915)
22 May 1951	Between Vidal Jct. and Lake Havasu Rd., SB	1	GMo (pers. comm.)
23 May–8 Jun 1985	Pinto Basin, JTNM, RIV	2	RMc (pers. comm.)
28 May 1950	Hwy. 62 between Earp and Vidal Jct., RIV	1	GMo (pers. comm.)
29 May 1949	Hwy. 95 <8.0 mi. S of Lake Havasu Rd., SB	1	GMo (pers. comm.)
30 May 1950	Hwy. 95 at Lobeck's Pass, Sawtooth Mtn., SB	1	GMo (pers. comm.)
1 Jun 1948	Hwy. 95 <8.0 mi. S of Lake Havasu Rd., SB	1	GMo (pers. comm.)
2 Jun 1950	Between Vidal Jct. and Lake Havasu Rd., SB	2+	GMo (pers. comm.)
11 Jun 1947	Hwy. 95 S of Chemehuevi Wash, SB	2	GMo (pers. comm.)
19 Jun 1951	Between Vidal Jct. and Lake Havasu Rd., SB	1	GMo (pers. comm.)
19 Jun 1963	Near Needles, SB	5	RS, AW (AFN 18:536, 1964)
25 Jun 1951	Between Vidal Jct. and Lake Havasu Rd., SB	1	GMo (pers. comm.)

[a]Excludes approximately 200 records from area previously recognized as the primary range of Bendire's Thrasher in the eastern Mojave Desert (Figure 3).

[b]Abbreviations: *Localities*—DVNM, Death Valley National Monument; IMP, Imperial Co.; INY, Inyo Co.; JTNM, Joshua Tree National Monument; KE, Kern Co.; LA, Los Angeles Co.; MON, Mono Co.; RIV, Riverside Co.; SB, San Bernardino Co. *References*—ASE, A. Sidney England; ASm, Arnold Small; AW, Art Wang; BBS, Breeding Bird Survey; BLM, Bureau of Land Management; BrE, Brett Engstrom; DZ, David Zumata; EAC, Eugene A. Cardiff; EH, E. Heller; FH, Fred Heath; GLB, Gordon L. Bolander; GMc, Guy McCaskie; GMo, Gale Monson; GSS, G. Shumway Suffel; GWP, Gary W. Potter; JD, Jon Dunn; JM, Joe Morlan; JVR, J. V. Remsen; KG, Kimball Garrett; KJ, Kent Johnson; MVZ, Museum of Vertebrate Zoology, Univ. Calif., Berkeley,; PM, Paul Mack; RMc, Robert McKernan; RS, Rich Stallcup; SWC, Steven W. Cardiff; TMe, Tony Metcalf; USFWS, U. S. Fish and Wildlife Service.

[c]References to *American Birds* (AB) or *Audubon Field Notes* (AFN) are not included in the Literature Cited.

[d]Subdivisions and boundaries of the Mojave and Colorado deserts are illustrated in Figures 1 and 3.

the elevation was interpolated from the map. At each stop, we played a taped recording of a Bendire's Thrasher song to elicit responses from nearby birds. Each playback session was approximately 5 minutes long and consisted of 60 seconds of song followed by 60 seconds of silence, 30 seconds of song, 60 seconds of silence, 30 seconds of song at low volume, and ended with 60+ seconds of silence. Sheppard (1970) had found this playback protocol to be effective for locating LeConte's Thrashers (*Toxostoma lecontei*). During the playback session, we recorded the number of individuals for all species in the family Mimidae and whether the detection was visual or auditory. In 1986, we used the song playback technique at 445 points on 38 transects in the Mojave Desert and at 27 points on four transects in the Colorado Desert. These data were collected between 26 April and 4 May and between 31 May and 8 June. In 1987, we conducted surveys between 8 May and 23 May at 292 points on 25 transects in the Mojave Desert.

RESULTS AND DISCUSSION

Breeding Phenology

The breeding schedule of Bendire's Thrashers in California is known primarily from nests and breeding pairs observed only once. Records of singing Bendire's Thrashers indicate that territorial behavior begins when birds first return to breeding areas beginning in mid-March and continues through mid-June, by which time most young from first nests are fledged (Figure 2). Presumed first clutches have been observed from late March through the end of April (Figure 2). Nestlings from first clutches have been recorded from early May through early June, and fledglings leave the nest between late April and mid-June. The dates for various breeding phenology milestones are consistent with observations in Arizona (Brown 1901).

The only breeding attempt in California observed repeatedly was one followed in Kelso Valley in the western Mojave Desert (R. Saval, pers. comm.; Table 2; Figure 2). The nest contained two chicks on 13 June but was empty on 17 June, and an adult with a single fledgling was observed on 22 June. On 3 July Saval discovered a second nest with four eggs within 100 m of the first nest. On 19 July two adults and two nestlings were observed at the second nest. This record is the only evidence of multiple broods for California, but second and even third nestings are well known from Arizona (Brown 1901).

For each stage in the nesting cycle for which records exist, the earliest California observations are in the Colorado Desert and the latest are from the western Mojave Desert (Figure 2). This pattern suggests that breeding begins earlier in the southeast and progresses across the desert to the northwest. However, the number of records in the Colorado Desert and the western Mojave Desert is inadequate to permit a firm statement that this pattern is real, and the single singing male observed in February in the Colorado Desert (Table 3; Figure 2) may have been a migrant.

Only five nests with eggs have been found in California. Three nests contained four eggs each; the other records did not report clutch size. Brown (1901) indicated that in Arizona most clutches have 3 eggs, 4-egg clutches are the typical upper limit, but 5-egg clutches are known.

Breeding-Season Distribution in the Deserts of California

Our analysis of the breeding-season distribution of Bendire's Thrasher in California is presented below for five geographical subdivisions of the Mojave Desert and for the Colorado Desert. The boundaries between these regions are shown in Figure 1.

Eastern Mojave Desert. The best-known and largest breeding area for Bendire's Thrasher in California has been the eastern Mojave Desert (Table 2; Figure 3). The existence of this population was first

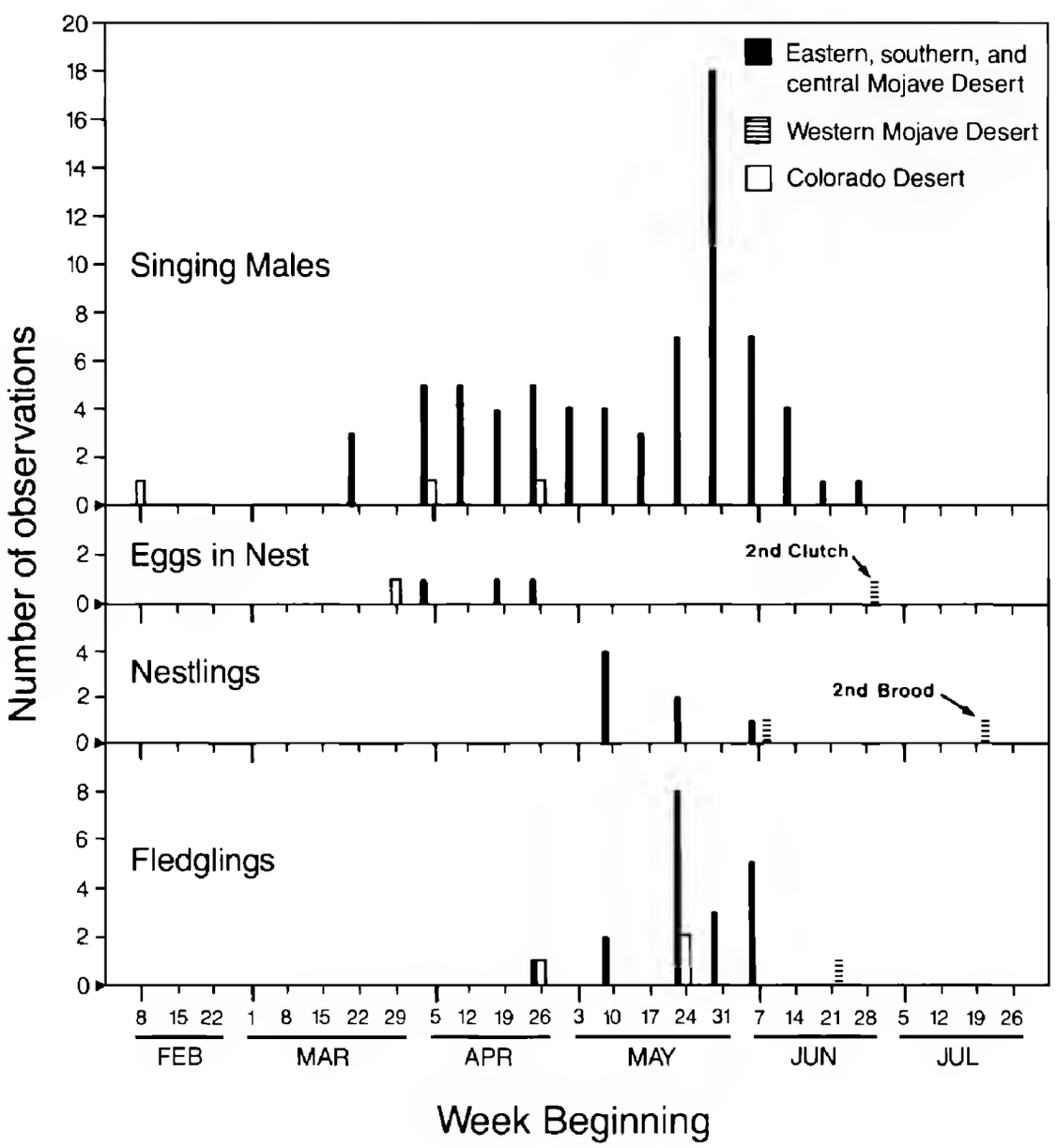


Figure 2. Breeding phenology of Bendire's Thrashers in the deserts of California based on historical records.

Table 2 Confirmed Breeding Records of Bendire's Thrasher from California[a]

Date	Locality	Number	Reference[b]
Eastern Mojave Desert[c]			
22 Apr–28 May 1976	Lanfair Valley, SB	1 pair + 4 nestlings	SWC (pers. comm.)
12–14 May 1978	SW edge of Lanfair Valley, SB	1 pair+4 nestlings	SWC (BLM; AB 33:94, 1979)
14 May 1938	2.0 mi. NNE of Cima, SB	2 juveniles	Johnson et al. (1948)
15 May 1938	2.0 mi. NNE of Cima, SB	1 pair + 4 juveniles	Johnson et al. (1948)
15 May 1987	13.0 mi. SE Ivanpah, SB	1 pair + 3 juveniles	BAC (NRC)
26 May 1980	Cima Rd. 2.25 mi. N I-15, SB	1 pair + 4 nestlings	BM, AS (pers. comm.)
27 May 1972	Near Cima, SB	adults+ juveniles	SWC (BLM)
24 Apr–29 May 1976	2.5 mi. SE of Cima, SB	1 pair + 1 nestling	EAC (BLM; NRC)
29 May 1976	5.5 mi. SSE of Cima, SB	1 pair + 4 juveniles	Cardiff (BLM)
30 May 1976	6.0 mi. NW of Cima, SB	1 pair + 1 juvenile	Cardiff (BLM)
30 May 1976	7.5 mi. SE of Cima, SB	1 pair+ 1 juvenile	Cardiff (BLM)
3 Jun 1979	Watson Wash, SB	1 juvenile	SWC. (pers comm.)
4 Jun 1979	Lanfair Valley, SB	1 adult + 4 juveniles	SWC (pers. comm.)
11 Jun 1978	Lanfair Valley, SB	1 pair + 2 juveniles	BAC, SJN (BLM; AB 33:93, 1979)
12 Jun 1976	12.0 mi. SE of Ivanpah, SB	4 nestlings	SWC (NRC)
12 Jun 1976	13.5 mi. N of Goffs, SB	2 pairs + 1 juvenile	Cardiff (BLM)
12 Jun 1976	13.25 mi. ESE of Cima, SB	1 pair + 2 juveniles	Cardiff (BLM)
12 Jun 1976	13.25 mi. ESE of Cima, SB	1 juvenile	Cardiff (BLM)
13 Jun 1976	10.0 mi. S of Mountain Pass, SB	1 pair + 1 juvenile	Cardiff (BLM)
Southern Mojave Desert			
11 Apr 1920	Victorville, SB	4 eggs	SBCM 5987; Pierce (1921)
26 Apr 1920	Victorville, SB	1 female + 3 juveniles	Specimen; Pierce (1921)
26 Apr 1975	1.0 mi. NW Yucca Valley, SB	1 pair + 3 juveniles	JAD (NRC)

Table 2 (Continued)

Date	Locality	Number	Reference[b]
11 May 1987	2.5 mi. N Belle Campground, JTNM, SB	1 pair + 1 juvenile	AMC (pers. comm.; AB 41: 1488, 1987)
28 May 1974	Hidden Valley Campground, JTNM, SB	1 pair + 3 juveniles	RR (AB 28: 950, 1974)
1 Jun 1974	Ryan Mtn., JTNM, RIV	1 pair + 4 juveniles	RR (AB 28: 950, 1974)
Central Mojave Desert			
12 May 1982	Superior Valley N of Barstow, SB	1 adult + 3 nestlings	ASE (AB 36: 1017, 1982)
3 Jun 1981	Superior Valley N of Barstow, SB	1 pair + 2 juveniles	ASE
Western Mojave Desert			
13 Jun–Jul 1987	Kelso Valley, KE	1st nest + 2 nestlings 2nd nest + 4 eggs	RSa 19 (pers. comm.; AB 41: 1488, 1987)
Colorado Desert			
1 Apr 1920	Turtle Mtns., SB	Egg set	SBCM 1632
5 May 1985	Corn Springs, RIV	1 adult + 3 juveniles	RMc (pers. comm.)
24 May 1953	Hwy. 95 12.0 mi. N Vidal Jct., SB	3 juveniles	GMo (pers. comm.)
29 May 1949	9.0 mi. N Vidal Jct., SB	3 juveniles	GMo (pers. comm.)

[a]Abbreviations: *Localities*—JTNM, Joshua Tree National Monument; KE, Kern Co.; RIV, Riverside Co.; SB, San Bernardino Co. *References*—AMC, Alan M. Craig; AS, Andy Sanders; ASE, A. Sidney England; BAC, Barbara A. Carlson; BLM, Bureau of Land Management; BM, Bev MacIntosh; EAC, Eugene A. Cardiff; GMo, Gale Monson; JAD, James A. Davis; MVZ, Museum of Vertebrate Zoology, University of California, Berkeley; NRC, Nest Record Card, Laboratory of Ornithology, Cornell University; RMc, Robert McKernan; RR, Richard Rowlett; RSa, Rick Saval; SJN, Sheldon J. Newberger; SWC, Steven W. Cardiff.

[b]References to *American Birds* (AB) or *Audubon Field Notes* (AFN) are not included in the Literature Cited.

[c]Subdivisions and boundaries of the Mojave and Colorado deserts are illustrated in Figures 1 and 3.

documented by Johnson et al. (1948), and ornithologists and bird watchers continue to return to the area in search of this species. We located approximately 200 historical records for the eastern Mojave Desert, all but 10 in the area extending south from the south side of Clark Mountain, over Cima Dome, through a few canyons in the Mid

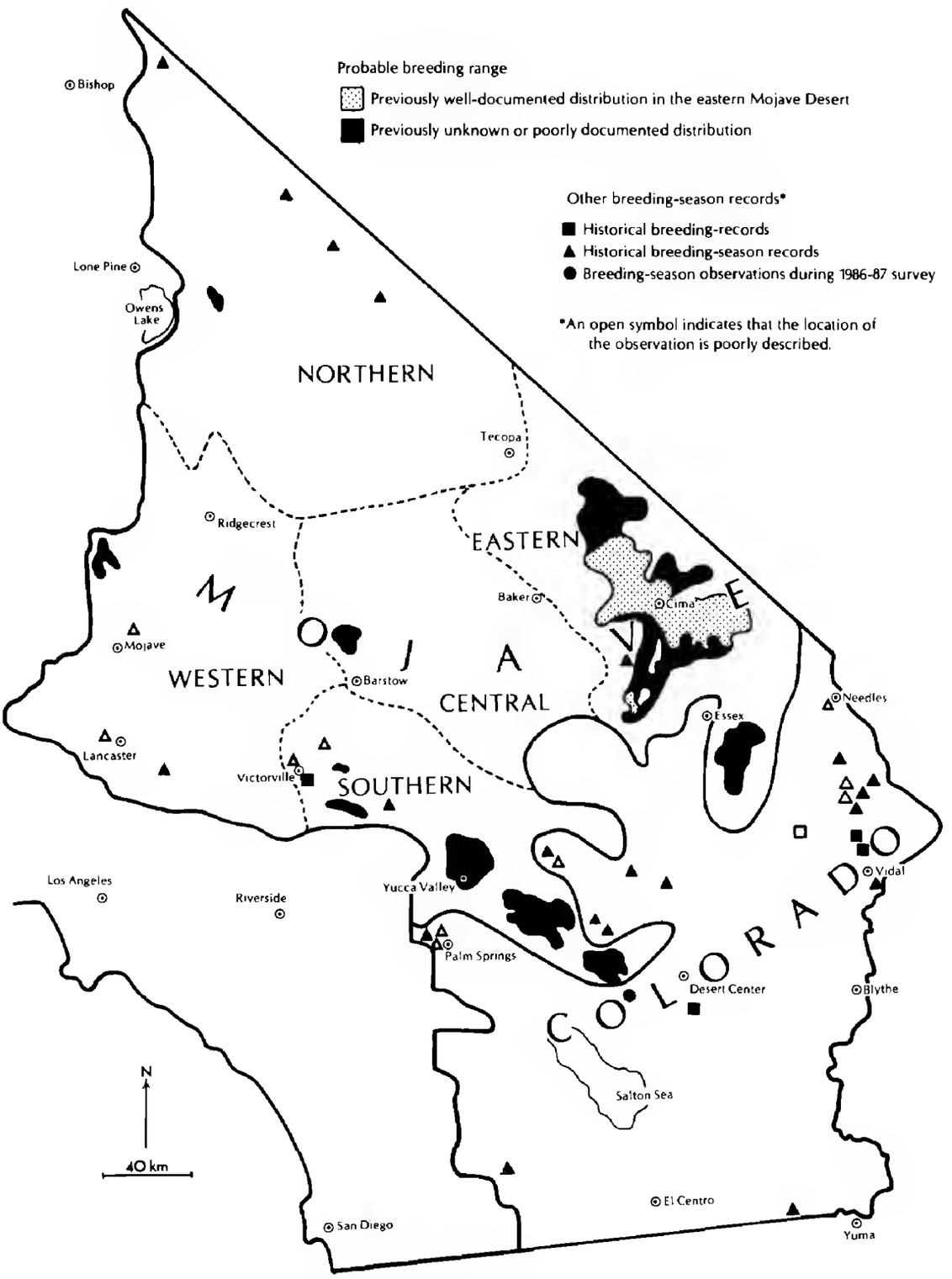


Figure 3. Breeding range of Bendire's Thrasher in the Mojave Desert based on historical records and the results of our study. Historical records for the Colorado Desert are also shown.

Hills, and through Lanfair, Gold, Round, and Pinto valleys on the south side of the New York Mountains and Mid Hills to northern Fenner Valley. Seven historical records were from the area near Granite Pass between the Granite and Providence mountains and the adjacent bajadas (Table 1). We located only four records from suitable breeding habitat for the area north or west of Cima Dome, with the most noteworthy being of a pair on the north side of Clark Mountain (Table 1). The bird observed at Salt Creek was in habitat apparently unsuitable for breeding and its status was not known. However, this species was not found at the site during biweekly surveys conducted from November 1977 through January 1979 (A. S. England, unpublished data).

We conducted song playback surveys on 10 transects in the eastern Mojave Desert in 1986 and on five transects in 1987 (Table 5). Bendire's Thrashers were present at 36 of 73 sample points within the traditionally well-known breeding range of the species (Table 5). On the Lanfair Valley transect, we found birds in southern Ivanpah Valley, on the north side of the New York Mountains, and farther south than previously recorded along Lanfair Road into upper Fenner Valley. We also detected this species at 8 of 12 sample points in suitable habitat on the Providence Mountains transect along the flanks of these mountains. This thrasher was relatively common on the transect along the north side of Clark Mountain and on the Shadow Valley transect west of Clark Mountain and north of Cima Dome. On the basis of these results, we have concluded that this relatively well-known population of Bendire's Thrasher is more widely distributed than previously documented (Figure 3).

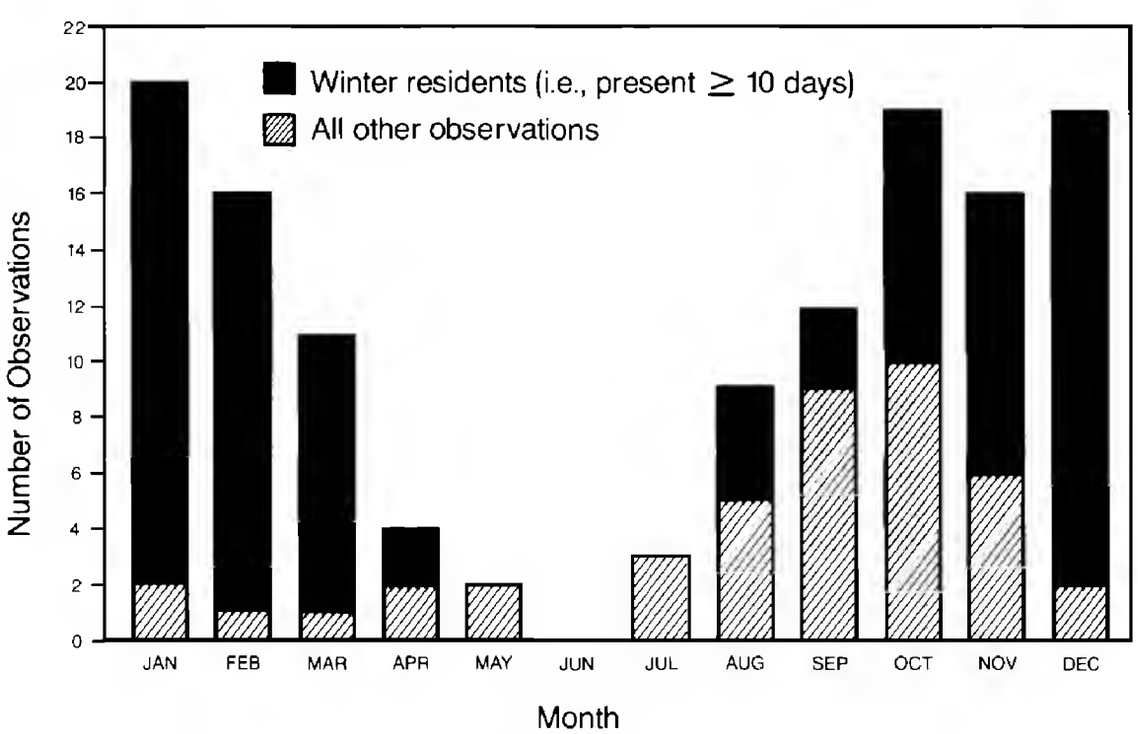


Figure 4. Monthly distribution of California observations of Bendire's Thrashers away from known breeding locations (Tables 3 and 4). Birds present at a location in more than 1 month were counted as one observation for each month detected.

Table 3 Desert Records for Bendire's Thrasher in the Nonbreeding Season (August through mid-March)[a]

Date	Days[b]	Number	Locality	Reference[c]
Mojave Desert[d]				
13 Aug 1978	1	2	Round Valley,[e] SB	SWC (BLM)
13 Aug 1985	1	1	Pinto Valley,[e] SB	SWC (pers. comm.)
13–14 Aug 1985	2	1	Cedar Canyon Rd., Mid Hills,[e] SB	SWC (pers. comm.)
22 Aug 1978	1	6	Lanfair Valley,[e] SB	ASE
28 Aug 1978	1	2	Lanfair Valley,[e] SB	SWC (pers. comm.)
29 Aug 1985	1	1	Lanfair Valley,[e] SB	LSUMZ 126499
29 Aug 1985	1	1	Lanfair Valley,[e] SB	LSUMZ 126521
29 Aug 1985	1	1	Lanfair Valley,[e] SB	LSUMZ 126597
29 Aug 1985	1	1	Lanfair Valley,[e] SB	LSUMZ 126598
30 Aug 1978	1	1	Lanfair Valley,[e] SB	SWC (BLM)
30 Aug 1985	1	1	Lanfair Valley,[e] SB	LSUMZ 126599
1 Sep 1980	1	6	Kelso, Mid Hills,[e] SB	EAC *fide* SWC (pers. comm.)
10 Sep 1978	1	1	Lanfair Valley,[e] SB	SWC (BLM)
8 Oct 1978	1	2	Lanfair Valley,[e] SB	BAC (BLM)
8 Oct 1978	1	1	Lanfair Valley,[e] SB	SWC (AB 33: 216, 1979)
12 Oct 1985	1	1	Near Lancaster, LA	FH (AB 40: 160, 1986)
13 Nov 1973	1	1	Near Lancaster, LA	AB 28:109, 1974
17 Nov 1968–1 Dec 1968	15	1	Morongo Valley, SB	JS, RMa (AFN 23:110 and 522, 1969)
19 Nov 1978	1	1	Lanfair Valley,[e] SB	BAC (BLM)
17 Dec 1983–5 Mar 1984	80	1	Near Lancaster, LA	JD (AB 38:358, 1984)
Winter 1977–78	1	1	Salt Lake, INY	RMS (AB 33:94, 1979)
1 Jan 1966	1	1	7.0 mi. E of Red Mtn., KE	LACM 66090
29 Feb 1984	1	1	Lanfair Valley,[e] SB	SWC (pers. comm.)
Colorado Desert				
1 Nov 1964–27 Jan 1965	88	1	S end of Salton Sea, IMP	Garrett and Dunn (1981)
12 Nov 1967	1	1	Near Niland, IMP	EAC (AFN 22:90, 1968)
17 Dec 1973–1 Feb 1974	46	1	Bard, IMP	RS (AB 28:693, 1974); Rosenberg et al. (in press)

Table 3 (Continued)

Date	Days[b]	Number	Locality	Reference[c]
14 Feb 1987–15 Feb 1987	2	2[f]	Chemehuevi Wash, SB	RMc (AB 41: 331, 1987)
2 Mar 1968	1	1	Near Niland, IMP	GSS, DAG (AFN 22:479, 1968)

[a]Abbreviations: *Localities*—IMP, Imperial Co.; INY, Inyo Co.; KE, Kern Co.; LA, Los Angeles Co.; SB, San Bernardino Co. *References*—ASE, A. Sidney England; BAC, Barbara A. Carlson; BLM, Bureau of Land Management; DAG, David A. Gaines; EAC, Eugene A. Cardiff; FH, Fred Heath; GSS, G. Shumway Suffel; JD, Jon Dunn; JS, Jay Sheppard; JVR, J. V. Remsen; LACM, Los Angeles County Museum; LSUMZ, Louisiana State University Museum of Zoology; RMa, Ralph Manke; RMc, Robert McKernan; RMS, Robert M. Stewart; RS, Rich Stallcup; SWC, Steven W. Cardiff;

[b]Number of consecutive days between the first and last observations at a location.

[c]References to *American Birds* (AB) or *Audubon Field Notes* (AFN) are not included in the Literature Cited.

[d]The boundary between the Mojave and Colorado deserts is illustrated in Figures 1 and 3.

[e]Known breeding location.

[f]Includes one singing male.

Table 4 California Records for Bendire's Thrashers outside the Mojave and Colorado Deserts[a,b]

Date	Days[c]	Locality	Reference[d]
11 Jan–19 Feb 1984	40	Goleta, StB	ABi (AB 38:358, 1984)
14 Jan 1959	1	Near Shandon, SLO	Garrett and Dunn (1981)
14 Jan–14 Feb 1986	32	Palos Verdes Peninsula, LA	BL (AB 40:335, 1986)
26 Jan–22 Mar 1985	56	Near Lakeview, RIV	AMC (AB 39:211, 1985)
28 Jan–3 Mar 1985	35	Coronado, SD	JC (AB 39:211, 1985)
16 Feb–16 Mar 1985	29	Otay Mesa, SD	MO (AB 39:211, 1985)
4 Apr 1970	1	Imperial Beach, SD	GMc (AB 24:645, 1970)
17–18 Apr 1980	2	Farallon Islands, SF	BrB (AB 34:812, 1980)
1 May 1982	1	San Luis Obispo, SLO	FRT (AB 36:894, 1982)
19 May 1984	1	Farallon Islands, SF	JP (AB 38:955, 1984)

Table 4 (Continued)

Date	Days[c]	Locality	Reference[d]
14 Jul 1975	1	Farallon Islands, SF	DeSante and Ainley (1980)
21 Jul 1985	1	Irvine, ORN	DRW (AB 39:963, 1985)
30 Jul–2 Aug 1976	4	San Pedro, LA	IPL, JD (AB 31:224, 1977)
1 Aug 1977–8 Apr 1978	251	Courtland, SAC	RS (AB 32:254, 396, and 1052, 1978)
8 Aug 1976–11 Apr 1977	247	Courtland, SAC	AP (AB 31:219, 371, and 1045, 1977)
17 Aug–12 Oct 1980	57	Pt. Loma, SD	DP (AB 35:227, 1981)
21 Aug 1983	1	Santa Clara River Estuary, VEN	SDR (AB 38:247, 1984)
25–29 Aug 1979	5	Goleta, StB	PL (AB 34:202, 1980)
25 Aug 1978–28 Feb 1979	188	Courtland, SAC	AP (AB 33:211 and 311, 1979)
27 Aug 1964	1	Solana Beach, SD	GMc, JS (McCaskie et al. 1967)
30 Aug 1983	1	Santa Barbara Island, StB	CD (AB 38:247, 1984)
1 Sep 1976	1	Malibu, LA	TC (AB 31:224, 1977)
2–5 Sep 1973	4	Farallon Islands, SF	DeSante and Ainley (1980)
14 Sep 1973	1	Imperial Beach, SD	HK (AB 28:109, 1974)
15 Sep–1 Oct 1979	17	Pt. Mugu, VEN	BB (AB 34:202, 1980)
15–16 Sep 1979	2	San Clemente Island, SD	PJ (AB 34:202, 1980)
16 Sep 1988	1	Gaviota, StB	PK (AB 43:169, 1989)
18 Sep 1968	1	Palos Verdes Peninsula, LA	RS, GSS (AFN 23:110, 1969)
29 Sep 1973	1	San Nicolas Island, StB	LJ, JD (AB 28:109, 1974)
Early October 1966	1	El Capitan State Park, StB	RMW (AFN 21:78, 1967)
1–2 Oct 1964	2	Imperial Beach, SD	GMc, GSS (McCaskie et al. 1967)
4 Oct 1970	1	Imperial Beach, SD	GMc (AB 25:110, 1971)
4–11 Oct 1973	8	San Diego, SD	JWD (AB 28:109, 1974)
7 Oct–2 Dec 1980	57	Malibu, LA	BE (AB 35:227, 1981)
10 Oct 1912	1	Los Angeles, LA	MVZ 23259; Miller (1913)
15 Oct 1988–11 Mar 1989	148	Acampo (Lodi), SJ	DGY (AB 43:164 and 363, 1989)
16 Oct 1975	1	Imperial Beach, SD	JD (AB 30:128, 1976)
16 Oct 1975–31 Mar 1976	168	Courtland, SAC	AP, RS (AB 30:122 and 763, 1976)
17 Oct 1975	1	Santa Barbara Island, StB	LJ, KG (AB 30:128, 1976)
21 Oct 1973	1	Imperial Beach, SD	GSS (AB 28:109, 1974)
31 Oct 1987–1 Mar 1988	123	Acampo (Lodi), SJ	GE, DGY (AB 42:131 and 318, 1987)
8 Nov 1973–31 Jan 1974	85	Imperial Beach, SD	JD (AB 28:109 and 693, 1974)

Table 4 (Continued)

Date	Days[c]	Locality	Reference[d]
9–12 Nov 1978	4	Pt. Mugu State Park, VEN	TC (AB 33:216, 1979)
12 Nov 1978	1	Imperial Beach, SD	EC (AB 33:216, 1979)
16 Nov 1962	1	Imperial Beach, SD	GMc (McCaskie and Banks 1964)
27 Nov 1974	1	Near San Diego, SD	SW (AB 29:123, 1975)
9 Dec 1984–26 Jan 1985	49	Lake Perris, RIV	AMC (AB 39:211, 1985)
17 Dec 1978–10 Mar 1979	84	Imperial Beach, SD	EC (AB 33:315, 1979)
20 Dec 1969	1	Imperial Beach, SD	AFN 24:455, 1969
21 Dec 1968	1	Imperial Beach, SD	CSULB 3742; JS (AFN 23:522, 1969)
21 Dec 1984–23 Jan 1985	34	Goleta, StB	RAH (AB 39:211, 1985)
21 Dec 1985–15 Feb 1986	57	Acampo (Lodi), SJ	TM, ML (AB 40:327, 1986)
24–27 Dec 1979	4	San Pedro, LA	HF (AB 34:308, 1980)

[a]Abbreviations: *Localities*—LA, Los Angeles Co.; ORN, Orange Co.; RIV, Riverside Co.; SAC, Sacramento Co.; SD, San Diego Co.; SF, San Francisco Co.; SJ, San Joaquin Co.; SLO, San Luis Obispo Co.; StB, Santa Barbara Co.; VEN, Ventura Co. *References*—AB, Allyn Bissel; AMC, Alan M. Craig; AP, Arvill Parker; BB, Bruce Broadbrooks; BE, Barbara Elliott; BL, Barbara Lachina; BrB, Bryant Bainbridge; CD, Charles Drost; CSULB, California State University, Long Beach; DGY, David G. Yee; DP, Dennis Parker; DRW, Douglas R. Willick; EAC, Eugene A. Cardiff; EC, Elizabeth Copper; FRT, Fern R. Tainter; GE, Gil Ewing; GMc, Guy McCaskie; GSS, G. Shumway Suffel; HF, Hal Ferris; HK, Harry Krueger; IPL, Isabel P. Ludlum; JC, Jim Coatsworth; JD, Jon Dunn; JP, J. Pennimon; JS, Jay Sheppard; JWD, John W. DeWitt; KG, Kimball Garrett; LJ, Lee Jones; ML, Mike Lippsmeyer; MO, Marty Orell; MVZ, Museum of Vertebrate Zoology, University of California, Berkeley; PJ, Paul Jorgensen; PK, Pat Kelly; PL, Paul Lehman; RAH, Robb A. Hamilton; RMW, Russ and Marion Wilson; RS, Rich Stallcup; SDR, Steve and Diane Ross; SW, Susan Wise; TC, Terry Clark; TM, Tim Manolis.

[b]All obserations are of single birds.

[c]Number of consecutive days between the first and last observations at a location.

[d]References to *American Birds* (AB) or *Audubon Field Notes* (AFN) are not included in the Literature Cited.

We also discovered a previously unreported population of Bendire's Thrashers southeast of Essex along the Old Woman Mountains transect (Table 5; Figure 3). In 1986 and 1987, we detected the species at 10 of 13 sample points above an elevation of 850 m. On the adjacent Ward Valley transect, we found three birds in this elevational range on the south side of the Piute Mountains (Table 5). The habitat in the Old Woman and Piute mountains lacked Joshua Trees but had fairly dense stands of Mojave Yucca and other succulents. The thrasher population apparently extended from the south side of the Piute Mountains at least to the center of the Old Woman Mountains.

We did not locate Bendire's Thrashers along either the California Valley or the Kingston Mountains transects (Table 5). The plant species composition appeared to be suitable for the thrasher at both sites, but the soil in California Valley was rocky desert pavement and the topography along the Kingston Mountains transect was extremely steep with rocky soils.

Southern Mojave Desert. Historical breeding-season records for this portion of the Mojave Desert are centered around three general locations: Lucerne Valley/Victorville, Yucca Valley/Pioneertown, and Joshua Tree National Monument (JTNM). We located five historical records of Bendire's Thrashers in the Lucerne Valley/Victorville area (Tables 1 and 2), including the first two verified nestings reported in California, but the species has been recorded in this area only twice since 1920 (Table 1). We found only one historical record that confirmed breeding in the Yucca Valley/Pioneertown area (Table 2), but breeding in this area is also suggested by irregular and repeated observations of birds in apparently suitable habitat (Table 1). Our literature review yielded eight historical records for JTNM (Tables 1 and 2); three records confirmed breeding by Bendire's Thrashers in JTNM (Table 2), where the species is considered to be scarce (McCaskie 1973) or occasional (Miller and Stebbins 1964).

In 1986 and 1987, we conducted song playback surveys on four transects in the Lucerne Valley/Victorville area (Table 5; Figure 1). We did not find Bendire's Thrashers on the Stoddard Mountain transect, where the species was reported on 22 May 1969 (Table 1; Figure 1), or on the nearby Goat Mountain transect (Table 5). Both transects were through areas with either Joshua Trees or Mojave Yucca, but the Stoddard Mountain area had been heavily used by off-road vehicles, and the soil at Goat Mountain was very rocky. At both sites, the habitat had widely spaced Joshua Trees, Mojave Yucca, and Creosote Bush (*Larrea tridentata*) with few other shrubs and only sparse annual growth. We did locate Bendire's Thrashers both years on the Sidewinder Mountain and Apple Valley transects (Table 5). The habitat in southeastern Apple Valley was a relatively rich mixture of Joshua Trees and cholla cactus. The area has been partially developed, and houses were scattered along the transect. The Sidewinder Mountain transect crossed an undeveloped area with few obvious signs of human use. The habitat was a diverse mixture of shrubs with numerous Joshua Trees, Mojave Yucca, and cholla cactus.

Table 5 Bendire's Thrasher Detections on Transects in the Mojave and Colorado Deserts during the 1986–87 Surveys[a]

Transect (Abbreviation)	1986			1987			Cumulative	
	Sample Points	Points with Thrashers	Birds Detected	Sample Points	Points with Thrashers	Birds Detected	Sample Points	Points with Thrashers
Eastern Mojave Desert								
Cima Dome (CD)[b]	12	7	10	12	2	2	12	8
California Valley (CV)	11	0	0	—	—	—	11	0
Clark Mountain (CM)	12	7	9	—	—	—	12	7
Halloran Summit (HS)[b]	10	5	5	10	5	6	10	7
Kingston Mountains (KM)	11	0	0	—	—	—	11	0
Lanfair Valley (LV)[b]	27	9	11	29	11	15	29	13
Old Woman Mountains (OW)	16	9	12	17	5	9	19	10
Providence Mountains (PM)[b]	22	8	9	11	4	5	22	8
Shadow Valley (SV)	12	4	7	—	—	—	12	4
Ward Valley (WV)	16	3	3	—	—	—	16	3
Southern Mojave Desert								
Apple Valley (AV)	13	1	1	17	3	5	17	4
Goat Mountain (GM)	6	0	0	8	0	0	6	0
Joshua Tree National Monument (JT)	41	17	19	—	—	—	41	17
Landers (LA)	8	0	0	20	3	3	20	3
Pipes Canyon (PC)	6	0	0	15	2	2	15	2
Sidewinder Mountain (SI)	10	3	5	10	2	2	10	3
Stoddard Mountain (ST)	10	0	0	10	0	0	10	0
Yucca Valley (YV)	6	0	0	—	—	—	6	0
Central Mojave Desert								
Copper City Road (CR)	11	3	4	—	—	—	11	3
Goldstone (GS)	3	0	0	—	—	—	3	0
Western Mojave Desert								
Alpine Butte (AB)	19	0	0	15	0	0	19	0
Baldy Mesa (BM)	7	0	0	—	—	—	7	0
Beekley Road (BR)	9	0	0	9	0	0	9	0

Table 5 (Continued)

Transect (Abbreviation)	1986 Sample Points	1986 Points with Thrasher	1986 Birds Detected	1987 Sample Points	1987 Points with Thrashers	1987 Birds Detected	Cumulative Sample Points	Cumulative Points with Thrashers
Butterbread Spring (BS)	28	0	0	17	1	1	28	1
County Line (CL)	8	0	0	8	0	0	8	0
Freeman Canyon (FC)	8	0	0	—	—	—	8	0
Graham Canyon (GC)	10	0	0	10	0	0	10	0
Mojave (MO)	7	0	0	—	—	—	7	0
Mojave River (MR)	5	0	0	5	0	0	5	0
Oak Spring Ranch (OS)	7	0	0	7	0	0	7	0
Pinyon Hills (PH)	5	0	0	5	0	0	5	0
Rosamond Hills (RH)	8	0	0	—	—	—	8	0
Saddleback Butte (SB)	18	0	0	18	0	0	18	0
Shadow Mountains (SH)	5	0	0	5	0	0	5	0
Soledad Mountain (SO)	6	0	0	—	—	—	6	0
Tehachapi (TE)	2	0	0	—	—	—	2	0
Northern Mojave Desert								
Centennial Flat (CF)	10	0	0	10	0	0	10	0
Lee Flat (LF)	16	3	3	16	6	9	16	7
Santa Rosa Flats (SF)	—	—	—	10	0	0	10	0
Santa Rosa Mines Road (SM)	—	—	—	6	0	0	6	0
Colorado Desert								
Chemehuevi Wash (CW)	2	0	0	—	—	—	2	0
Havasu Lake Road (HL)	9	0	0	—	—	—	9	0
Turtle Mountains (TM)	10	0	0	—	—	—	10	0
Vidal Wash (VW)	6	0	0	—	—	—	6	0

[a]Subdivisions and boundaries of the Mojave Desert are illustrated in Figures 1 and 3. The locations of transects are illustrated in Figure 1.
[b]Within the area previously recognized as the primary range of Bendire's Thrasher in the eastern Mojave Desert.

In the Yucca Valley/Pioneertown area, we conducted surveys on three transects in 1986 and on two in 1987 (Table 5; Figure 1). Bendire's Thrashers were not observed on the Yucca Valley transect; this transect crossed a heavily developed residential area with scattered Joshua Trees on remaining undeveloped lots and as landscape plants around homes. We did not find Bendire's Thrashers on either the Landers or the Pipes Canyon transects in 1986, but did locate them on both in 1987 (Table 5). The number of points on each transect was increased in 1987 to include areas not sampled the first year, and in both cases the 1987 observations were at new points. Two birds observed on the Pipes Canyon transect were found near the intersection of Highway 247 and Pipes Wash, west of the Landers transect. Three birds observed on the Landers transect in 1987 were on the uplands due east of Pipes Wash. Thus both transects appeared to intersect the same small population of thrashers. All five locations with Bendire's Thrashers were in habitats with Joshua Trees and cholla cactus. The points in Pipes Wash also had large Catclaws (*Acacia greggii*), but the two birds observed there were at the edge of the wash on nearby hillsides. Mojave Yucca was common along the Landers transect, and houses were scattered along the route.

We used the playback technique to sample thrashers at 41 points along the JTNM transect in 1986 (Table 5; Figure 1) and found the thrasher to be much more common than expected. We located birds at 17 points, and 13 of the points where we did not find them were at low elevations in the Colorado Desert either in Pinto Basin or south of the Cottonwood Pass entrance to JTNM. The habitat at most sites occupied by the thrasher had relatively dense stands of Mojave Yucca and few or no Joshua Trees.

Central Mojave Desert. Bendire's Thrashers were first reported from this region in 1981 at a site west of Lane Mountain near Superior Valley (Table 1), and breeding was confirmed there in 1981 and 1982 (Table 2). We conducted song playback surveys in Superior Valley along Copper City Road and near Goldstone in 1986 and found three birds in Superior Valley (Table 5). Both sites were relatively small, isolated stands of Joshua Tree woodland.

Western Mojave Desert. Our literature review documented three historical breeding-season records of Bendire's Thrashers in the western region of the Mojave Desert (Table 1). Two were early April observations of probable migrants. The other was a mid-June sighting of a singing male in Joshua Tree woodland in Kelso Valley on the eastern slope of the Sierra Nevada west of Red Rock Canyon State Park. Breeding in Kelso Valley was confirmed in 1987 (Table 2).

Much of the western Mojave Desert supports Joshua Tree woodland that appears suitable for Bendire's Thrashers, but observations of birds are curiously lacking. Therefore, we concentrated much of our effort in this region, sampling 152 points on 16 transects in 1986 and 99 points on 10 transects in 1987 (Table 5). Despite this intense effort, we located only one Bendire's Thrasher (Table 5). This silent individual was seen on 11 May 1987 in upper Butterbread Canyon, one ridge east of Kelso Valley. The Butterbread Spring transect included sample points in Kelso

Valley, but we did not observe thrashers there. The breeding record for Kelso Valley and other observations in the area suggest that Bendire's Thrashers may breed either sparsely or sporadically in these and possibly other canyons on the southeastern slope of the Sierra Nevada northwest of Mojave (Figure 3), but are otherwise absent from the western Mojave Desert.

Northern Mojave Desert. Prior to our study, the only records of Bendire's Thrashers from this portion of the Mojave Desert were four observations of presumed migrants found between 23 May and 1 June (Table 1; Figure 3). These observations were recorded around Memorial Day in Death Valley National Monument and at Oasis Ranch in Fish Lake Valley. All were at desert oases regularly visited by bird watchers searching for vagrants.

We conducted song playback surveys for Bendire's Thrashers in Joshua Tree woodland along two transects in the northern Mojave Desert in 1986 and along four in 1987 (Table 5). The thrasher was present both years on the Lee Flat transect east of Lone Pine (Figure 3). Although breeding has not been confirmed there, it is strongly suggested by detections at 7 of 16 survey points in apparently suitable habitat, presence in 2 consecutive years, and unsolicited singing. Bendire's Thrashers were not found in similar vegetation at nearby sites.

Colorado Desert. Most historical breeding-season records of Bendire's Thrashers in the Colorado Desert were from the northern edges near the boundary with the Mojave Desert (Figure 3). The only exceptions were of single birds observed at Brock Ranch in southeastern Imperial County and at Palm Spring in Anza-Borrego Desert State Park (Table 1; Figure 3). Approximately 81% of all breeding-season records were between mid-March and May when they could have been of either locally breeding individuals or spring migrants (Tables 1 and 2). Garrett and Dunn (1981) regarded this species as transient in the Colorado Desert. We located four historical breeding records confirming that this species does breed in the Colorado Desert (Table 2; Figure 3). Garrett and Dunn (1981:280) reported "unsubstantiated reports of nesting on the creosote desert to the west of the Colorado R. between Needles and Blythe." The source of this statement may have been a figure illustrating the Arizona distribution of Bendire's Thrasher in *The Birds of Arizona* (Phillips et al. 1964) that indicated summer records exist in California for the area between Needles and Blythe. These observations were not mentioned in the accompanying account for the species. G. Monson and A. R. Phillips (pers. comm.) provided us with 19 records from the late 1940s and early 1950s supporting these observations (Tables 1 and 2), including two observations of juveniles north of Vidal Junction. These records, an egg set collected in the nearby Turtle Mountains (Table 2), and a February 1987 observation in Chemehuevi Wash of two birds including a singing male (Table 3), suggest at least sporadic nesting in Chemehuevi Valley and adjacent areas. The hypothesis that nesting in this region is sporadic is supported by the fact that Daniels (1979a,b) did not report Bendire's Thrashers during winter and breeding-bird surveys in Chemehuevi Wash.

In 1986, we conducted song playback surveys for Bendire's Thrashers on four transects in areas and habitats where birds had been reported but failed to locate any. We did find one Bendire's Thrasher near Chiriaco Summit in the Colorado Desert at the beginning of the JTNM transect (Figures 1 and 3). The habitat there was a dense and diverse stand of desert scrub visually dominated by Palo Verde (*Cercidium floridum*), Ocotillo (*Fouquieria splendens*), and cholla cactus.

Movement Patterns in California

An immature female Bendire's Thrasher collected on 21 June 1961 in pine–fir forest on Mt. Charleston, Clark Co., Nevada (Austin and Bradley 1965), indicates that movements away from breeding habitats begin immediately after the end of the breeding season. Birds seen during late May and early June in habitat not suitable for breeding may be late spring migrants, unsuccessful breeders, or post-breeding dispersers wandering away from breeding habitats (e.g., four records in the northern Mojave Desert, Table 1). Only 28 historical records exist for Bendire's Thrasher in either the Mojave or Colorado deserts between 1 August and 15 March (Table 3), and these include only six observations after 1 September in known breeding areas. Thus, existing records suggest that a few birds linger on the breeding grounds past August (Table 3). This number may be higher than currently documented because the birds are not vocal and are fairly secretive at this time of year, so may be easily missed, and few ornithologists or bird watchers visit the desert from July through February.

Most birds that breed in California presumably migrate southeast to wintering grounds in southern Arizona, southwestern New Mexico, Sonora, and Sinaloa (A.O.U. 1983). However, 53 historical California records of Bendire's Thrasher outside the Mojave and Colorado deserts (Table 4) demonstrate that some individuals move west or northwest from breeding areas in California or elsewhere. Nearly all records from the nonbreeding season (August through mid-March) and away from breeding areas are for sites close to the coast (Tables 3 and 4). Fall migrants first appear in coastal California in mid-July (Table 4; Figure 4), and coastal and desert records indicate that fall movements continue until October or early November. These migrants overlap with a few birds that spend all or part of the winter in California (Tables 3 and 4; Figure 4).

Over 35% of winter records for Bendire's Thrashers in California were of birds present for more than 10 days and could have been winter residents rather than migrants (Tables 3 and 4; Figure 4). Most remarkable were records of presumably the same birds that returned each winter to Courtland, Sacramento County, for 4 consecutive years and to Acampo, San Joaquin County, for 3 of 4 years (Table 4). After the first year they were reported, these birds were first observed each year between August and October and were last observed between mid-February and mid-April (Table 4). Other individuals repeatedly observed during the winter were usually last seen in early to mid-March (Tables 3 and 4), but a few lingered to mid-April (Table 4). Winter records at

Lancaster, the south end of the Salton Sea, and near Bard suggest that a few birds may winter in the California deserts. In view of the scarcity of winter records for the state, Bendire's Thrasher should be considered a rare and possibly sporadic winter resident in California.

Spring migration begins by February, when birds occasionally appear in the southern Colorado Desert (Table 3), and continues through April and May, when a few records exist for coastal California. The end of spring migration may overlap with movements by early post-breeding dispersers and unsuccessful breeders.

Habitat Relationships

Historical records of breeding Bendire's Thrashers in the eastern Mojave Desert all fall between 680 and 1708 m. We found birds from 575 m at Chiriaco Summit in the Colorado Desert to 1775 m on Lee Flat in the northern Mojave Desert. The typical lower elevational limit of probably breeding birds was approximately 950 m. Six possibly breeding birds were found between 800 and 925 m near the transition between the Mojave and Colorado deserts along either the JTNM, Ward Valley, or Old Woman Mountains transects. Two birds observed below 750 m were also along the JTNM and Ward Valley transects. All observations above 1525 m were either at Lee Flat or near Keys View in JTNM.

Our field surveys confirmed that Joshua Trees, Mojave Yucca, or Spanish Bayonet are at all Mojave Desert locations with probably breeding Bendire's Thrashers. The composition of the perennial shrub layer was highly variable. Dominant shrub species at most sites were Creosote Bush, Cheese Bush (*Hymenoclea salsola*), Nevada Squaw-tea (*Ephedra nevadensis*), Burro Bush (*Ambrosia dumosa*), and Big Galleta Grass (*Hilaria rigida*). In most cases, the shrubs were diverse, including California Buckwheat (*Eriogonum fasciculatum*), Spiny Hopsage (*Grayia spinosa*), Cooper Desertthorn (*Lycium cooperi*), Anderson Desertthorn (*L. andersonii*), ratany (*Krameria* sp.), Bladdersage (*Salazaria mexicana*), and goldenbush (*Happlopappus* sp.) as other common species.

Bendire's Thrashers also occurred where the vegetation consisted of Blackbrush (*Coleogyne ramosissima*) with scattered junipers (*Juniperus osteosperma*, *J. occidentalis*, or *J. californica*), Joshua Trees, and cholla cactus. Locations with this type of perennial vegetation included Halloran Summit, the road to Keys View in JTNM, and Clark Mountain near Keany Pass. Although the vegetation on Lee Flat had a sparse overstory of Joshua Trees, the understory differed from that at other sites, consisting primarily of Shadscale (*Atriplex confertifolia*), Spiny Hopsage, Winterfat (*Eurotia lanata*), and Spiny Menodora (*Menodora spinescens*). Historical records from higher elevations in the eastern Mojave Desert indicate that Bendire's Thrashers also breed in areas dominated by Big Sagebrush (*Artemisia tridentata*) with scattered junipers.

Desert washes dominated by Catclaw in the eastern Mojave Desert are typically considered the habitat of Crissal Thrashers (*Toxostoma dorsale*)

(e.g., Garrett and Dunn 1981). Historical records suggest that Bendire's Thrashers also use this vegetation, especially at lower elevations. We found Bendire's Thrashers in washes dominated by Catclaw on only three occasions, but at least two of these observations were of birds that apparently flew into the wash from adjacent habitat in response to the song playback.

CONCLUSIONS

Most Bendire's Thrashers leave breeding areas by the end of July; a few individuals may remain into August or later. Most migrants move to wintering grounds to the southeast. However, occasional individuals, from either California or elsewhere, move north and west and spend all or a portion of the winter in coastal California. Spring movements begin in February and early March, and singing birds begin to appear on the breeding grounds in late March and early April.

The eastern Mojave Desert near Cima Dome and Lanfair Valley and the southern Mojave Desert at JTNM are the two primary breeding areas for Bendire's Thrashers in California. However, this species is more widely distributed during the breeding season than previously recorded. The eastern Mojave population extends considerably farther to the north, east, and south than previously known and includes a newly discovered disjunct population in the Old Woman Mountains. Birds in JTNM are more widespread and the population appears to be more contiguous than generally recognized. Elsewhere in the Mojave Desert, Bendire's Thrashers are restricted to widely scattered locations supporting either Joshua Trees, other species of yuccas, or cholla cactus. Large tracts of desert, especially in the western Mojave Desert, support one or more of these plant species but lack populations of Bendire's Thrasher. The habitat variables limiting the distribution of this species have yet to be quantified with the detail necessary to understand its complex distribution. Observations over several years in Superior and Kelso valleys suggest that these small isolated populations are either permanent and previously undetected or persist only a few years. Additional studies could (1) locate new populations, (2) determine population sizes, and (3) establish whether small isolated populations are permanent or undergo regular extinction and recolonization. Bendire's Thrashers do breed very locally and sporadically in the Colorado Desert, where they are restricted to habitats with arborescent species such as Palo Verde. This type of habitat is similar to that occupied by this thrasher in Arizona. Research is needed to clarify the breeding distribution and habitat use of this species in the Colorado Desert.

ACKNOWLEDGMENTS

Partial funding was provided by the California Department of Fish and Game and Bureau of Land Management. Daniel W. Anderson served as project sponsor at the Department of Wildlife and Fisheries Biology, University of California, Davis. Daniel W. Anderson, Kristin H. Berry, Steven W. Cardiff, Gordon Gould,

Larry D. Foreman, Tim Manolis, J. V. Remsen, Jr., Charles van Riper III, Kent Smith, Philip Unitt, and Jerry Verner provided useful comments on either our initial study design or earlier drafts of this paper. Jay M. Sheppard shared his knowledge about the use of recorded songs to locate thrashers and helped us design the sampling protocol. Steven W. Cardiff, Alan M. Craig, Paul Mack, Bev McIntosh, Robert McKernan, Gale Monson, Allan R. Phillips, and Rick Saval provided information on recent records from their field notes. Karen English-Loeb prepared the original versions of Figures 1 and 3. Janet Williams prepared Figures 2 and 4 and revised Figures 1 and 3.

LITERATURE CITED

American Ornithologists' Union. 1983. Check-list of North American Birds. 6th ed. Am. Ornithol. Union, Washington, D.C.

Austin, G. T., and Bradley, W. G. 1965. Bird records from southern Nevada. Condor 67:445–446.

Bent, A. C. 1948. Life histories of North American nuthatches, wrens, thrashers, and their allies. U.S. Natl. Mus. Bull. 195.

Brown, H. 1901. Bendire's Thrasher. Auk 18:225–231.

Daniels, B. E. 1979a. Winter bird-population study 81. Palo verde desert wash. Am. Birds 33:42.

Daniels, B. E. 1979b. Breeding bird census 150. Palo verde desert wash. Am. Birds 33:94.

DeSante, D. F., and Ainley, D. G. 1980. The avifauna of the south Farallon Islands, California. Studies Avian Biol. 4.

Garrett, K., and Dunn, J. 1981. Birds of Southern California: Status and Distribution. Los Angeles Audubon Soc., Los Angeles.

Grinnell, J. 1915. A distributional list of the birds of California. Pac. Coast Avifauna 11.

Grinnell, J., and Miller, A. H. 1944. The distribution of the birds of California. Pac. Coast Avifauna 27.

Heller, E. 1901. Notes on some little-known birds of southern California. Condor 3:100.

Johnson, D. H., Bryant, M. D., and Miller, A. H. 1948. Vertebrate animals of the Providence Mountains area of California. Univ. Calif. Publ. Zool. 48:221–376.

McCaskie, G. 1973. The spring migration: Southern Pacific Coast region. Am. Birds 27:821.

McCaskie, R. G., and Banks, R. C. 1964. Occurrence and migration of certain birds in southwestern California. Auk 81:353–361.

McCaskie, G., Stallcup, R., and DeBenedictis, P. 1967. The distribution of certain Mimidae in California. Condor 69:310–311.

Miller, L. 1913. A specimen of Bendire Thrasher in the San Diegan Region. Condor 15:41.

Miller, A. H., and Stebbins, R. C. 1964. The Lives of Desert Animals in Joshua Tree National Monument. Univ. of Calif. Press, Berkeley.

Phillips, A., Marshall, J., and Monson, G. 1964. The Birds of Arizona. Univ. of Ariz. Press, Tucson.

Pierce, W. M. 1919. Another California record of the Bendire Thrasher. Condor 21:123.

Pierce, W. M. 1921. The Bendire Thrasher nesting in California. Condor 23:34.

Remsen, J. V., Jr. 1978. Bird species of special concern in California: an annotated list of declining or vulnerable bird species. Calif. Dept. Fish and Game, Wildlife Mgt. Branch Admin. Rept. 78-1.

Rosenberg, K.V., Ohmart, R.D., Hunter, W.C., and Anderson, B.W. In press. Birds of the Lower Colorado River Valley. Univ. of Ariz. Press, Tucson.

Sheppard, J. M. 1970. A study of the LeConte's Thrasher. Calif. Birds 1:85–94.

Stephens, F. 1919. Unusual occurrences of Bendire Thrasher, Fork-tailed Petrel and Western Goshawk. Condor 21:87.

Accepted 14 September 1989

APPENDIX

The locations of Bendire's Thrashers detected during the 1986–87 surveys are described below by region of the desert. Each transect name and abbreviation is followed by the date(s) of the survey(s) and the number of Bendire's Thrashers heard, observed, and the total detected. For example, the Cima Dome transect was surveyed on 28 April 1986; six Bendire's Thrashers were heard, seven were observed, and a total of 10 were detected. Only the points or portions of transects where the thrasher was detected are described. SB, San Bernardino County; RIV, Riverside County.

Eastern Mojave Desert

Cima Dome (CD)—(28 Apr 1986: 6, 7, 10; 21 May 1987: 2, 2, 2)—Cima Rd., SB; from 4.0 km SE of Interstate 15 to 3.5 km NW of Kessler Peak.

Clark Mountain (CM)—(28 Apr 1986: 9, 3, 9)—Transmission line road over Keany Pass on N side of Clark Mtn., SB; from 5.0 km NE of Excelsior Mine Rd. to 1.8 km E of Keany Pass.

Halloran Summit (HS)—(28 Apr 1986: 3, 5, 5; 21 May 1987: 4, 5, 6)—Graded dirt road beginning at Halloran Summit, SB, on S side of Interstate 15; proceeding NE for 3.5 km then SE for 5.5 km.

Lanfair Valley (LV)—(29 Apr 1986: 6, 6, 11; 19 May 1987: 6, 13, 15)—Ivanpah Rd., SB. One bird observed on N slope of New York Mtns., 6.5 km SE of Ivanpah. Remainder detected in Lanfair Valley from 11.0 km NNE of Cedar Canyon Rd. to 13.3 km N of Goffs.

Old Woman Mountains (OW)—(30 Apr 1986: 9, 9, 12; 17 May 1987: 6, 7, 9)—Sunflower Springs Rd., SB; from 13.2 km SE of Essex to 1.5 km NE of Sunflower Spring. Also, on ungraded road intersecting Sunflower Springs Rd. 0.7 km NNE of Weaver's Well for 2.6 km towards Willow Spring.

Providence Mountains (PM)—(29 Apr 1986: 6, 6, 9; 18 May 1987: 4, 3, 5)—Black Canyon Rd., SB; from 1.0 km SE of Hole-in-the-Wall, S for 6.8 km. Also, along transmission line road over Foshay Pass from 0.2 km E of the pass to the E for 5.4 km.

Shadow Valley (SV)—(28 Apr 1986: 7, 1, 7)—Excelsior Mine Rd., SB; from 9.6 km NNE of intersection with transmission line road over Keany Pass (Clark Mtn.) to the NNE for 6.4 km.

Ward Valley (WV)—(30 Apr 1986: 3, 2, 3)—Transmission line road E of Little Piute Mtns., SB; at Township 7N, Range 19E, NW 1/4 Section 29. Also, on pipeline road along SE side of Piute Mtns. at Township 7N, Range 18E, SE 1/4 Section 14 and SE 1/4 Section 15.

Southern Mojave Desert

Apple Valley (AV)—(4 Jun 1986: 0, 1, 1; 14 May 1987: 1, 5, 5)—Desert View Rd., SB; from 3.2 km W of High Rd. to 0.8 km W of Milpas Rd.

Joshua Tree National Monument (JT)—(2 May 1986: 12, 12, 19)—One bird on graded dirt road into Lost Palms Canyon, 1.5 km N of Chiriaco Summit, RIV. Cottonwood Springs Rd./Pinto Basin Rd., RIV; from 1.1 km SW of Cottonwood Spring to 1.3 km SSE of intersection with Black Eagle Mine Rd.; at National Park Service housing near Cottonwood Spring; and along dirt road from Pinto Basin Rd., NW for 7.2 km to Smoke Tree Wash at Township 4S, Range 11E, NW 1/4 Section 31. General vicinity of White Tank, Jumbo Rocks, and Ryan campgrounds, RIV, at the following locations: 4.7 km SE and 0.4 km SE of White Tank Campground; 5.5 km NE, 1.9 km NE, and 1.4 km NW of Jumbo Rocks Campground; and 1.2 km WNW of Ryan Campground. Also, on Salton View Rd. 1.3 km W of Keys View, RIV, and on Monument Rd. in SB at Township 1S, Range 7E, SW 1/4 Section 26.

Landers (LA)—(16 May 1987: 1, 3, 3)—Yucca Mesa Rd. 6.1 km N of Highway 62, and La Brisa Dr. 1.4 and 2.0 km W of Yucca Mesa Rd.

Pipes Canyon (PC)—(16 May 1987: 2, 1, 2)—Pipes Wash, SB; 0.4 km NW and 0.4 km SE of intersection of Highway 247 and Pipes Canyon Rd.

Sidewinder Mountain (SI)—(5 Jun 1986: 4, 4, 5; 15 May 1987: 1, 1, 2)—Ungraded road from Highway 247 over Sidewinder Mtn., SB, at the following locations: Township 6N, Range 1W, NW 1/4 Section 29; and Township 6N, Range 2W, NE 1/4 Section 26 and NW 1/4 Section 22.

Northern Mojave Desert

Lee Flat (LF)—(7 Jun 1986: 3, 1, 3; 9 May 1987: 9, 6, 9)—Saline Valley Rd., Inyo Co.; 2.4 km NE of intersection with White Mtn. Talc Rd. Also, along White Mtn. Talc Rd., Inyo Co.; from 2.7 km NW of intersection with Saline Valley Rd. NW for 5.1 km.

Central Mojave Desert

Copper City Road (CR)—(27 Apr 1986: 4, 1, 4)—Copper City Rd./Randsburg–Barstow Rd., SB; from 9.9 km NNW of intersection with Irwin Rd., NNW for 5.3 km.

Western Mojave Desert

Butterbread Spring (BS)—(11 May 1987: 0, 1, 1)—Graded dirt road through Butterbread Canyon, Kern Co.; one bird 6.9 km NW of Butterbread Spring at Township 29S, Range 35E, NW 1/4 Section 7.

Bendire's Thrasher, Acampo, California, 3 November 1989

Photo by David Yee

THE BIOLOGY OF THE WHITE-FACED IBIS IN IDAHO

DANIEL M. TAYLOR, CHARLES H. TROST, and BRYAN JAMISON,
Department of Biological Sciences, Idaho State University, Pocatello, Idaho 83209
(present address of Taylor: 2903 Greenvale Pl., Nampa, Idaho 83868; present address of Jamison: 121 E. South 6th, Grangeville, Idaho 83530)

The White-faced Ibis in the United States breeds west of the Mississippi River and south of the 45th parallel (A. O. U. 1983), with the majority nesting in the Great Basin states (Ryder 1967). Historically in Idaho, it has been considered a casual summer visitor and irregular breeder (Larrison et al. 1967, Ryder 1967, Burleigh 1972). In this paper we show that while there were very few records of the White-faced Ibis for the state until the early 1960s, numerous active nesting colonies in Idaho are now known. We also document and describe the foraging of thousands of postbreeding ibises on the extensive mudflats of American Falls Reservoir, which, unlike sites described elsewhere (Bray and Klebenow 1988), were used daily throughout late summer.

STUDY AREAS AND METHODS

We conducted a literature survey for all White-faced Ibis records in Idaho, and contacted biologists and managers at National Wildlife Refuges and state Wildlife Management Areas throughout southern Idaho for information about the ibis. We also used our observations from 20 years combined field experience in southern Idaho.

We made weekly counts of White-faced Ibises from mid-July through September at American Falls Reservoir, Snake River, Idaho, in 1986 and 1987. The southern half of this reservoir lies in Bannock and Power counties, the northern half in Bingham County. The reservoir is about 35 km long, 10 km wide at its widest point, and covers approximately 23,490 ha (58,000 acres) at full capacity. It fills an ancient lake bed formed during the Pleistocene Epoch and drained by the Bonneville Flood about 15,000 years ago. Although we censused a variety of areas and habitat types at American Falls Reservoir in conjunction with a shorebird study (unpublished), nearly all White-faced Ibises were found on the extensive mudflats where the Snake River enters the reservoir. These were the Springfield Bottoms, and their shoreline was constantly changing. This shoreline receded 3200 m during the late summer and fall of 1986 and nearly 15 km in the late summer and fall of 1987 because of dropping water levels in the reservoir. The Springfield Bottoms' shore length varied from 2 to several km, increasing as the reservoir receded. It became dissected into many areas by the braiding of the Snake River channel and lesser streams at lower water levels. The substrate was a very soft and deep mud (researchers consistently sank from mid-calf to mid-thigh near the shore's edge). We sampled invertebrates, which we preserved in 10% formalin or 80% ethanol, by taking cores 10 cm deep. They were then sorted by sieving (0.82-mm mesh) and identified down to genus with a binocular dissecting scope. We recorded ibis behavior in instantaneous scans

38 times for 7 and 13 days, respectively, in 1986 and 1987. The times of these scans we picked somewhat arbitrarily, but scans were taken during all hours of day light.

HISTORICAL RECORDS

The White-faced Ibis was rarely recorded in Idaho until the late 1960s (Tables 1 and 2). Larrison et al. (1967) and Burleigh (1972) both considered it a casual visitor that might breed in the southern part of the state. It is possible that at least moderate breeding colonies have existed periodically in the state since its settlement by Europeans. The lack of records could be due to the nomadic nature of this ibis (Palmer 1962, Ryder 1967) and because few ornithologists worked in areas presently known to harbor colonies (Figure 1). However, the few early studies done indicate that White-faced Ibis were not common early in the state's history.

The only ornithologist to visit potential colony sites in Idaho during the 19th century (Merriam 1873, 1891) did not find any White-faced Ibises. The one probable early breeding record was at Minidoka (Figure 1), where Kenagy (1914) found the species abundant in 1911 and 1912 in the marshes behind the recently built Minidoka Dam. However, Davis (1935) failed to record it at the same location in the years 1919-1921 and saw just one bird in 1934. Levy (1950) found the ibis to be an uncommon late summer visitor during his travels throughout southern Idaho in 1949. It was not recorded at Gray's Lake National Wildlife Refuge (NWR) for three summers in the 1950s (Steel and Bizeau 1956), and only one was recorded in 1961 at Camas NWR (Oring 1962).

BREEDING RECORDS

Definitely breeding White-faced Ibis were first found in Idaho in 1963 at Minidoka NWR (Wilbur 1976, USFWS 1985). Since the late 1970s colonies of up to a few hundred pairs have been found at several locations in southeastern Idaho (Table 1, Figure 1), and this species has become increasingly common. The 1600 breeding pairs at Bear Lake NWR, Market Lake, and Oxford Slough in 1984 (Table 1) represent a little over 20% of the estimated Great Basin population of 7500 pairs in that year (USFWS 1985). We have no data since that year for two of these areas, but the Bear Lake NWR population has grown in the ensuing years (Table 1), with a peak of 2600 in 1986. Southern Idaho has thus supported a large proportion of the country's breeding White-faced Ibis during the 1980s.

POSTBREEDING CONCENTRATIONS AT AMERICAN FALLS RESERVOIR

Nonbreeding White-faced Ibis in Idaho have been found from April to October, but all flocks of over 100 birds have been found in late summer or early fall (Table 2). Most of the large nonbreeding concentrations of White-faced Ibises have occurred at American Falls Reservoir (Table 2, Figure 2). In 1986 several hundred birds used these mudflats throughout August, and the population peaked at about 1600 in early September (Figure 2). The ibises'

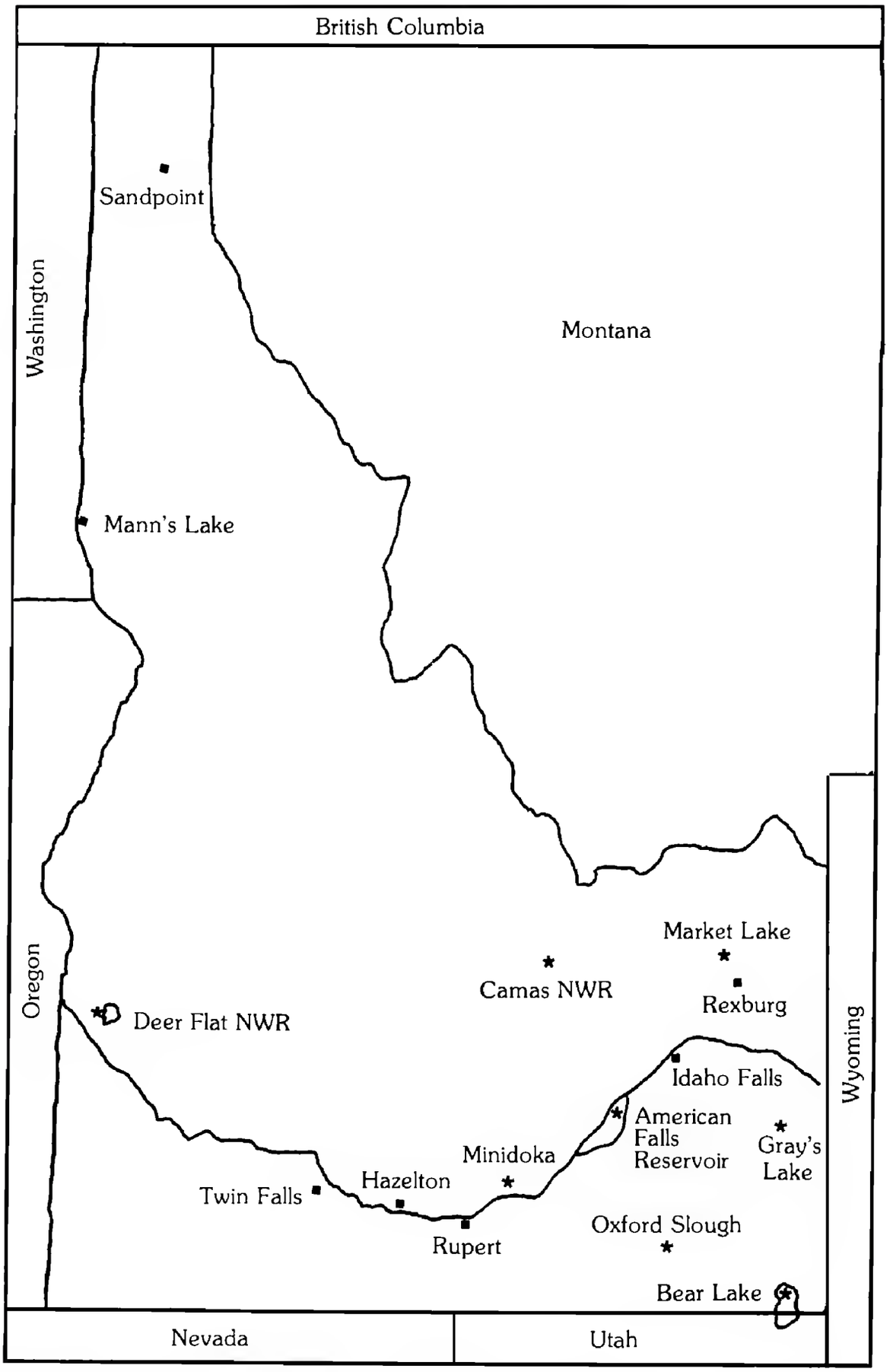


Figure 1. Locations where White-faced Ibises have been found in Idaho. There are also records near many of these locations. Asterisks, known or strongly suspected breeding colonies; squares, nonbreeding localities.

appearance that year coincided with the first exposure of mud by drawdown of the reservoir. In 1987 ibis numbers increased from several hundred in early July to a peak of 7400 in mid-August. There were at least 1000 ibises consistently using the mudflat from mid-July to early September, except during one count in early August (Figure 2). On that day large flocks were seen leaving the mudflat at dawn as we arrived to census. These counts do not represent all of the ibises using the reservoir since other areas with large mudflats, in particular the mouth of the Portneuf River, were not accessible to us during the two years.

Table 1 Breeding Records of the White-faced Ibis in Idaho

Location	Year	Number	Source[a]
American Falls	1979	400?	USFWS 1985
	1980	100+	AB 34:797, 1980
	1983	200 pairs	C. H. Trost (unpubl.)
Bear Lake NWR	1979	175 pairs	G. Deutscher (unpubl.)
	1980	120 pairs	G. Deutscher (unpubl.)
	1981	189 pairs	G. Deutscher (unpubl.)
	1982	150 pairs	G. Deutscher (unpubl.)
	1983	275 pairs	G. Deutscher (unpubl.)
	1984	700 pairs	G. Deutscher (unpubl.)
	1985	810 pairs	G. Deutscher (unpubl.)
	1986	2600 pairs	G. Deutscher (unpubl.)
	1987	1700 pairs	G. Deutscher (unpubl.)
Camas NWR	1977	209 pairs	USFWS 1985
	1978	209 pairs	USFWS 1985
	1980	16 adults	J. Richardson (unpubl.)
	1983	40 adults	J. Richardson (unpubl.)
	1986	50 adults	J. Richardson (unpubl.)
Deer Flat NWR	1970s	?	USFWS 1985
Gray's Lake NWR	1972	20 pairs	AB 27:91, 1972
	1973	20 pairs	USFWS 1985
	1986–7	?	E. Barney (unpubl.)
Market Lake NWR	1973–7	15 pairs	USFWS 1985
	1979	Substantial	AB 33:196, 1979
	1981	141 + young	C. H. Trost (unpubl.)
	1983	200 pairs	C. H. Trost (unpubl.)
	1984	458 pairs	USFWS 1985
Minidoka NWR	1963	23 nests	USFWS 1985
	1964	20 nests	S. R. Wilbur 1976
	1965	20 nests	R. A. Ryder 1967
	1977	15 nests	L. Peterson (unpubl.)
Oxford Slough	1977	150 pairs	USFWS 1985
	1979	150 pairs	USFWS 1985
	1983	125 pairs	C. H. Trost (unpubl.)
	1984	470 pairs	USFWS 1985

[a]AB, *American Birds*.

Because of drought in 1987, American Falls Reservoir never filled completely, unlike the previous year, and mudflats remained exposed through the summer. The reservoir experienced a large late-summer drawdown both years, but the 18 km of mudflat exposed in 1987 was far greater than the 3.2 km exposed in 1986. The earlier exposure of mud and greater degree of drawdown in 1987 may help explain the greater numbers of birds in that year. The drought of 1987 may have ruined other feeding areas, causing more birds to congregate at the reservoir.

At the Springfield Bottoms mudflats small to moderate (<100) flocks of White-faced Ibises would arrive and leave throughout the day, flock sizes similar to those observed in Nevada (Bray 1987). There were large numbers of birds on the mudflats throughout the day. The ibises concentrated along the main shoreline of the reservoir but were also found in nearby ephemeral pools, sloughs, and channels of feeder streams. The ibises either waded in shallow water or walked on the mud.

White-faced Ibises fed constantly while on the mudflats. The periodic scan-samples found ibises feeding 96% (7792/8106) of the time. Only 4% (314/8106) were preening or resting. Observations of individual birds that were preening or resting revealed that they usually soon returned to feeding. We never witnessed any agonistic interactions or kleptoparasitism between ibises.

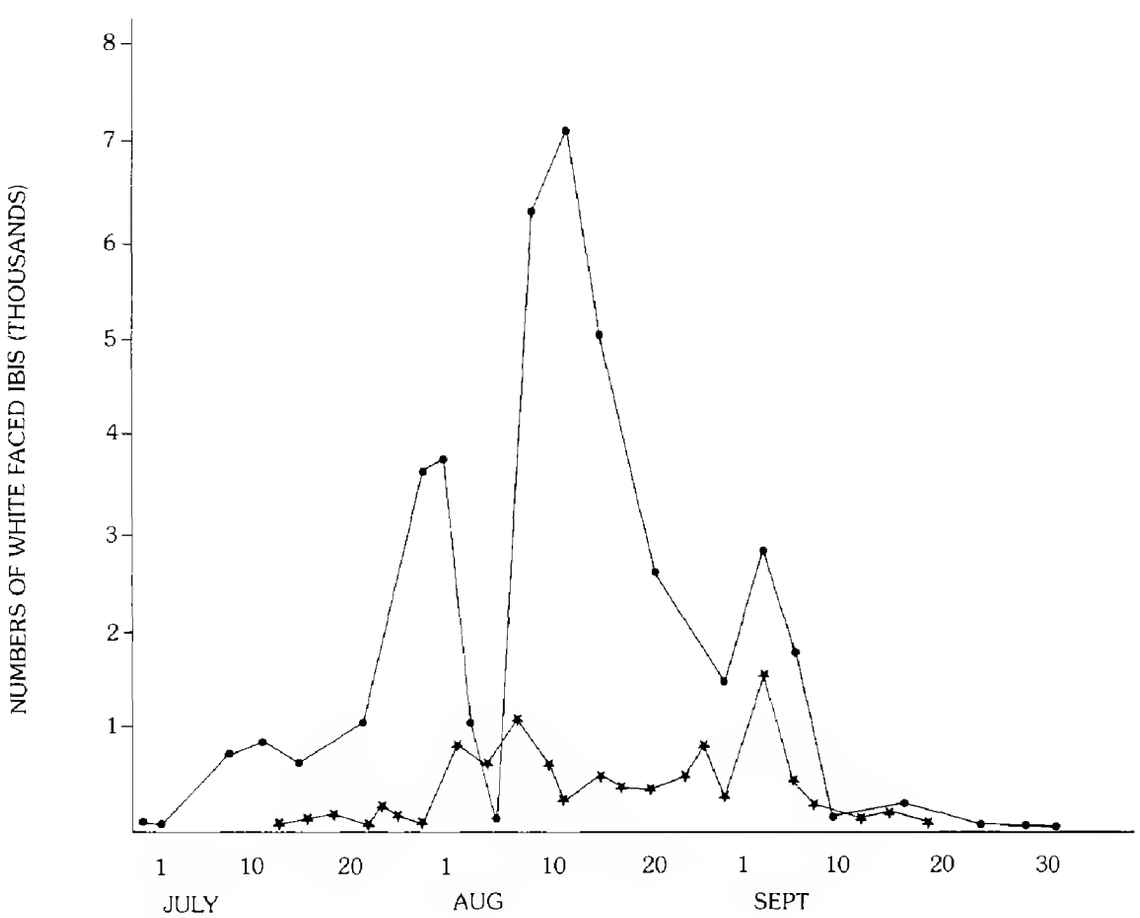


Figure 2. The number of White-faced Ibises on the extensive mudflats where the Snake River enters American Falls in 1986 (dots) and 1987 (small stars).

Sixty-four mud samples for invertebrates were taken on the Springfield Bottoms mudflats in both years. Total densities of invertebrates ranged from about 6000 to 25,000 per square meter during late summer. Only two invertebrate genera were common, the larva of a chironomid fly and a small (2-4 cm long, 1-2 mm diameter) oligochaete worm. We do not know if the ibises concentrated on one or both of these prey, but they are known to eat similar animals (Palmer 1962, Bray and Klebenow 1988).

Table 2 Nonbreeding Records of the White-faced Ibis in Idaho

Location	Year	Number	Source[a]
American Falls[b]	May 1968	Small groups	Pitcher (1968)
	Aug 1978	800	AB 33:196, 1979
	Aug 1979	97	AB 34:182, 1980
	Sep 1982	40	D. M. Taylor (unpubl.)
	Sep 1983	383	D. M. Taylor (unpubl.)
Burley	Aug 1986	346	D. M. Taylor (unpubl.)
	Aug 1987	40	D. M. Taylor (unpubl.)
Camas NWR	1960s	Small groups	Ryder (1967)
Deer Flat NWR	Jun 1932	?	Burleigh (1972)
	Aug 1950	450	AFN 4:253, 1950
	1951	?	AFN 5:30, 1951
	1961	Common	Ryder (1967)
	May 1978	15	AB 32:1033, 1978
	Aug 1979	75	AB 34:182, 1980
Hazelton	1949	Uncommon	Levy (1950)
Idaho Falls	Aug 1987	20	D. M. Taylor (unpubl.)
Mann's Lake	Aug 1977	1	AB 34:911, 1980
	May 1987	2	AB 41:463, 1987
Minidoka NWR	1909	Rare	Kenagy (1914)
	1910-1	Common	Kenagy (1914)
	1912-3	Abundant	Kenagy (1914)
	Jun 1934	1	Davis (1935)
	Jul 1958	2	Burleigh (1972)
	Apr 1974	11	AB 28:828, 1974
	Aug 1974	28	AB 29:89, 1975
	Sep 1976	45	AB 31:200, 1977
	May 1977	62	AB 31:1024, 1977
	May 1979	50	AB 32:1033, 1979
	1980	15-25	USFWS (1985)
Rexburg	Jul 1977	50	AB 31:1162, 1977
Sandpoint	Oct 1909	1	Sloanaker (1925)
Twin Falls	May 1979	1	Brown (1981)

[a]AB, *American Birds*; AFN, *Audubon Field Notes*.
[b]Does not include 1986 and 1987, see Figure 2.

The consistent daily use of the Springfield Bottoms mudflats throughout the late summer in both years varies dramatically from the patterns found in the other major study of the White-faced Ibis' foraging (Bray and Klebenow 1988) and our own limited observations at other locations in southeastern Idaho. Bray and Klebenow (1988), in the Lahontan Valley, Nevada, found these birds using recently flooded agricultural fields, primarily of alfalfa, for only one or two days while the soil was soft and muddy from irrigation. Our observations of feeding ibises in Idaho away from American Falls Reservoir were in flooded fields and pastures or rarely marshes where birds also fed for only one or a few days. The very large concentration of ibises at American Falls Reservoir was probably due to the constant supply of food in a soft, muddy substrate, which was continually being renewed as the reservoir's water level dropped. Such a favorable food supply in late summer would be highly sought by ibises to replenish fat reserves, which are reduced 70% during the breeding season (Capen and Leikers 1979), and to prepare for fall migration.

CAUSES OF RECENT POPULATION INCREASES IN IDAHO

The recent increase of White-faced Ibises in southeastern Idaho may be due to excessive flooding of the major colonies in Utah caused by the Great Salt Lake rising in the early and mid 1980s (G. Deutscher pers. comm.). This flooding was thought possibly to explain the recent increase of ibises at Lahontan Valley, Nevada (Bray 1987), and would be consistent with the recent increases of this ibis at Malheur NWR in southeastern Oregon (Ivey et al. 1988) and an extralimital breeding record in Iowa (Dinsmore and Dinsmore 1987).

Another explanation is that White-faced Ibis population have increased greatly in the last decade, allowing this species to colonize new areas. The White-faced Ibis population in northern Utah approximately doubled in the late 1970s (Steele 1984), and populations at Malhuer NWR have also been very productive recently (Ivey et al. 1988). This increase could be due to the higher water levels and flooding of the early 1980s in the Great Basin and/or recovery from reduced productivity in the 1970s caused by DDT and its residuals (Capen 1977, Steele 1984). Another possibility is that ibis populations in Idaho naturally fluctuate greatly and chaotically, and past peaks were unrecorded because of the lack of observers.

CONCLUSIONS

This nomadic species' population fluctuates between years and colonies (USFWS 1985) and has decreased drastically enough in the past for this ibis to be considered eligible for the United States Endangered Species List (G. B. Herron pers. comm. to Bray 1987). Because of this, the several areas in southeastern Idaho known to be heavily used by the White-faced Ibis need to be protected and managed for them. One important management act would be to have water drawn down at American Falls Reservoir early enough to expose mudflats at the Springfield Bottoms by early July. Management for this species in Idaho would increase the overall population and in-

crease the likelihood of survival of the Great Basin population if disaster strikes the traditional large populations of the Great Salt Lake, Malheur NWR, and the Lahontan Valley (USFWS 1985).

SUMMARY

There are few records and no confirmed breeding of White-faced Ibis in Idaho before the early 1960s, although this may be due to lack of observers. Numbers of birds have increased greatly since then, and in the 1980s a significant portion of the United States population nested in Idaho, including over 20% of the Great Basin population in 1984. Thousands of post-breeding White-faced Ibises congregated in late summer of 1986 and 1987 where the Snake River enters American Falls Reservoir. Here they fed throughout the day on the extensive mudflats, apparently capturing chiromonid larvae and/or small oligochaetes.

ACKNOWLEDGMENTS

We thank the Nongame Program of the Idaho Fish and Game Department and the U.S. Fish and Wildlife Service for partially funding this study. G. Deutscher, L. Peterson, M. Luther, E. Barney, C. Groves, J. Richardson, and personnel of the Southeast Idaho Wildlife Refuges Complex provided many records. B. North made Figure 1. The manuscript was improved greatly by commentary by J. Marks, G. Ivey, S. Bouffard, and an anonymous reviewer.

LITERATURE CITED

Bray, M. P. 1987. Feeding ecology of White-faced Ibis in a Great Basin Valley. M. S. thesis, Univ. Nevada, Reno.

Bray, M. P., and Klebenow, D. A. 1988. Feeding ecology of White-faced Ibis in a Great Basin Valley, USA. Colonial Waterbirds 11:24-31.

Brown, C. G. 1981. Salmon Falls Division Project Wildlife Study Final Report, Water and Power Resources Service, U.S. Dept. Interior Report No. 7-07-10-50022.

Burleigh, T. D. 1972. Birds of Idaho. Caxton, Caldwell, ID.

Capen, D. E. 1977. The impact of pesticides on the White-faced Ibis. Ph. D. dissertation. Utah State Univ., Logan

Capen, D. E., and Leiker, T. J. 1979. DDE residues in blood and other tissues of White-faced Ibis. Environmental Pollution 19:163-176.

Davis, W. B. 1935. An analysis of the bird population in the vicinity of Rupert, Idaho. Condor 37:233-238.

Dinsmore, S., and Dinsmore, J. S. 1987. White-faced Ibis nesting in Dickinson County. Iowa Bird Life 56:120-121.

Ivey, G. L., Stern, M. A., and Carey, C. G. 1988. An increasing White-faced Ibis population in Oregon. W. Birds 19:105-108.

Kenagy, F. 1914. A change in fauna. Condor 16:120-123.

Larrison, E. J., Tucker, J. L., and Jollie, M. T. 1967. A guide to Idaho birds, J. Ida. Acad. Sci. 5:1-220.

Levy, S. H. 1950. Summer birds in southern Idaho. Murrelet 31:2-8.

Merriam, C. H. 1873. Birds, in Sixth Annual Report. Geological Survey of the Territories (F. Hayden, ed.), pp. 671-715. Washington, D.C.

Merriam, C. H. 1891. Results of a biological reconnaissance of south-central Idaho. N. Am. Fauna 5:1-108.

Oring, L. W. 1962. Observations on the birds of southeastern Idaho. Murrelet 43:40-50.

Palmer, R. H., Ed., 1962. Handbook of North America Birds. Vol. 1. Yale Univ. Press, New Haven, CT.

Pitcher, K. W. 1968. Birds of Fort Hall Bottoms. M. S. Thesis, Idaho State Univ., Pocatello.

Ryder, R. A. 1967. Distribution, migration, and mortality of White-faced Ibis (*Plegadis chihi*) in North America. Bird-Banding 38:257-277.

Sloanaker, J. L. 1925. Notes from Spokane. Condor 27:73-74.

Steel, P. E., and Bizeau, E. G. 1956. Annotated list of the avifauna in and around Gray's Lake, Idaho. Murrelet 37:4-10.

Steele, B. B. 1984. Effects of pesticides on reproductive success of White-faced Ibis in Utah, 1979. Colonial Waterbirds 7:80-87.

U.S. Fish and Wildlife Service. 1985. White-faced Ibis management guidelines; Great Basin population. USFWS, Portland, OR.

Wilbur, S. R. 1976. New seasonal and distributional records of Idaho birds.. Murrelet 57:32-34.

Accepted 18 October 1989

NOTES

SIGHTINGS OF THE LAYSAN ALBATROSS IN THE NORTHERN GULF OF CALIFORNIA, MEXICO

MICHAEL W. NEWCOMER, Moss Landing Marine Laboratories, Moss Landing, CA 95039 (present address: 22371 Hartman Drive, Los Altos, CA 94024)

GREGORY K. SILBER, Institute of Marine Sciences, University of California, Santa Cruz, CA 95064

The Laysan Albatross, *Diomedea immutabilis*, the most abundant species of albatross in the north Pacific (Pitman 1985), has recently expanded its breeding range into the eastern Pacific. In May 1986, adults with chicks were discovered on Isla Guadalupe, 230 miles west of Baja California, Mexico (Dunlap 1988), with nesting continuing there at least through 1988 (Oberbauer et al. 1989). Courtship has also been reported at two other sites off Mexico: Alijos Rocks, 185 miles west of Baja California (Pitman 1985), and Isla San Benedicto, in the Islas Revillagigedo, about 230 miles south of the southern tip of Baja (Pitman 1988).

To date, only one account of the Laysan Albatross in the Gulf of California has been published: a single bird seen 5 May 1982, east of Cabo San Miguel, Baja California Norte (Wilbur 1987). Here we provide additional records gathered during fieldwork in the northern Gulf of California.

Each spring from 1986 to 1988 we conducted surveys for the Gulf of California Harbor Porpoise, *Phocoena sinus*, in the northern quarter of the Gulf of California. We used an 8-meter Boston Whaler to visually search 1072 nautical miles north of 30°N (see Silber 1990).

On 23 April 1987, we saw a single Laysan Albatross at 31°16′N, 114°48′W, about 13.5 miles north of San Felipe, Baja California Norte. Two days later, we saw the same or a second bird at 30°53′N, 114°27′W, near a surface slick of oil created by the bloated carcass of a dead Fin Whale, *Balaenoptera physalus*. The slick had also attracted other procellariiforms: Northern Fulmars, *Fulmarus glacialis*, Pink-footed and Sooty Shearwaters, *Puffinus creatopus* and *P. griseus*, and Black and Least Storm-petrels, *Oceanodroma melania* and *O. microsoma*. On 12 April 1988, we again observed a Laysan Albatross at 30°58′N, 114°24′W, about 10 miles southeast of Roca Consag.

There have been several prior records of Laysan Albatrosses occurring in the inland southwest United States. Dunn and Unitt (1977) and McCaskie (1984b) have surmised that these records were the result of Laysan Albatrosses flying north through the Gulf of California and continuing north after they reached the head of the Gulf. Both records for Arizona were from near Yuma, just north of the Gulf along the Colorado River (Monson and Phillips 1981, Rosenberg and Stejskal 1988). All Laysan Albatrosses seen in interior southern California have occurred near, or to the northwest of, the Salton Sea (McCaskie 1984a,b, 1985), an area that has attracted other marine birds from the Gulf. Our sightings are consistent with the above records, all of which are for the spring and summer months.

The expansion of breeding Laysan Albatrosses into the eastern Pacific led McCaskie (1988) to predict that their numbers off California can be expected to increase. The species' occurrence will, no doubt, also increase in the Gulf of California, and it may colonize islands there.

The Gulf of California Harbor Porpoise study was conducted under research permit numbers 301856, 300422, and 400036, issued by Mexico's Secretaría de Pesca. The study was supported by the Nature Conservancy, The American Cetacean Society (Los Angeles Chapter), and the Center for Marine Conservation. Logistical support was provided by the University of California, Santa Cruz, the Center for the Study of Deserts and Oceans, and the West Coast Whale Research Foundation. The paper was improved by comments from Robert Pitman and Steve Howell.

LITERATURE CITED

Dunlap, E. 1988. Laysan Albatross nesting on Guadalupe Island, Mexico. Am. Birds 42:180-181.

Dunn, J., and Unitt, P. 1977. A Laysan Albatross in interior southern California. W. Birds 8:27-28.

McCaskie, G. 1984a. The spring migration. Southern Pacific Coast region. Am. Birds 38:957-958; 960-963; 965-966.

McCaskie, G. 1984b. The nesting season. Southern Pacific Coast region. Am. Birds 38:1060-1063.

McCaskie, G. 1985. The spring season. Southern Pacific Coast region. Am. Birds 39:349-351.

McCaskie, G. 1988. The spring season. Southern Pacific Coast region. Am. Birds 42:480-483.

Monson, G., and Phillips, A. R. 1981. Annotated Checklist of the Birds of Arizona. 2nd ed. Univ. of Ariz. Press, Tucson.

Oberbauer , T. A., Cibit, C., and Lichtwardt, E. 1989. Notes from Isla Guadalupe. W. Birds 20:89-90.

Pitman, R. L. 1985. The marine birds of Alijos Rocks, Mexico. W. Birds 16:81-92.

Pitman, R. L. 1988. Laysan Albatross breeding in the eastern Pacific—and a comment. Pacific Seabird Group Bull. 15:52.

Rosenberg, G. H., and Stejskal, D. 1988. The nesting season. Southwest region. Am. Birds 42:1324-1328.

Silber, G. K. 1990. Occurrence and distribution of the vaquita, *Phocoena sinus*, in the northern Gulf of California. Fishery Bull. 88: in press.

Wilbur, S. R. 1987. Birds of Baja California. Univ. of Calif. Press, Berkeley.

Accepted 11 October 1989

FIRST RECORD OF A PURPLE GALLINULE IN WYOMING

GREGORY D. JOHNSON, Department of Zoology and Physiology, University of Wyoming, Laramie, Wyoming 82071 (present address: Wildlife International, Ltd., 305 Commerce Drive, Easton, Maryland 21601)

On 23 September 1986, I collected a juvenile male Purple Gallinule (*Porphyrula martinica*) near Leazenby Lake, located in Albany County approximately 13 km south of Laramie, Wyoming, on the east side of U.S. Route 287. Leazenby Lake lies in a high (elevation 2240 m) grassy basin between the Laramie and Snowy ranges. According to Wyoming Game and Fish Department records (S. A. Ritter, Wyoming Game and Fish Department nongame bird biologist, pers. comm.), this specimen represents the first Purple Gallinule documented in the state of Wyoming.

The bird was found dead beneath a cottonwood (*Populus* sp.) tree after a strong wind storm. A necropsy indicated the bird died of trauma (E. S. Williams, D.V.M., Wyoming State Veterinary Laboratory, pers. comm.) possibly caused by a collision in flight with the cottonwood tree or some other object. The necropsy also revealed that bird had been feeding on smartweed (*Polygonum* sp.) seeds shortly before its death. The bird's identification was verified from the specimen by W. R. Eddleman, currently Professor of Wildlife Biology at the University of Rhode Island, and from a photograph of the specimen by S. A. Ritter.

A study skin of the bird has been deposited in the Department of Zoology and Physiology Museum, University of Wyoming. The specimen was a light buffy brown overall, with a bluish-green tinge on the wings and back. There were no white streaks on the flanks as there are on the Common Gallinule or Moorhen (*Gallinula chloropus*). The bill and feet were olive colored. Measurements taken are as follows (W. R. Eddleman pers. comm.): weight, 150 grams; total length, 310 mm; wing chord, 173 mm; tarsus, 62.0 mm; tail, 56.0 mm; middle toe, 60.5 mm, culmen, 43.0 mm; bursa of Fabricus, 14.0 mm deep × 3.7 mm wide.

In the continental United States, the Purple Gallinule is normally confined to the southeastern states. However, its presence in Wyoming is not a complete surprise. The American Ornithologists' Union (1983, Check-list of North American Birds, 6th ed., A. O. U., Washington, D.C.) reports that the Purple Gallinule "wanders widely but irregularly north," and the species has been recorded in some of the states surrounding Wyoming, namely, Utah, Colorado, and South Dakota.

I thank William R. Eddleman and Sharon A. Ritter for verifying the specimen's identification. William R. Eddleman also prepared the museum specimen and provided measurements of the bird. Elizabeth S. Williams conducted a thorough necropsy of it. Douglas B. Inkley and William R. Eddleman provided helpful comments on a draft of this note.

Accepted 11 October 1989

Volume 20, Number 3, 1989

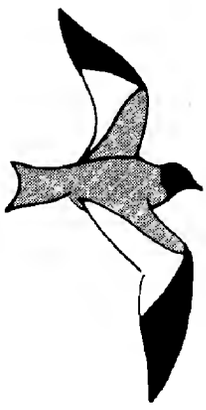
Cover photo by ©W. Edward Harper, of Sacramento, California: Rough-legged Hawk *(Buteo lagopus)*, Gardinerville, Nevada, 10 January 1988.

Western Birds solicits papers that are both useful to and understandable by amateur field ornithologists and also contribute significantly to scientific literature. The journal welcomes contributions from both professionals and amateurs. Appropriate topics include distribution, migration, status, identification, geographic variation, conservation, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, and techniques for censusing, sound recording, and photographing birds in the field. Papers of general interest will be considered regardless of their geographic origin, but particularly desired are reports of studies done in or bearing on the Rocky Mountain and Pacific states and provinces, including Alaska and Hawaii, western Texas, northwestern Mexico, and the northeastern Pacific Ocean.

Send manuscripts to Philip Unitt, 3411 Felton Street, San Diego, CA 92104. For matter of style consult the *Suggestions to Contributors to Western Birds* (8 pages available at no cost from the editor) and the *Council of Biology Editors Style Manual* (available for $24 from the Council of Biology Editors, Inc., 9650 Rockville Pike, Bethesda, MD 20814.

Reprints can be ordered at author's expense from the Editor when proof is returned or earlier.

Good photographs of rare and unusual birds, unaccompanied by an article but with caption including species, date, locality and other pertinent information, are wanted for publication in *Western Birds*. Submit photos and captions to Photo Editor.



WESTERN BIRDS

Vol. 20, No. 4, 1989

Waterbirds at Point Reyes

WESTERN BIRDS

Quarterly Journal of Western Field Ornithologists

Membership dues, for individuals and institutions, including subscription to *Western Birds:* Patron, $1000; Life, $250; Supporting, $50 annually; Contributing, $25 annually; Regular, $14 U.S. ($17 outside U.S.) annually. Dues and contributions are tax-deductible to the extent allowed by law.

Send membership dues, changes of address, correspondence regarding missing issues, and orders for back issues and special publications to the Treasurer. Make checks payable to Western Field Ornithologists.

Back issues of *California Birds/Western Birds:* $15 per volume, $4.00 for single issues. Xerox copies of out of print issues (Vol. 1, No. 1; Vol. 2, Nos. 1 and 4; Vol. 6, No. 2): $4.50 each. *Checklist of the Birds of California:* $2.00 each, 10 or more $1.50 each. *Pelagic Birds of Monterey Bay, California:* $2.50 each, 10 or more $2.00 each, 40 or more $1.50 each. All postpaid.

Published July 31, 1990 ISSN 0045-3897

WESTERN BIRDS

Volume 20, Number 4, 1989

SEASONAL ABUNDANCE OF WATERBIRDS AT POINT REYES: A COASTAL CALIFORNIA PERSPECTIVE

W. DAVID SHUFORD, GARY W. PAGE, JULES G. EVENS, and LYNNE E. STENZEL, Point Reyes Bird Observatory, 4990 Shoreline Highway, Stinson Beach, California 94970

Numerous studies undertaken since 1940 document seasonal abundance patterns of aquatic birds in California wetlands. Many of these studies focus only on shorebirds at a single site (e.g., R. W. Storer 1951, Recher 1966, Jehl and Craig 1970, and Gerstenberg 1972) but together they span the length of the state from San Diego Bay (Jehl and Craig 1970) to Humboldt Bay (Gerstenberg 1972). The most ambitious shorebird census study is that of Jurek (1972, 1973, 1974), who used volunteer observers to count shorebirds in wetlands throughout the state. State and federal agencies have also conducted waterfowl censuses throughout California. Some researchers have attempted to quantify the seasonal abundance patterns of all aquatic birds in wetland habitat: Gerdes (1970) at Morro Bay, Winkler et al. (1977) at Mono Lake, Bollman et al. (1970) and Gill (1972a) in San Francisco Bay, Swarth et al. (1982) in salt ponds in south San Francisco Bay, King et al. (1987) at San Elijo Lagoon, and Funderburk and Springer (1989) at lakes Earl and Talawa. Collectively, these studies and the more general accounts of Grinnell and Miller (1944), Cogswell (1977), McCaskie et al. (1979), and Garrett and Dunn (1981) provide a very useful description of the seasonal use patterns of aquatic birds in California.

Since 1965 volunteers and the staff of Point Reyes Bird Observatory (PRBO) have conducted censuses of birds in the wetlands of the Point Reyes Peninsula, Marin Co., California. These censuses, which extend up to 10 consecutive years at a single site, provide more detailed information on variation in bird numbers than has been reported previously for California waterbirds. In this paper we describe the seasonal use patterns of aquatic birds of two estuaries, one lagoon, and the inshore zone

of the ocean off southern Point Reyes, and, when appropriate, compare these patterns to those found elsewhere in coastal California. We also examine the influence that variations in rainfall have on variations in bird abundance, on the timing of species' arrival and departure, and on intersite variation in occurrence patterns on Point Reyes.

Beyond describing the dynamics of this local system, the data provide a baseline on the population sizes and seasonal abundance patterns of birds in most wetlands of the Point Reyes Peninsula. In contrast with many of California's wetlands, the Point Reyes wetlands remain relatively pristine. Much of the study area is currently protected wildlife habitat and should remain so into the future, thereby permitting continued monitoring of changes in bird abundance in a natural system.

STUDY AREA AND METHODS

The study area included wetlands of the Point Reyes Peninsula (bounded on the east by Bolinas Lagoon, the Olema Valley, and Tomales Bay), Marin Co., and Bodega Harbor, Sonoma Co. (Fig. 1). Seasonal abundance patterns were derived from counts of aquatic birds on Bolinas Lagoon, Limantour Estero, Abbott's Lagoon, and the nearshore coastal waters between Stinson Beach and the Point Reyes Lighthouse. Supplemental information was also obtained from censuses at Drake's Estero and Bodega Harbor and incidental sightings as described below. We called Bolinas Lagoon, Limantour Estero, Bodega Harbor, Drake's Estero, and Tomales Bay seasonal estuaries (see Pritchard 1967) because they are semi-enclosed bodies of water subject to daily tidal action, and their salt water is measurably diluted by fresh water only from October through April. In contrast, Abbott's Lagoon's lower basin is separated from the ocean by a barrier bar that is only occasionally breached during storms, extremely high tides, or periods of heavy runoff. Breaching causes a rapid drop in water level and subjects the lagoon to tidal action for a few days. Abbott's Lagoon is essentially brackish, minimally influenced by tidal action, and best fits the definition of a true lagoon (Caspers 1967). For simplicity, we refer to the estuaries and Abbott's Lagoon as wetlands, even though they also contain deepwater habitat.

Rain is highly seasonal with about 95% of the yearly total falling from October through April (Fig. 2). From 1967 to 1982, June through May rainfall on the coast 6 km northwest of Bolinas Lagoon averaged 88.3 cm (SE = 8.1); extremes were 44.9 and 40.7 cm in the drought years of 1975–76 and 1976–77, respectively, and 147.0 and 132.6 cm in the wettest years, 1972–73 and 1981–82, respectively.

Census Locations

Bolinas Lagoon. Bolinas Lagoon, 24 km northwest of San Francisco, is a Marin Co. Nature Preserve. At mean low tide 26.0% of the 587-ha estuary is open water, 57.2% unvegetated tidal flat, and 16.8% salt marsh or upland. More information on the area is available in Ritter (1969), Ritter and Brown (1973), Bergquist (1978), and Page et al. (1979).

We conducted 247 censuses at Bolinas Lagoon (hereafter Bolinas) between June 1971 and May 1982 at a frequency declining from one every 10 days in 1971 and 1972 to one per month for only part of the year in 1981 and 1982. Censuses were during specific 5-day periods if tides were suitable (Fig. 3) or the nearest appropriate period if they were not suitable (see Page et al. 1979 for further details of census methods).

Limantour Estero. Limantour Estero, a Point Reyes National Seashore (PRNS) natural area 20 km northwest of Bolinas, is bordered by hills, freshwater impoundments, a spit with scattered high dunes, and a channel to the ocean shared with Drake's Estero. Several intermittent streams run into the estero. At the time of our study, at mean low tide 47.6% of the 331-ha estuary was open water, 41.2% non-vegetated tidal flat, and 11.2% salt marsh or upland. Six freshwater impoundments abutting the estero added an additional 63.9 ha of aquatic bird habitat. Since 1982 breaks in dikes have drained 28.1 ha of pond habitat, part of which was restored to tidal action.

Figure 1. Point Reyes study area. a, Bird Rock; b, Kehoe Marsh; c, Chimney Rock; d, Drake's Beach Pond; e, Horseshoe Pond; f, Schooner Bay; g, Glenbrook and Muddy Hollow ponds; h, Inverness; i, Olema Marsh; j, Point Resistance; k, Five Brooks Pond; l, Abalone Flat; m, Bolinas and Bolinas sewer ponds; n, Palomarin; o, Audubon Canyon Ranch; p, Bolinas Bay. The 10 numbered sub-areas denote sections of the inshore zone censused between September 1980 and September 1981.

The 146-ha northern extension of the estuary (upper Limantour) was not censused initially (see below) because of its distance from the census route along the spit. One hundred sixty-six counts, encompassing the southern 169 ha of the estero and 16.4 ha of impoundments (Muddy Hollow Pond and a small nearby pond), between June 1967 and June 1981 contributed to the data base for all species. An additional 63 counts of ponds from July 1965 to May 1967 augmented the data for the Cinnamon Teal, Redhead, and Ring-necked Duck, which were restricted primarily to the impoundments. Although censuses were distributed fairly evenly throughout the year (Fig. 3), they were not taken in specified 5-day periods or with respect to tides until 1973–74.

Abbott's Lagoon. This undeveloped area lies 2 km northwest of the northern end of Drake's Estero in PRNS. Two interconnected freshwater ponds, derived mainly from winter runoff, total 32 ha and are linked to the northeast shore of the lower, brackish 83-ha lagoon, which temporarily becomes tidal on rare occasions

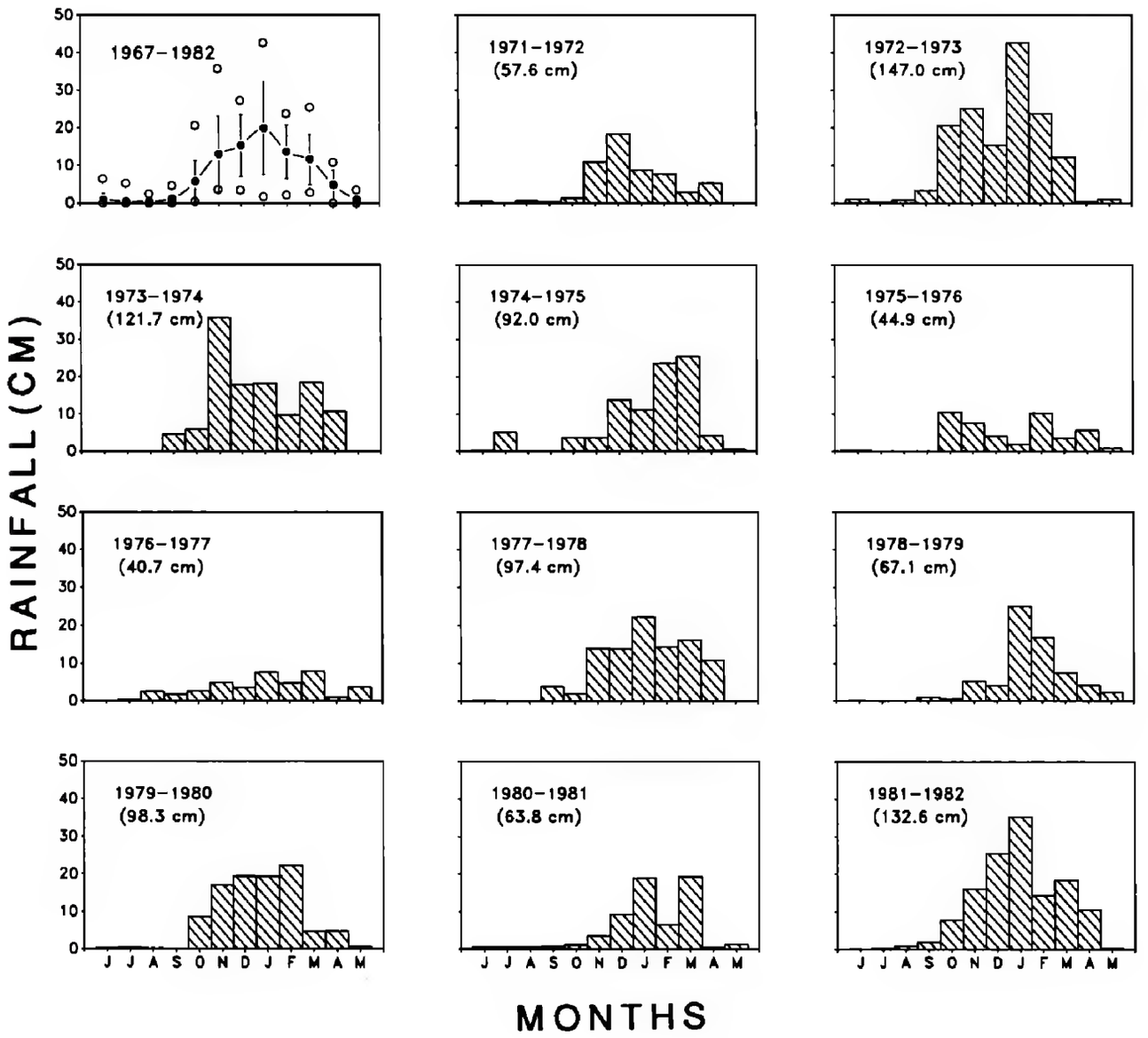


Figure 2. Rainfall patterns at Palomarin, 6 km northwest of Bolinas. Upper left, monthly rainfall for the period 1967–1982. Solid circles, mean; vertical bars, one standard deviation; open circles, minimum and maximum values. Other graphs, rainfall by month for individual years; yearly totals in parentheses.

when the barrier bar is breached. Even when the bar is intact the surface area of the lagoon varies by a factor of about 2, depending on rain and evaporation. Dunes and an extensive sand flat border the lagoon's southwest margin.

We conducted 135 censuses of the 115 ha of combined lagoon and pond habitat between July 1973 and June 1982. The censuses did not correspond with specified 5-day time periods or tides until June 1980.

Supplemental census areas: Drake's Estero, upper Limantour Estero, and Bodega Harbor. At monthly intervals from October 1979 to May 1980 and from

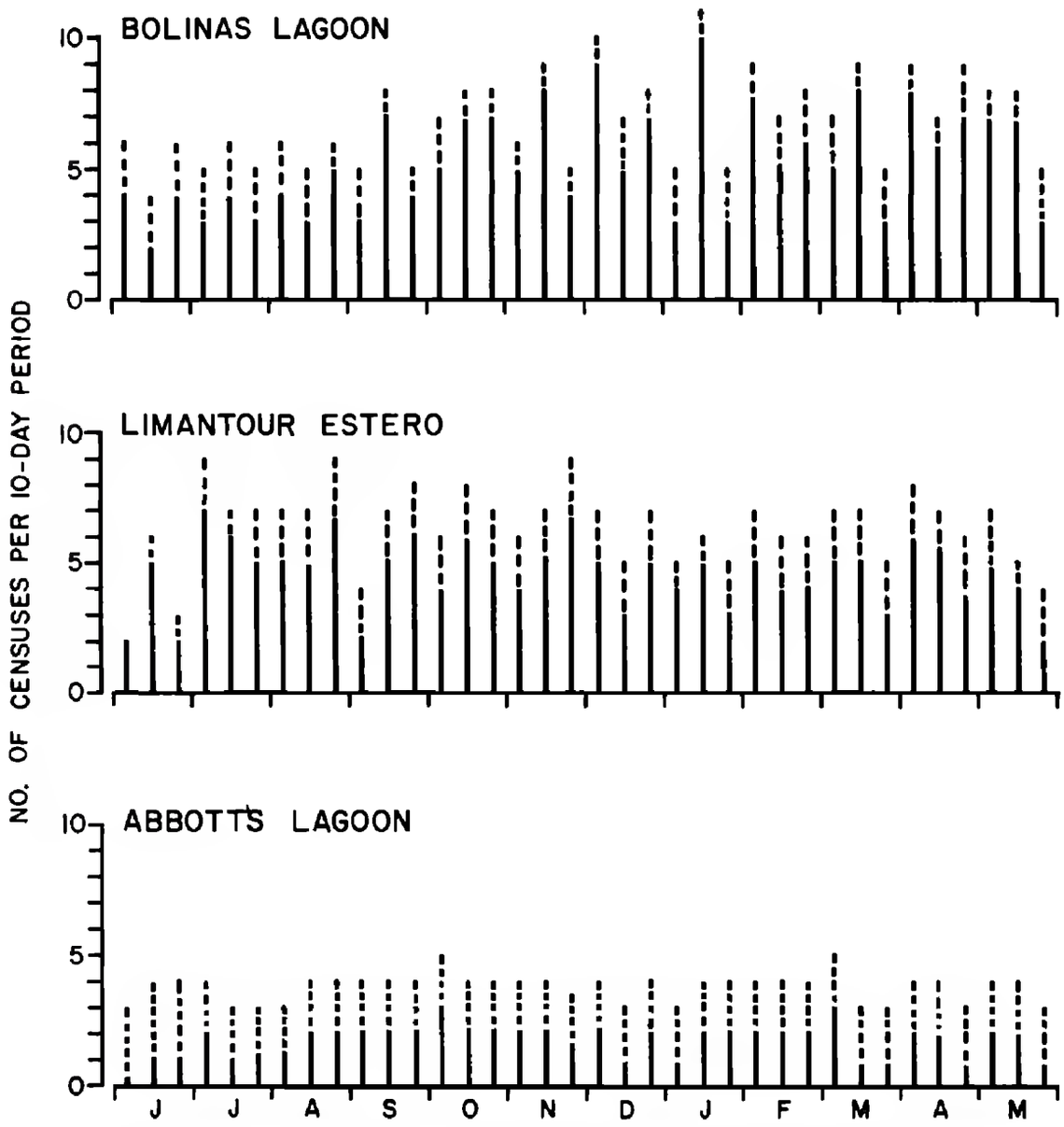


Figure 3. Numbers of censuses of aquatic birds taken at three wetlands during 10-day periods (alternate 5-day periods) from 5–9 June through 21–25 May between 1967 and 1982. Censuses taken outside these 5-day periods are tallied in the closest 5-day period. Dotted lines for Bolinas indicate censuses on which only shorebirds were counted. Dotted lines for Limantour indicate censuses valid for only the Cinnamon Teal, Ring-necked Duck, and Redhead (see Methods). Solid lines for Abbott's indicate censuses used for graphs of the Black-bellied Plover, Semipalmated Plover, Marbled Godwit, Western Sandpiper, Least Sandpiper, and Dunlin; all censuses used for other species (see Methods).

September 1980 to June 1981 we conducted 18 censuses of the 964-ha Drake's Estero and 39.1 ha of adjacent ponds. From October 1979 to May 1980 we conducted 8 monthly censuses of the 146-ha north–south arm of Limantour Estero and 37.7 ha of adjacent ponds. From November 1978 to February 1979 and from November 1979 to May 1980 we conducted 11 monthly censuses of Bodega Harbor, a 368-ha estuary 55 km northwest of Bolinas.

Outer coast. We made 12 counts of aquatic birds inshore in the ocean from Rocky Point, just south of Stinson Beach, to the Point Reyes Lighthouse within 4 days of monthly censuses in adjacent estuaries between September 1980 and September 1981. One to three people counted non-flying birds as far from shore as they could see with binoculars and 20× spotting scopes in each of 10 sub-areas (Fig. 1). We refer to sub-areas 6–10 as Drake's Bay. Flying birds were not tallied to ensure that counts represented birds definitely using study area waters. Assuming an effective census distance of 1500 m from shore, we estimated the area covered as 9400 ha of coastal water.

Unidentified Birds

Those taxa regularly posing identification problems in wetlands were Western and Clark's grebes, scaups, dowitchers, small sandpipers (Least Sandpipers, Western Sandpipers, and Dunlins), and gulls. Both species of large grebes, scaups, and dowitchers were pooled for all analyses. Unidentified small sandpipers were apportioned among those identified as described by Page et al. (1979). The seasonal abundance patterns of gulls are based on identified birds only, underestimating the abundance of most species except for Bonaparte's and Heermann's gulls. Despite this limitation the graphs of gulls are useful for defining patterns of seasonal occurrence.

On censuses of nearshore waters identification of the species of small grebes (Horned and Eared), scoters, and particularly loons often proved difficult because of the long distances between birds and observers. We allocated unidentified birds to species by using proportions of those identified from the same sub-area of the coast unless numbers of those identified in a sub-area were very small. In such cases the proportions of identified birds in either the eastern or western five sub-areas were used to apportion the unidentified birds by species and sub-area. Unidentified loons constituted 9–86% (median 20%) of the ones identified on the 10 coastal censuses, unidentified scoters 6–60% (median 26%), and unidentified small grebes 0–24% (median 10%), except on the September 1980 census, when only 3 of 25 small grebes were identified.

Other Data Sources

We used sightings from published and unpublished sources to supplement our census data, especially for rare to very rare species. Foremost among these sources were the quarterly seasonal reports of the Middle Pacific Coast Region of *American Birds*, formerly *Audubon Field Notes* (cited as AB or AFN), and the compilation of records from which the published accounts were derived, the "American Birds Notebooks" (cited as ABN: observer's initials) on file with the regional editors. Unpublished PRBO records, the authors' field notes, and personal communications from other observers (cited as PRBO or the observer's initials) were an additional source of data. Observers whose initials are cited are David G. Ainley (DGA), Peter Allen (PA), Stephen F. Bailey (SFB), Laurence C. Binford (LCB), Bob Boekelheide (BB), Gerald Brady (GB), Courtney Buechert (CoB), Scott Carey (ScC), Ted (TAC) and Zoe Chandik (ZCh), Bill Clow (BC), Howard L. Cogswell (HLC), Chris Cutler (CC), Dave DeSante (DDeS), Richard Ditch (RD), Richard A. Erickson (RAE), Jules G. Evens (JGE), Marc Fenner (MFe),

Rudi Ferris (RF), William B. Gladfelter (WBG), Philip E. Gordon (PEG), Keith Hansen (KH), Rob Hayden (RHa), R. Phil Henderson (RPH), Burr Heneman (BHe), David A. Holway (DAH), Alan S. Hopkins (ASH), Steve N. G. Howell (SNGH), Stuart Johnston (SJ), Durrell D. Kapan (DDK), John Kelly (JPK), Susan Kelly (SK), Joe Kennedy (JKe), Bill Lenarz (BiL), Phil Lenna (PL), Gary S. Lester (GSL), Baron McClean (BMc), Peter J. Metropulos (PJM), Grace Miller (GM), Joseph Morlan (JM), Dan P. Murphy (DPM), Gary W. Page (GWP), Benjamin D. Parmeter (BDP), Steve Perry (SP), Ed Piccolo (EP), Lina Jane Prairie (LJP), William M. Pursell (WMP), Peter Pyle (PP), C. J. Ralph (CJR), J. Van Remsen (JVR), Barry Sauppe (BSa), Kenneth Schulz (KSc), David Shuford (DS), John Smail (JS), Bruce Sorrie (BSo), Rich Stallcup (RS), Lynne E. Stenzel (LES), Robert M. Stewart (RMS), Nick Story (NS), Chris Swarth (CSw), Ted Van Velzen (TVV), Nils Warnock (NW), Alice Williams (AW), David Wimpfheimer (DWm), Jon Winter (JW), and Keiko Yamane (KY).

We also used information from the Point Reyes Peninsula Christmas Bird Count (CBC) and, secondarily, the Marin Co. (southern), Tomales Bay, and Drake's Bay CBCs, published in *American Birds*. Unless otherwise noted, the only records of extreme rarities that we report have been reviewed and accepted by the California Bird Records Committee (CBRC). These records are cited as CBRC and either have been published in CBRC reports (Winter 1973, Winter and McCaskie 1975, Luther et al. 1979, Luther 1980, Luther et al. 1983, Binford 1983, Binford 1985, Morlan 1985, Roberson 1986, Dunn 1988) or have been accepted by that committee and will be published in the near future (D. Roberson, CBRC Secretary, in litt.).

We followed Ainley and Sanger's (1979) definitions for the zones in the ocean used to describe the distribution of sea-going birds. "Oceanic" describes waters of the deep ocean from the continental slopes beyond the continental or insular shelves. "Neritic" describes waters over the continental shelf. The neritic zone can be subdivided into inshore and offshore zones. The demarcation between the inshore and offshore zones is the line beyond which the bottom is too deep for a diving seabird to reach—a depth of approximately 70 m (Ainley and Sanger 1979). We place quotes around "offshore" and "inshore" when we refer to literature that defines these terms differently or not at all.

Data Analysis

We determined seasonal abundance patterns for all but very rare species from the censuses of Bolinas Lagoon, Limantour Estero, and Abbott's Lagoon. Because most species are scarce to absent in the wetlands in summer, we defined a year as extending from 1 June to 31 May. For all but very rare species, the minimum, mean, and maximum number of birds in alternate 5-day periods (Fig. 3) are graphed by wetland and species. Bolinas shorebird graphs derived from censuses from June 1971 to May 1976 (e.g., Fig. 25) were published by Page et al. (1979). Bolinas graphs for non-shorebirds (e.g., Fig. 4) are based on 176 censuses from August 1972 to May 1980, except for that for the American Coot, which is based on only 125 censuses from August 1972 to May 1976 because of the sharp drop in numbers after that period. Most graphs for Abbott's Lagoon are based on all 135 censuses from July 1973 to June 1982. We used only the 75 censuses taken at low tides from June 1980 to June 1982 to graph results for certain shorebirds known to fly from Drake's Estero to Abbott's to roost at high tide (Fig. 3). Occurrence patterns in the inshore zone are described primarily by histograms based on censuses of the outer coast (see Figs. 5, 6, and 7). We present preliminary data on winter population trends at Bolinas and Limantour (see Fig. 14) that are part of ongoing studies.

Occurrence patterns of very rare species recorded on wetland censuses on Point Reyes are described by either histograms summarizing area-wide records (see Fig. 12) or by a summary or listing of individual records. Histograms are based on all records available through fall 1982, except that CBC records were excluded to avoid the bias of intense observer effort each year during late December. Histograms are based on Point Reyes records only, except those for the Cattle Egret, Lesser Yellowlegs, Wilson's Phalarope, Parasitic Jaeger, and Common Tern, which also include additional Marin Co. records to give better definition to migratory periods. The graph of Lesser Golden-Plover includes only wetland census records and excludes records from upland habitat where migrant and wintering birds mingle, blurring the boundaries of migratory periods. Listings of records in the species accounts include all data available through fall 1988 and selected data through spring 1989. Although we occasionally use census data from Bodega Harbor in the species accounts, we do not use them in describing occurrence patterns of very rare species.

Peaks and troughs in the graphs of seasonal abundance (e.g., Fig. 4) enabled us to select dates that independently define each species' occurrence by fall, winter, spring, or summer periods. We eliminated the tails of peaks and troughs from the intervals defining periods to minimize the effect of unusually early or late influxes or departures of birds on seasonal means. The dates used to define periods for each species are reported in table 4 of Page et al. (1983), which may be obtained from the authors on request. From the seasonal means calculated for each year and site we derived an average abundance index expressed as birds per 100 ha for the three main census areas—Limantour, Bolinas, and Abbott's—combined. Following the approach of DeSante and Ainley (1980), we used a logarithmic scale (base 4) to categorize each species' overall abundance in the three wetlands as follows:

Very rare: less than 0.1 birds per 100 ha
Rare: 0.1–0.4 birds per 100 ha
Uncommon: 0.5–1.6 birds per 100 ha
Fairly common: 1.7–6.4 birds per 100 ha
Common: 6.5–25.6 birds per 100 ha
Very common: 25.7–102.4 birds per 100 ha
Abundant: 102.5–409.6 birds per 100 ha

The following terms were used to categorize the regularity of occurrence of relatively rare species in a geographic region broader than the study area:

Irregular: not recorded every year but on average recorded more than once every 5 years.
Casual: recorded on average less than once every 5 years.
Vagrant: a species far from its normal range of occurrence. This term alone does not indicate regularity of occurrence but must be modified by one of the two previous terms, e.g., a casual vagrant to coastal California.

The following terms were used to categorize the seasonal occurrence status of each species:

Breeder: species confirmed as nesting in the study area by the presence of active nests, flightless young, or recently fledged young with some down remaining.
Resident: species present continuously throughout a non-migratory period. Although some individuals may stage in the area during migration, migrants are not sufficiently abundant that their occurrence can be detected by a substantial spring or fall peak in numbers. Resident does not imply breeding even

when the classification is as a year-round (winter and summer) resident or summer resident.

Transient: species passing through the area during migration. In a given season, if numbers swell noticeably during migration periods, species that might otherwise be classified as residents may be defined primarily as transients.

Dispersant: species that arrive in an area after a long-distance dispersal from their breeding sites. The timing and magnitude of occurrence varies markedly from year to year, probably in response to fluctuating food supplies or marked variations in reproductive success.

Visitant: species occurring intermittently in marginal habitat or on the edge of its normal range.

SPECIES ACCOUNTS

We describe the seasonal occurrence patterns and abundance of all species of aquatic birds recorded on censuses of the Point Reyes wetlands in species accounts, except for Osprey, Bald Eagle, and Belted Kingfisher, which we arbitrarily exclude. The accounts provide information on inter-wetland and year-to-year variation in occurrence patterns, peculiarities of distribution on Point Reyes, historical population trends, sex- or age-related differences in migrational timing or distribution, and habitat preferences. Seasonal abundance patterns in the Point Reyes area are compared to those on the rest of the California coast when these comparisons are instructive. The northern California coast, from Monterey Co. north to the Oregon border, is the most frequent frame of reference for these comparisons; the central California coast refers to the sub-area from Monterey Co. north to include the counties surrounding San Francisco Bay. Southern California is the area from San Luis Obispo Co. south to the Mexican border.

Red-throated Loon (*Gavia stellata*)

A rare summer resident and uncommon winter resident (Fig. 4). High inshore summer counts off Drake's Beach were 25 birds on 10 Jul 1977 (ABN: JVR) and 24 on 1 Jul 1981 (DS). The only suggestion of a peak of migrants on our censuses was in Nov and Dec on inshore waters (Fig. 5). Although limited movement occurs in Sep (ABN), fall migration over inshore and offshore waters occurs primarily from mid-Oct to mid-Dec with peak movement in Nov (Cogswell 1977, DeSante and Ainley 1980, ABN).

Away from the censused wetlands, flocks of 200 to 800 birds are reported along the Marin Co. shoreline in most years between late Dec and late Feb (ABN). Concentrations are reported most regularly at Tomales Bay, where the high count was 2000 to 3000 birds on 27 Feb 1965 (ABN: JKe, TAC). We know of no other mid-winter gatherings of comparable size elsewhere in California. We suspect these birds are attracted to feed on spawning Pacific Herring (*Clupea harengus pallasii*) at the state's largest runs just inside San Francisco and Tomales bays (Spratt 1981).

Spring migration over neritic waters extends primarily from late Mar to early Jun (ABN); peak migration dates in central California range from 17 to 21 Apr (ABN: BSa et al.).

At Point Reyes, Red-throated Loons were found in greatest numbers in inshore waters (Table 1), deep bays, estuaries, and lagoons. They were rare in freshwater

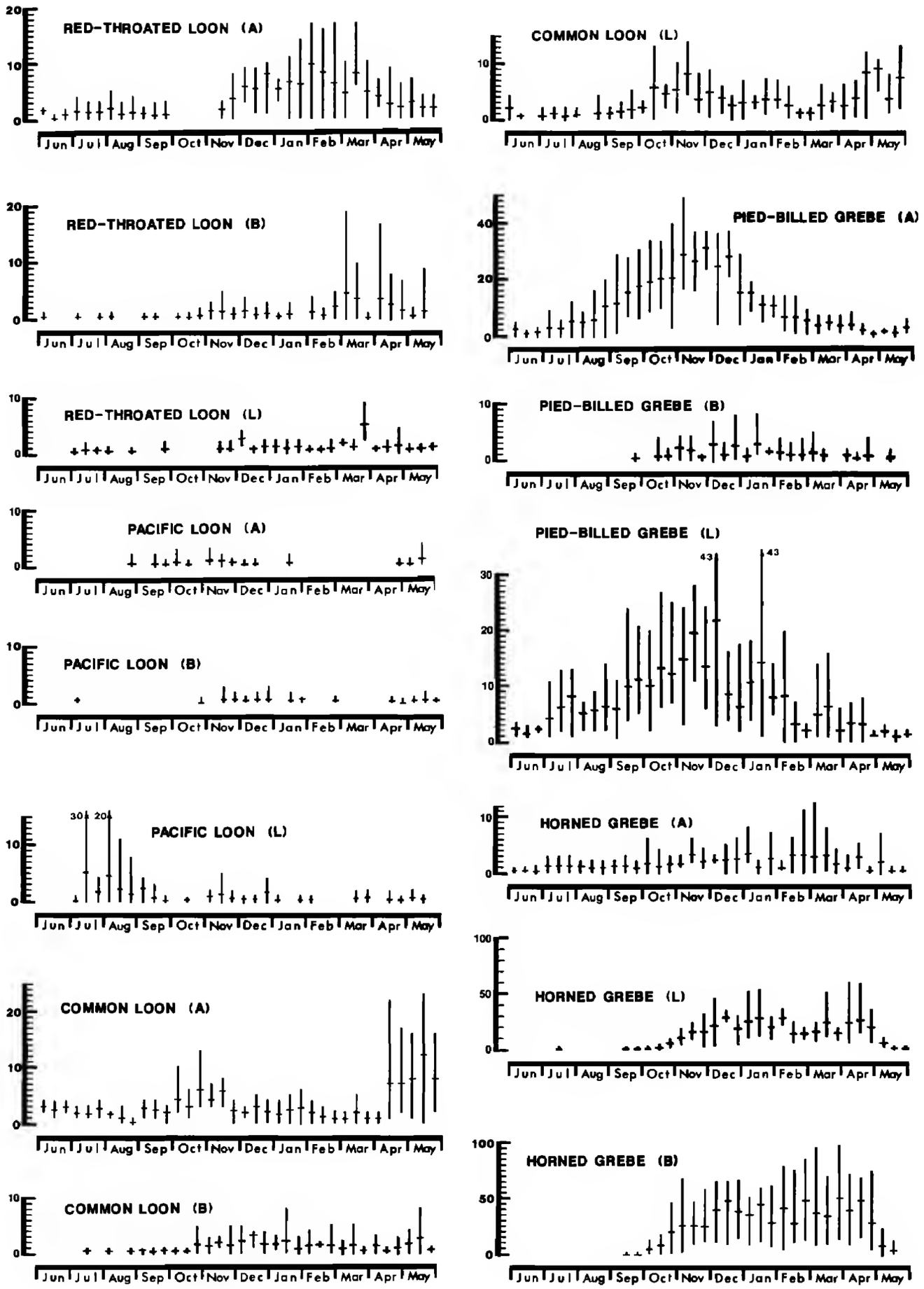


Figure 4. Seasonal abundance of some loons and grebes in wetlands of Point Reyes. The top of each vertical line represents the maximum number counted on any census during the corresponding third of a month, the bottom of each vertical line represents the minimum number counted on any census during the corresponding period, and the horizontal line is the mean for the corresponding period. Maxima exceeding the scale on the graph are indicated by arrows and the appropriate number. A, Abbott's Lagoon; B, Bolinas Lagoon; L, Limantour Estero.

ponds, lakes, and reservoirs, but more frequent there during migration than at other times. During migration, Red-throated Loons occupy ocean waters closer to shore than do Pacific and Common loons, and during winter they are closer to shore than are Pacifics (Briggs et al. 1987).

Pacific Loon (*Gavia pacifica*)

A rare summer resident, rare fall transient, very rare winter resident, and rare spring transient (Fig. 4). Although thousands of Pacific Loons fly by Point Reyes during spring and fall migrations, few pause here. Peak inshore numbers were recorded in Jul and Aug (Fig. 5). At that time the species was rare or absent on the wetlands (Fig. 4), except at Limantour, where birds move into the estero mouth from Drake's Bay. From Jul to Sep high single-observer counts for inshore waters have ranged from about 30 to 85 birds (ABN) with a maximum of 170 on

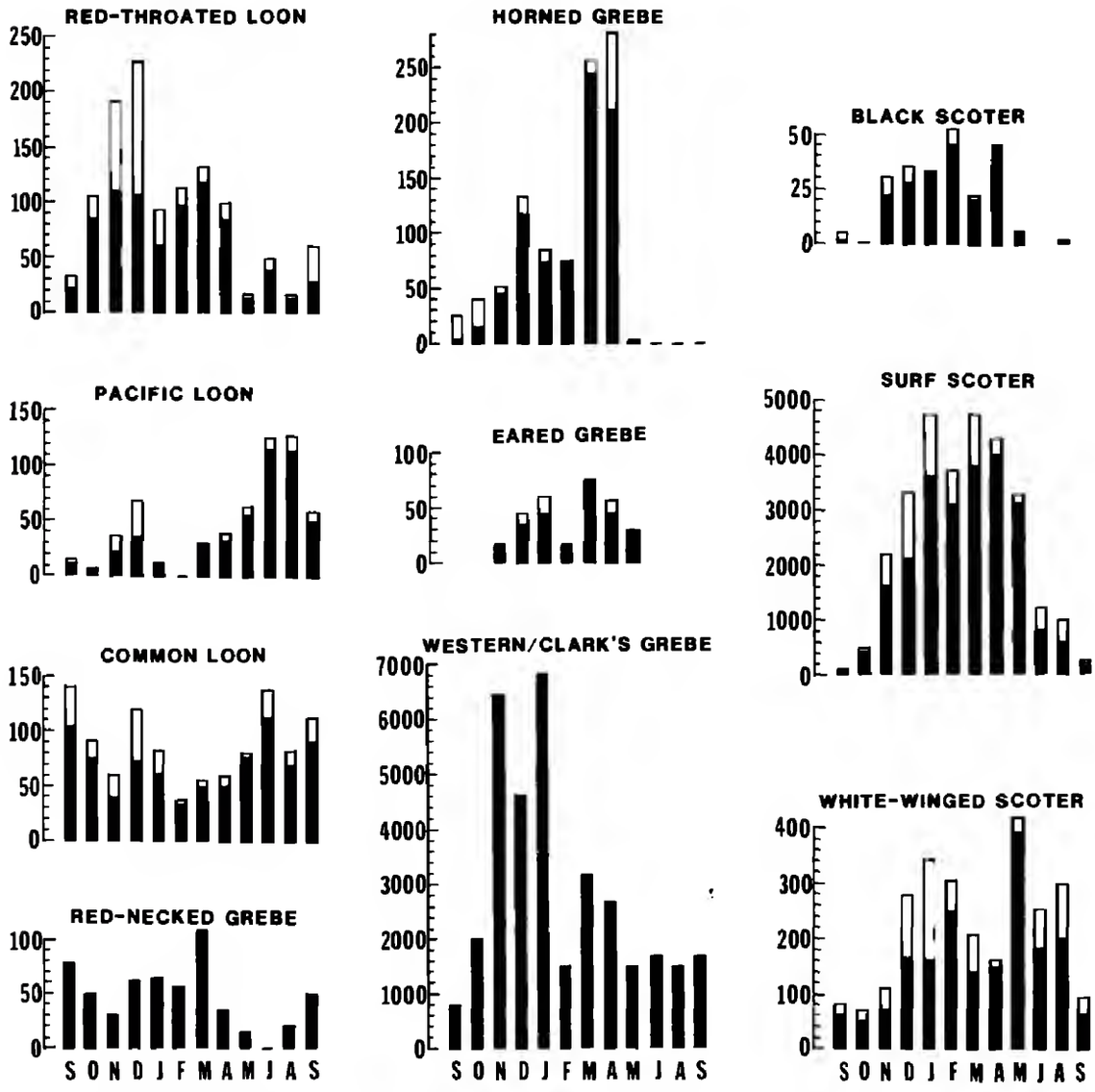


Figure 5. Seasonal abundance of loons, grebes, and scoters in the inshore zone along the southern coast of Point Reyes (see Fig. 1) from September 1980 through September 1981 (there was no June 1981 census). Solid bars, identified birds; open bars, unidentified birds, proportioned among the identified as described under Methods.

Table 1 Comparison between Inshore and Estuarine Areas of Monthly Counts of Waterbirds, November 1980 to March 1981[a]

	Inshore			Estuarine		
Species	*M*	SE	Range	*M*	SE	Range
Red-throated Loon	98	10	60-118	5	1	1-7
Pacific Loon	20	6	1-36	2	2	0-8
Common Loon	51	7	33-72	18	4	8-28
Loon spp.	81	31	15-84	—	—	—
Red-necked Grebe	64	12	31-107	1	[b]	0-1
Horned Grebe	120	36	51-256	245	30	201-327
Eared Grebe	42	12	16-74	328	107	181-746
Western/Clark's Grebe[c]	4498	994	506-6799	76	6	61-91
Black Scoter	29	4	20-45	—	—	—
Surf Scoter	2836	419	1608-3778	737	101	547-1004
White-winged Scoter	158	29	71-251	269	46	148-418
Scoter spp.	850	96	594-1088	—	—	—

[a] Estuarine counts combined for three estuaries; inshore counts combined for 10 sub-areas (Fig. 1). See Methods for corrections for small numbers of unidentified birds. *M*, mean number of birds for 5 counts; SE, 1 standard error.
[b] Value of 0.2.
[c] Predominantly Western Grebe (see species account).

Drake's Bay on 1 Sep 1980 (DS). Along the central California coast fall migration extends from mid-Oct through Dec with peak movement from Nov to early Dec (ABN, Cogswell 1977, DeSante and Ainley 1980). However, sometimes thousands of birds can still be seen flying south past Point Reyes from mid- to late Dec (AB 33: 309, 35: 331).

Although generally much less numerous in California after Dec (Briggs et al. 1987), Pacific Loons occupy sheltered coastal waters then and concentrate locally, apparently to feed on spawning Pacific Herring. High mid-winter counts are of 2000 birds flying north at Bolinas on 6 Jan 1977 (AB 31: 367), 2500 to 2800 off Muir Beach on 4 Feb 1978 (JGE), and about 6300 just north of the Golden Gate on 3 Jan 1983 (BB). Spring migration over neritic waters extends primarily from late Mar to early Jun (ABN); peak migration dates in central California range from 21 Apr to 6 May (ABN: BSa et al.). The end of spring migration was difficult to define. Records such as that of 300 to 1000 Pacific Loons at Drake's Bay between 18 and 24 Jun 1982 (AB 36: 1011, ABN) may have represented summer stragglers, since numbers typically dwindled later in the summer (Fig. 5).

Pacific Loons occurred in greater numbers in the inshore zone than in the estuaries (Table 1). In the inshore study area they usually concentrated in Drake's Bay (Fig. 6). Although overlapping with the other loons in habitat choice, Pacifics tend to occupy deeper coastal waters and migrate farther from shore (Briggs et al. 1987). In northern California they migrate primarily over the continental slope within 50 km of shore, but also over the continental slope up to 110 km from shore (Briggs et al. 1987). During migration in Apr 1986 they were seen feeding with Common Murres 65–80 km off Point Reyes (D. G. Ainley pers. comm.).

Pacific Loons occur rarely along the coast on freshwater lakes, reservoirs, and ponds, especially during migration (ABN, pers. obs.).

Common Loon (*Gavia immer*)

A rare summer resident, uncommon fall transient and winter resident, and fairly common spring transient (Fig. 4). Numbers in neritic waters in Jul were among the highest of the year, whereas from Jun to Aug estuarine numbers were the lowest (Figs. 4 and 5). The highest single-observer summer count was of 76 birds in Drake's Bay on 28 Jul 1980 (AB 34: 925). A high fall count was of a flock of 150 off Bolinas on 16 Oct 1976 (JGE). Although limited data from the Pacific Coast suggest some southward movement from mid-Sep to Oct (Palmer 1962, ABN), fall peaks at Abbott's and Limantour indicated a mid-Oct through early Dec passage as at the Farallones (DeSante and Ainley 1980). Although not evident from our censuses of birds *on* inshore waters (Fig. 5), Common Loons migrate in fall over neritic waters off California from late Oct to mid-Dec (Briggs et al. 1987).

Common Loons migrate in spring over neritic waters primarily from late Mar through May (ABN); peak migration dates in central California range from 12 Apr to 6 May (ABN: BSa et al.). Peak spring numbers in Point Reyes wetlands were found in Apr and May (Fig. 4).

Common Loons use estuaries, lagoons, larger bays, and inshore waters. They were more evenly spread between estuarine and inshore habitats than the other loons (Table 1, Fig. 6); inshore they were concentrated in Drake's Bay (Fig. 6). The species is also found on the coast in small numbers on freshwater lakes, ponds, and reservoirs (ABN, pers. obs.).

Pied-billed Grebe (*Podilymbus podiceps*)

A rare summer resident and fairly common winter resident exhibiting no migratory peaks (Fig. 4); small numbers nest at scattered sites in the study area and elsewhere in Marin Co. (PRBO unpubl. data). Declining early winter numbers at the wetlands (Fig. 4) may have partly reflected shifts of birds to freshwater habitat newly available or enhanced as a result of winter rains. The broad overlap of the breeding and wintering range and the species' nocturnal migratory habits (Palmer 1962) make it difficult to define migration periods. A Sep to Nov fall migration was indicated by increases on the wetlands (Fig. 4).

Although most closely associated with freshwater ponds, Pied-billed Grebes at Point Reyes also use bays, estuaries, lagoons, and, rarely, inshore neritic waters in the non-breeding season. They breed here on freshwater ponds with much shore and emergent vegetation or in marshes with some open water.

Horned Grebe (*Podiceps auritus*)

A very rare summer visitant and a common winter resident (Fig. 4). Two birds at Limantour on 16 Jul 1975, one to two at Abbott's on six dates from 5 Jun to 25 Jul 1980, three at Drake's on 23 Jun 1980, and one at Bolinas on 24 Jun 1981 were the only summer census records. Repeated sightings of one to two birds at Drake's Bay from 5 to 20 Jun 1980 and 6 Jun to 18 Aug 1981 (DS) demonstrated occasional oversummering on inshore waters. Migration spanned late Sep to Dec in fall and Mar to early May in spring (Figs. 4 and 5).

Horned Grebes use estuaries, lagoons, and inshore waters in preference to freshwater habitats. In our study area Horned Grebes occurred in greater numbers in estuaries than in inshore waters (Fig. 7, Table 1), where most birds were found in Drake's Bay (Fig. 7). Horned Grebes outnumbered Eared Grebes by almost 3

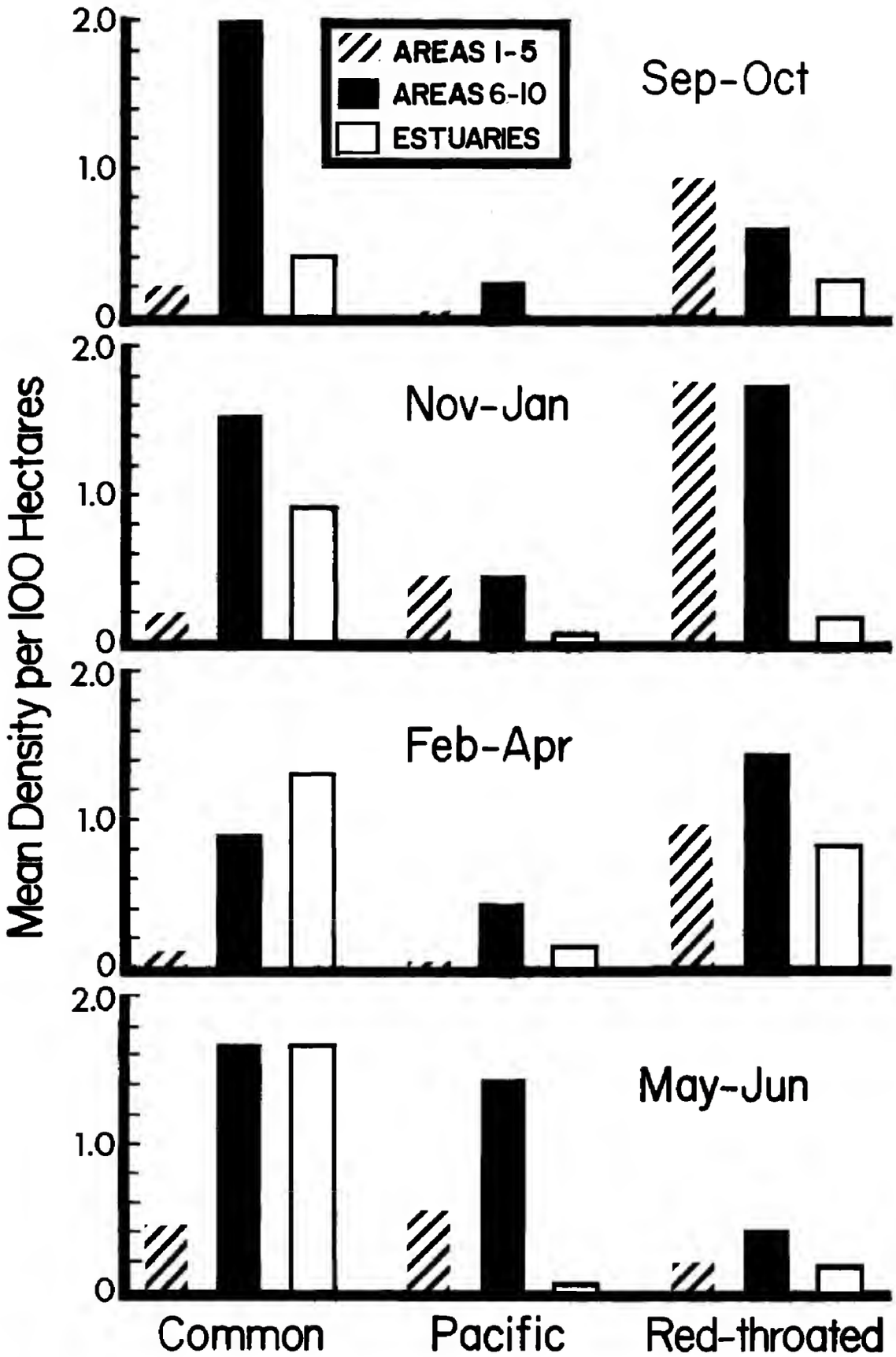


Figure 6. Densities of positively identified loons in estuaries and along two stretches of the southern coast of Point Reyes. See Fig. 1 for sub-areas. Estuarine values are for Bolinas Lagoon, Limantour Estero, and Drake's Estero combined.

to 1 in the inshore study area in winter, whereas at the Farallon and Channel islands, Horned Grebes are vastly outnumbered by Eared Grebes (DeSante and Ainley 1980, Briggs et al. 1987). Cogswell (1977) reported that Horned Grebes have become increasingly common in coastal California since 1930.

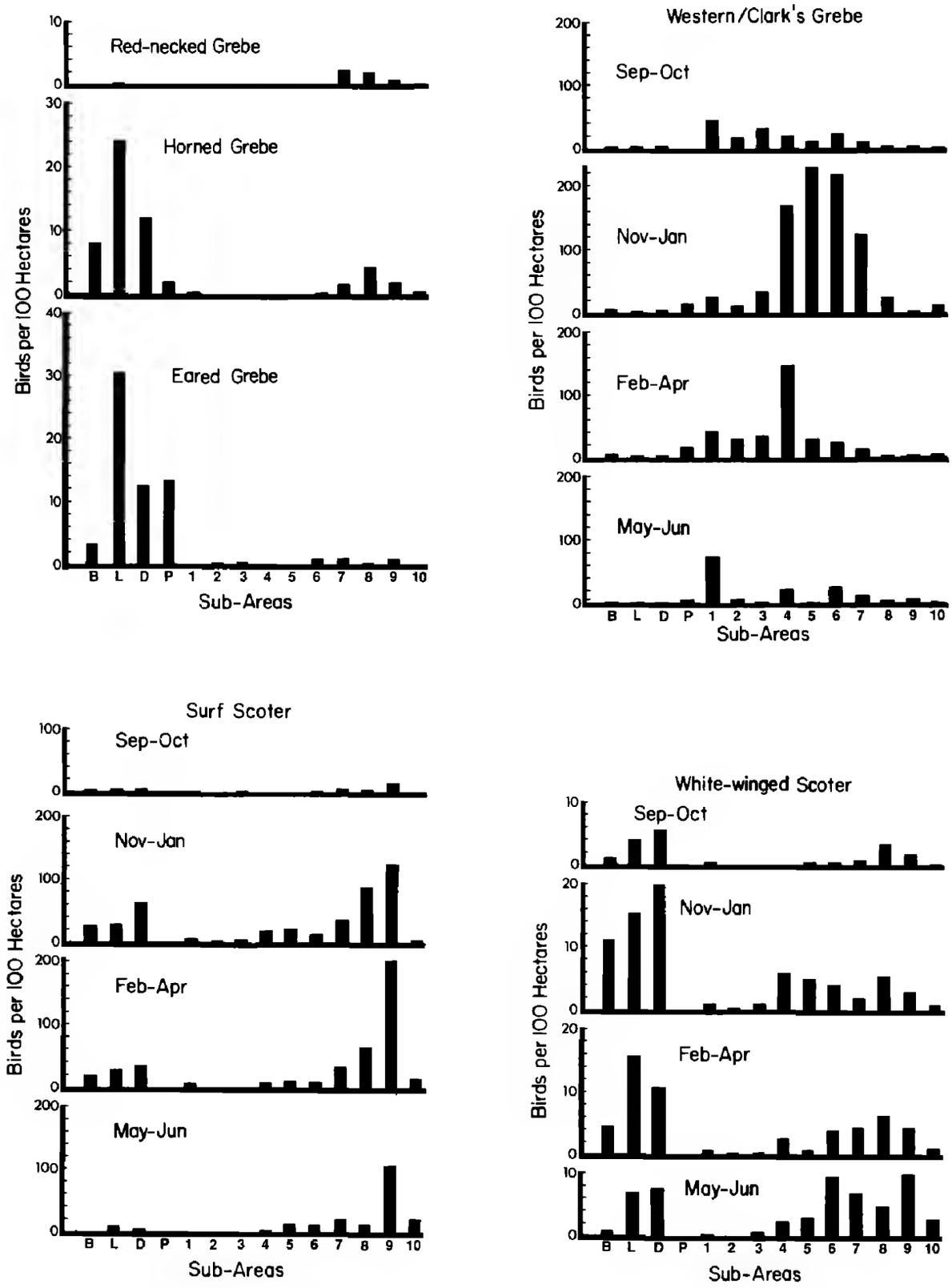


Figure 7. Densities of grebes and scoters along the southern coast of Point Reyes. The numbered sub-areas are shown in Figure 1. B, Bolinas Lagoon; L, Limantour Estero; D, Drake's Estero; P, Horseshoe Pond.

Red-necked Grebe (*Podiceps grisegena*)

A very rare estuarine winter resident with 18 birds on 32 census dates from 23 Sep to 8 May; 12 of the 18 were at Limantour on 25 dates. Repeated sightings of one to two birds in the inshore zone off Drake's Beach from 6 Jun to 20 Jul 1980 (ABN), from 6 Jun to 31 Jul 1981 (ABN), and from 18 Jun to 9 Jul 1983 (AB 37: 1022) represented oversummering birds. A bird at Limantour Estero on 10 and 16 Jul 1975 (AB 29: 1025, ABN) was the only one found in an estuary in summer. In 1981 in Drake's Bay, 3 birds on 4 Aug (ABN: DWm), 7 on 15 Aug (AB 36: 212), and 21 on 17 and 18 Aug (Fig. 5) suggested that fall arrival begins in early Aug and that numbers increase through the month. High inshore counts of 78 birds in Sep and 107 in Mar (Fig. 5, Table 1) were during fall and spring migratory periods. Although our data suggested fall movement from Aug to Sep, Palmer's (1962) statement that "nearly all birds are on salt water by mid-November" suggests a more protracted migration.

Our Mar peak, the occurrence of 15 birds on Drake's Bay on 7 May 1981 (Fig. 5), and the paucity of late May and early Jun records for northern California (ABN) suggest that spring migration extends from Mar to early May. Red-necked Grebes are scarce diurnal migrants over inshore waters of the central California coast in spring, from at least 11 Mar to 5 May (ABN: BSa et al.), because the species is very rare in southern California (Garrett and Dunn 1981) and most birds probably migrate at night (Palmer 1962).

Red-necked Grebes are generally considered rare in California (Grinnell and Miller 1944, Cogswell 1977, McCaskie et al. 1979), but at least locally in inshore waters at Point Reyes their numbers were similar to those of the other grebes and loons, except for the abundant Western Grebe (Table 1). We found no reference to numbers of Red-necked Grebes consistently this high elsewhere on the California coast. Virtually all Red-necked Grebes recorded on inshore censuses were in Drake's Bay (Fig. 7, Table 1), but they also congregated at the mouth of Tomales Bay, where there were sightings of 45 birds on 22 Dec 1973 (ABN: SFB) and 37 on 9 Jan 1978 (DS). Although Red-necked Grebes at Point Reyes inhabit mostly inshore waters and the mouths of deeper bays, they sometimes also occupy estuaries, lagoons, and, occasionally, brackish streams (DS) or freshwater ponds adjoining marine waters (fide J. Morlan).

Eared Grebe (*Podiceps nigricollis*)

A very rare summer visitant and common winter resident (Fig. 8). The only summer census record was of one bird at Abbott's on 29 Jun 1976. At Abbott's, where Eared Grebes were most numerous, the fall build-up was protracted and the spring decline was rapid (Fig. 8). None of the wetlands exhibited migratory peaks (Fig. 8). Except for the low Feb numbers (see Methods), seasonal use of inshore waters was similar to that in the estuaries (Figs. 5 and 8). Our evidence of protracted fall migration (Fig. 8) is supported by the pattern inland at Mono Lake, where numbers in fall begin to build up in late Jul and peak in mid-Oct; large numbers may remain until at least late Dec in some years (Jehl 1988). In San Francisco Bay salt ponds, where greater numbers "winter" than on Point Reyes, the population increases throughout the fall and winter and peaks in Apr (Swarth et al. 1982). This may reflect the overlapping of birds from the protracted fall migration with those from spring migration, which extends from Mar to mid-May (Palmer 1962, Jehl 1988).

In our study area Eared Grebes used estuaries and lagoons more than inshore waters (Table 1, Fig. 7), where they concentrated in Drake's Bay (Fig. 7; see also Horned Grebe). Eared Grebes were also numerous on freshwater ponds.

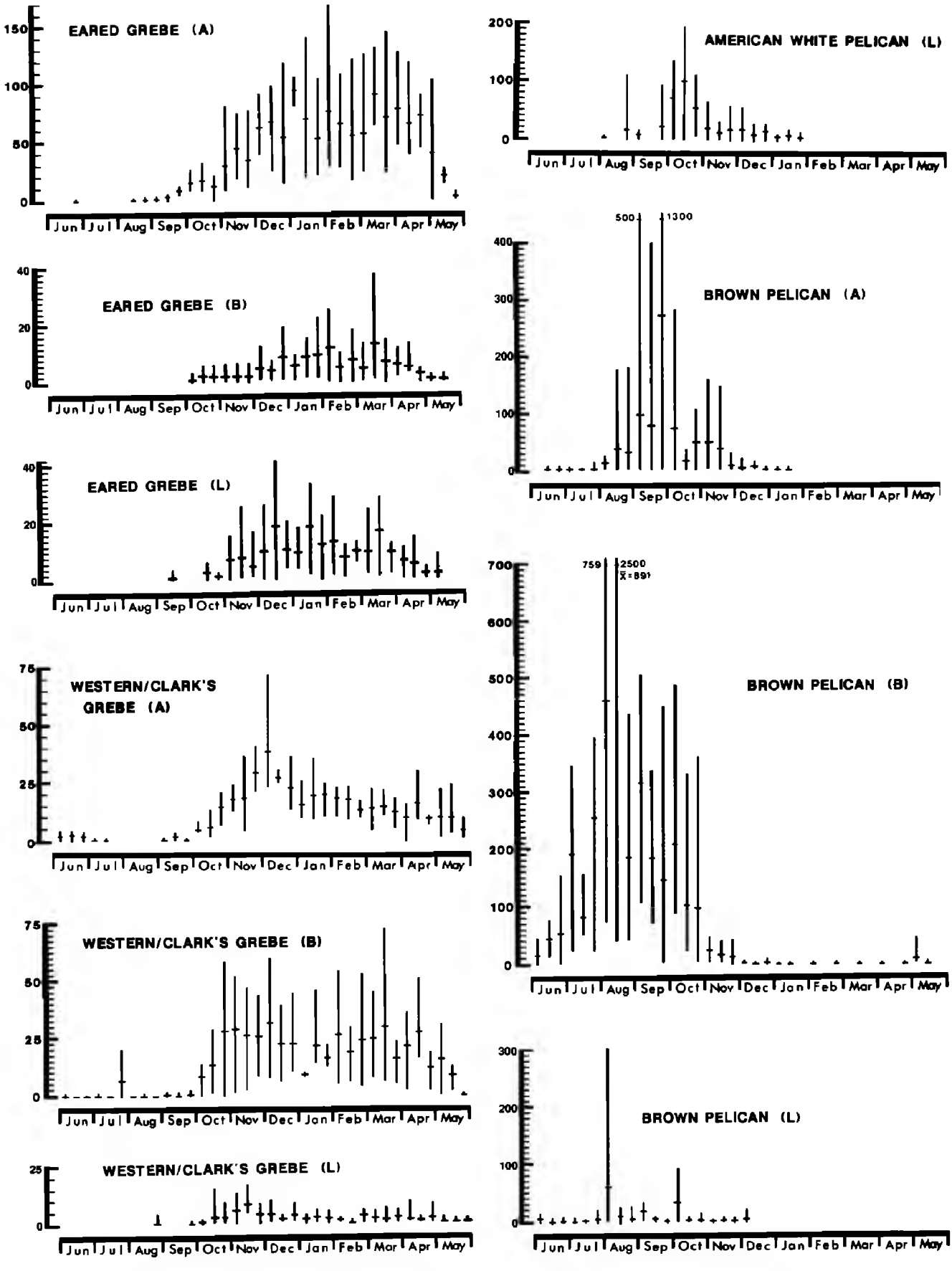


Figure 8. Seasonal abundance of some grebes and pelicans in wetlands of Point Reyes. See Figure 4 for details.

Western Grebe (*Aechmophorus occidentalis*) and Clark's Grebe (*A. clarkii*)

We did not distinguish Western and Clark's grebes, formerly thought to be morphs of a single species, on our censuses. *Aechmophorus* spp. were rare summer residents, common fall transients, and fairly common winter residents (Fig. 8). Fall migration extended primarily from Sep to Dec (Fig. 8) and perhaps to Jan (Fig. 5). Briggs et al. (1987) also recorded peak numbers on inshore waters along the California coast from Nov through Jan. A fall peak at Abbott's and Limantour was followed by a gradual decline in numbers through the winter, while at Bolinas no fall peak was evident and numbers remained relatively stable through the winter (Fig. 8). Seasonal use of inshore waters was similar to that of the estuaries, except that inshore waters supported a large oversummering population (Figs. 5 and 8). Spring movement extends from late Mar through May (Palmer 1962, Figs. 5 and 8).

Aechmophorus spp. were found in much larger concentrations in inshore waters than in estuaries, lagoons, or ponds (Fig. 7, Table 1); inshore concentrations shifted seasonally (Fig. 7). Overall, *Aechmophorus* densities were the highest of any waterbird in our inshore study area. These birds prefer waters within 0.5 km of shore over sandy bottom less than 10 m deep, especially downwind from major headlands (Briggs et al. 1987).

Western Grebes are much more common in this area than Clark's Grebes. Counts in Jan 1977 showed 88.4% of the birds in California and Nevada to be Westerns; at the two Marin Co. sites close to our study area 87.1% of the birds were Westerns (Ratti 1981). Also, at least 90% of 280 birds in Drake's Bay on 18 Apr 1980 were Westerns (JGE). Both Western and Clark's grebes oversummer on coastal waters, with the former predominating (ABN).

Ashy Storm-Petrel (*Oceanodroma homochroa*)

A very rare visitant with one census record of a single, apparently healthy, individual found inside Bolinas Lagoon on 21 Feb 1977 (AB 31: 368). For much of the year this species inhabits pelagic waters off California from the continental shelf edge to 25 km seaward, particularly on the warm sides of thermal fronts bordering upwellings (Briggs et al. 1987). A few Ashy Storm-Petrels breed in our study area on Bird Rock, Tomales Point; over 75% of the world's population breeds nearby on the Farallones (Sowls et al. 1980). Off central California peak numbers occur from Sep to Jan; an increase in sightings seaward of the continental slope after Dec suggests that many birds winter in deeper waters (Briggs et al. 1987). Stragglers inside San Francisco Bay and casualties on city streets have invariably been immature birds (D. G. Ainley pers. comm.).

American White Pelican (*Pelecanus erythrorhynchos*)

A fairly common winter resident (Fig. 8). A summering bird on Drake's Estero from 8 Mar to 8 Jul 1965 was apparently injured (PRBO). There appears to be no regular movement along the coast; instead, birds move directly overland to and from inland breeding sites. Birds from Drake's Estero use Limantour erratically, explaining the gaps in the Limantour graph. Censuses at Limantour reveal the normal timing of sightings, early Aug to late Jan (Fig. 8), but not the Oct to Jan period of peak numbers on Point Reyes (pers. obs.). Earliest and latest non-census records, respectively, were 17 Jul 1983 (RMS) and 3 Feb 1981 (DS), except for 21 birds on Tomales Bay on 24 May 1988 (ABN: RHa), 61 there on 2 June 1988 (TNo), a number there on 12 June 1989 (TNo), and 7 at Bolinas on 27 Jun 1989 (KH). These May and June sightings paralleled widespread reports at that time in

the San Francisco Bay Area (AB 42: 477, ABN), and particularly high numbers in that season in 1988 may have reflected breeding failures inland following the 1986–89 drought. From 1970 to 1988 the median number of White Pelicans recorded on the Point Reyes CBC was 77 (range 6–827); the high count is likely an overestimate due to duplicate counts of conspicuous soaring flocks. The highest non-census count at a single location was 360 at Limantour on 19 Dec 1971 (CBC data fide BiL). White Pelicans' occurrence on Point Reyes is generally briefer than on San Francisco Bay, where small numbers occur irregularly through the spring, non-breeders may arrive as early as mid-May, and substantial numbers may build up by late Jun to early Jul (ABN).

On Point Reyes White Pelicans use shallow estuarine waters and, to a limited extent, freshwater ponds. Most birds aggregate in Drake's Estero and near the mouth of Tomales Bay, perhaps because suitable fish prey concentrate in the extensive eelgrass beds at these sites. White Pelicans irregularly used Bodega, Abbott's, and Bolinas, in descending order of frequency. The sandspit at the mouth of Drake's Estero, the mouth of Walker Creek on Tomales Bay, and Bird Rock off Tomales Point are traditional roosting sites.

Habitat loss and disturbance reduced overall numbers and breeding sites in California from the 1880s until the late 1950s (Grinnell and Miller 1944, Remsen 1978). This decline paralleled a reduction in the number of breeding colonies throughout the western U.S., with numbers stabilizing in recent years (Sloan 1982, Smith et al. 1984, Sidle et al. 1985). These declines suggest that numbers of White Pelicans wintering on the California coast have also decreased historically.

Brown Pelican (*Pelecanus occidentalis*)

A very common summer to early winter dispersant and a very rare late winter to spring visitant (Fig. 8). Seasonal movements of Brown Pelicans, and a number of other seabirds, are strongly affected by seasonal cycles of upwelling and temperature changes in the California Current (see below and Results and Discussion). At Point Reyes Brown Pelicans were most numerous at Bolinas, where numbers increased from Jun to Aug, peaked from late Jul to early Oct, and declined sharply thereafter (Fig. 8). Although a few birds were present at Abbott's by Jun, numbers there did not increase markedly until Aug. Brown Pelicans visited Limantour erratically. In neritic waters, however, Brown Pelicans frequently may be found earlier and later in the year than in Point Reyes estuaries. Birds dispersing north typically begin to trickle into San Francisco Bay and neritic waters north of Monterey in May, rarely in Apr, or exceptionally in Mar (ABN); they arrive later farther north (Anderson and Anderson 1976, Henny and Collins 1980, Briggs et al. 1983). Overall on the central California coast, pelican numbers peak in Sep and Oct (Briggs et al. 1983). In neritic waters of this region a secondary peak occurs in Nov and Dec, but the birds do not fly consistently south, as would be expected of a rapid, directed migration. Stragglers are usually seen in neritic waters through Jan, and occasionally small numbers remain through winter and spring, as in 1977–78, 1983–84, and 1987–88 (AB 32: 394 and 1050, AB 38: 352, Briggs et al. 1983, AB 42: 314). A few stragglers sometimes use Bolinas Lagoon in winter as well.

The timing of arrival in northern California varies annually as a function of variation in the seasonal warming of the ocean surface (Anderson and Anderson 1976; Briggs et al. 1981, 1983). While the timing of peak numbers is correlated with timing of peak mean sea surface temperatures south of Point Reyes (Briggs et al. 1983), the magnitude of the peak appears to be related more to preceding events at breeding colonies in the Gulf of California (Anderson and Anderson

1976, Briggs et al. 1981, 1983). The pelicans' northward dispersal lags well behind the warming trend (Briggs et al. 1981), as would be expected for a species responding to fish productivity. Exceptionally early dispersal is often preceded by breeding failures in the Gulf of California related to unusually warm water along the Pacific Coast, which, in turn, often corresponds to intense El Niños off South America (Anderson and Anderson 1976). Early arrivals at Bolinas of 44 birds on 7 May 1973 and 8 birds on 28 Apr 1983 (JGE) heralded very early build-ups of numbers along the northern California coast in El Niño years (AB 27: 814 and 912; AB 37: 907). Counts off Bolinas of 6 birds on 24 Apr and 35 on 26 Apr 1987 (RMS) and 450 on 30 Apr 1989 (ABN: PEG) also coincided with early build-ups along the northern California coast (AB 41: 483, ABN) in non-El Niño, though warm-water, years. The departure of Brown Pelicans to the south in early winter coincides with a period of dwindling food resources, but departure at that time is perhaps more strongly influenced by stormy weather (D. W. Anderson pers. comm.).

At Bolinas Lagoon marked year-to-year variation in the timing of peak numbers (Fig. 9) was caused to some extent by pelicans concentrating to prey on Northern Anchovies (*Engraulis mordax*), which also migrate seasonally north to central California (Mais 1974, Parrish et al. 1981) and move in and out of bays and estuaries (Richardson 1980). The highest pelican counts in our study area—6000 birds inside Bolinas Lagoon on 7 Sep 1984 (RMS), 9000 in Bolinas Lagoon and Bolinas Bay on 8 Sep 1984 (DGA, RF), and 3800 in Bolinas Lagoon on 24–25 Aug 1985 (RMS)—were recorded during large anchovy runs.

Overall in central California, pelicans concentrate from Point Lobos to Bodega at traditional, safe roosts near optimal foraging areas (Briggs et al. 1981). Traditional pelican roosts in the Point Reyes area are on tidal flats, sand spits, and large offshore rocks. Foraging birds frequent estuaries, lagoons, and inshore and offshore waters (mostly within 20 km of shore), particularly where plumes of cool, upwelled water intrude into warmer, more stratified water of the California Current (Briggs et al. 1983, 1987).

Anderson and Gress (1983) summarized population trends, showing a drastic decline from 1969 to 1973, coinciding with high DDT levels that affected reproductive success in pelican populations in southern and Baja California, and an increase from 1974 to 1980, as pollution levels declined. By the mid-1980s the southern California breeding population appeared to have reached historical levels, but the species is still listed as endangered by state and federal governments (D. B. Lewis pers. comm). We did not detect any consistent trends in pelican numbers over the course of our study, perhaps because of the marked year-to-year variability in numbers and the local extent of our census efforts (see Briggs et al. 1983).

Double-crested Cormorant (*Phalacrocorax auritus*)

A fairly common summer resident, common fall transient, and fairly common winter resident (Fig. 10). High Aug to Dec numbers at wetlands corresponded with post-breeding dispersal of adults and young from the nearby Farallon Islands (Boekelheide, Ainley, Huber, and Lewis in press), as evidenced by sightings of Farallon-banded birds at Bolinas Lagoon, Drake's Estero, Tomales Bay, and Abbott's Lagoon (*ibid*, DS pers. obs.). Migration of inland breeders to the coast (Sowls et al. 1980) or the dispersal of other coastal breeding populations may also contribute to the fall peak. Although Farallon-banded birds have been recovered from British Columbia to San Diego, with the majority found along the central California coast, overall there is a southward trend to dispersal, especially among first-year birds (Boekelheide, Ainley, Huber, and Lewis in press). Since Double-crested Cormorants are essentially absent from the Farallones from Sep until mid-

Mar (*ibid*), the Jan decline in wetland numbers may have been due to birds moving to increased freshwater habitat following heavy winter rains. Notable spring migratory movement was indicted by flocks of about 1000 flying up the west shore of Tomales Bay on 8 and 9 Apr 1986 (AB 40: 519).

Although some Double-crested Cormorants on Point Reyes estuaries in summer are Farallon breeders on foraging trips (Boekelheide, Ainley, Huber, and Lewis in press), many others are immature non-breeders. Recently the species has been discovered nesting on the Richmond–San Rafael and Oakland–San Francisco (Bay) bridges (AB 38: 1057). Birds from these colonies may venture outside of San Franciso Bay on occasion, but probably most breeding birds in summer in the Point Reyes area originate from the Farallon Islands.

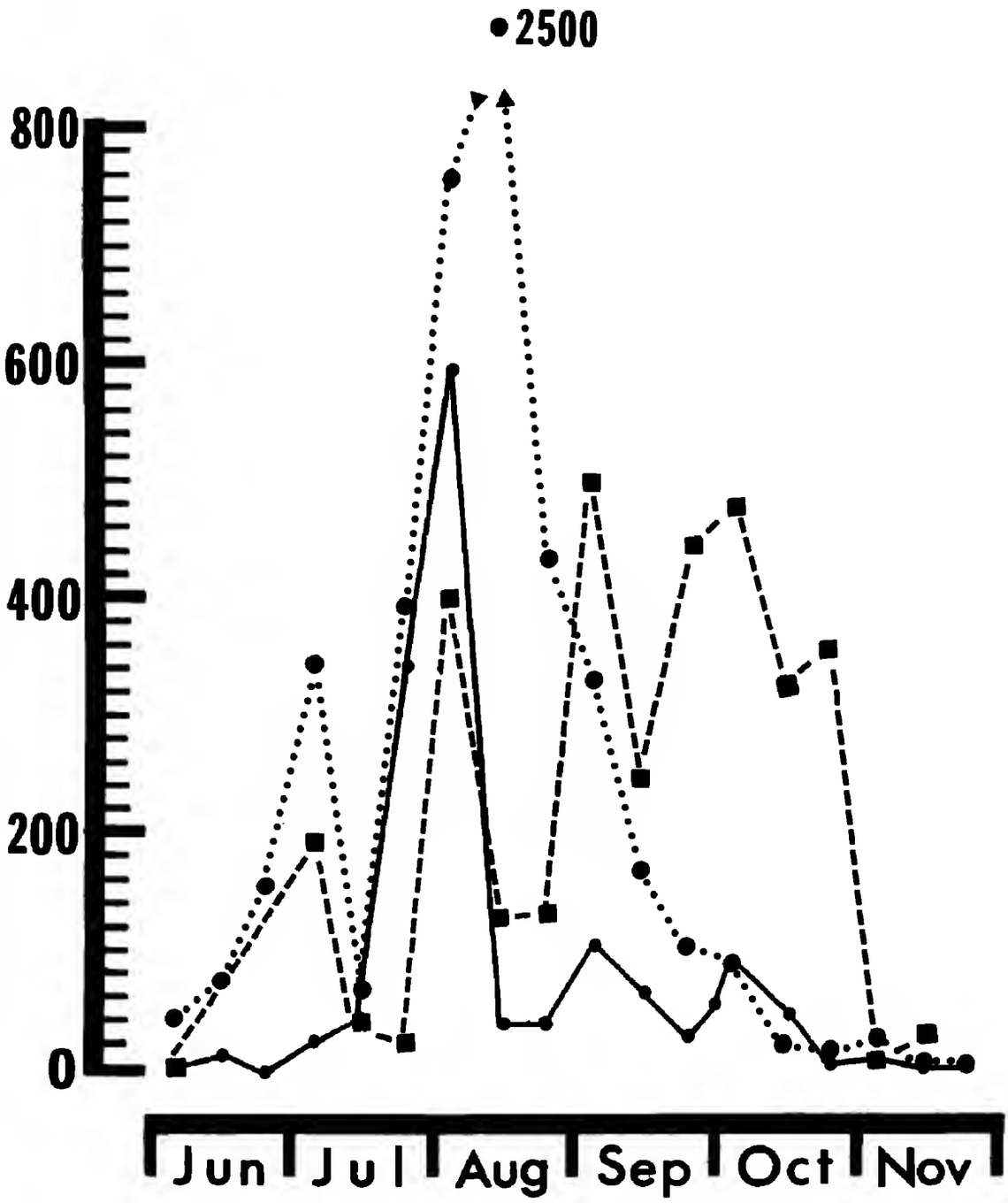


Figure 9. Numbers of Brown Pelicans at Bolinas Lagoon during 1973 (dotted line), 1974 (broken line), and 1975 (solid line).

In the Point Reyes area Double-crested Cormorants forage in estuaries, lagoons, bays, and large ponds; they occur only rarely here in inshore waters.

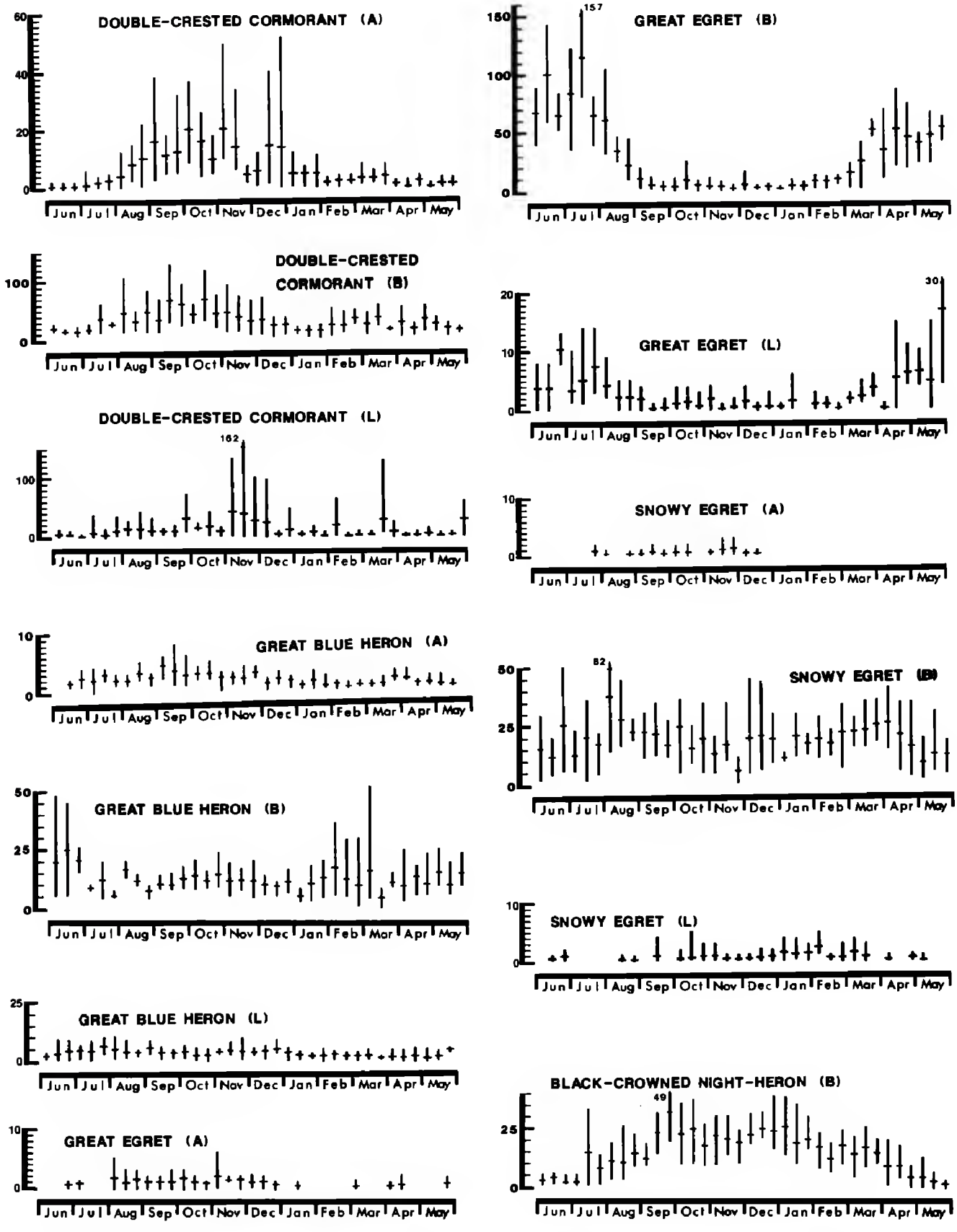


Figure 10. Seasonal abundance of the Double-crested Cormorant and some herons and egrets in wetlands of Point Reyes. See Figure 4 for details.

They often roost on sandbars, small islands, and pilings. A few also roost during the day on some coastal rocks and reefs, and many roost at night on Bird Rock off Tomales Point (DS). They forage for schools of fish "from the surface to near, but not on, bottoms having no relief" (Ainley et al. 1981).

Double-crested Cormorants formerly bred on coastal bluffs at Point Resistance just north of Bear Valley (L. P. Bolander and Bryant 1930). Although they have not bred recently anywhere along the Point Reyes shoreline (Sowls et al. 1980, authors' pers. obs.), they do breed on offshore rocks, cliffs, and man-made structures at scattered sites elsewhere along the California coast (Sowls et al. 1980, ABN). Because of various disturbances, breeding populations at the Farallones (Ainley and Lewis 1974), on islands off southern California and Baja California (Gress et al. 1973), and in interior California (Grinnell and Miller 1944, Remsen 1978, Sowls et al. 1980) have declined steeply. Ainley and Lewis (1974) argued that the failure of marine breeding populations to recover from their decline was due to the crash in the late 1940s of the Pacific Sardine (*Sardinops caerulea*) population, apparently caused by overfishing at a time of unfavorable environmental conditions. Human disturbance on the Farallones undoubtedly continued to keep numbers down, but with protection the population has increased modestly since the early 1970s (Boekelheide, Ainley, Huber, and Lewis in press). Other increases on Anacapa Island off southern California (Anderson and Gress 1983), in San Francisco Bay, and for California as a whole (USFWS Breeding Bird Surveys fide Sam Droege) indicate a trend of widespread recovery of breeding populations of Double-crested Cormorants.

Brandt's Cormorant (*Phalacrocorax penicillatus*)

Brandt's Cormorants nest regularly on offshore rocks and coastal bluffs in our study area and all along the California coast, including the Farallon Islands, where 45% of the total California population breeds (Sowls et al. 1980). They were very rare fall and winter visitants to the estuaries (Fig. 11). The scarcity of spring and summer estuarine sightings coincided with the occupation of nearby nesting colonies; more numerous fall sightings coincided with the dispersal of juveniles (Boekelheide, Ainley, Morrell, and Lewis in press). Our data for inshore waters were not adequate to explain seasonal movements, especially since Brandt's Cormorants are highly mobile when feeding (PRBO unpubl. data). After dispersal from nearby breeding areas, Brandt's Cormorants were least abundant in our inshore study area from Dec to Apr, a pattern similar to that for the central California coast overall (Briggs et al. 1987). Farallon band recoveries show an Aug to Nov northward movement by juveniles and, to a lesser degree, by adults (Boekelheide, Ainley, Morrell, and Lewis in press). Movement to the south, as early as Sep (Briggs et al. 1987), leaves the winter population spread out along the entire California coast with the bulk of the birds in the central region (Briggs et al. 1987, Boekelheide, Ainley, Morrell, and Lewis in press). Garrett and Dunn (1981) reported a northward movement in Feb and Mar in Santa Barbara Co.

Brandt's Cormorants prefer neritic waters mostly within 10 km of shore and 25 km of roosts and colonies (Briggs et al. 1987); they are rarely found in the small estuaries and lagoons (Fig. 11). Large numbers occur regularly in San Francisco Bay, and seasonally in Tomales Bay during winter herring runs. They feed primarily on both schooling and non-schooling fish on or just above rocky, sandy, or muddy bottoms, though they also catch appreciable prey from middle depths to the surface (Ainley et al. 1981). The Farallon nesting population was decimated by commercial egg collectors in the 1800s but has recovered rapidly since the 1920s (Ainley and Lewis 1974).

Pelagic Cormorant (*Phalacrocorax pelagicus*)

Pelagic Cormorants breed regularly on rocky coastal cliffs in our study area and all along the California coast (Sowls et al. 1980). They forage in inshore waters, mostly within 10 km of land (Briggs et al. 1987), and in the mouths of deep bays. They were very rare visitants to the wetlands from Sep to early Jun (Fig. 11). The greater incidence of fall sightings coincided with dispersal from breeding sites. Information on seasonal movements is scanty (Boekelheide, Ainley, Huber, and Lewis in press). Garrett and Dunn (1981) reported increased numbers south of San Luis Obispo Co. from mid-Sep to late Apr, indicating that some Pelagic Cormorants move south in winter (Garrett and Dunn 1981), but Briggs et al. (1987) did not note any seasonal movements. Although Pelagic Cormorants often feed on solitary prey that hide in rocky reefs (Ainley et al. 1981), Farallon breeders are strongly dependent on mid-water schooling rockfish (*Sebastes* spp.)

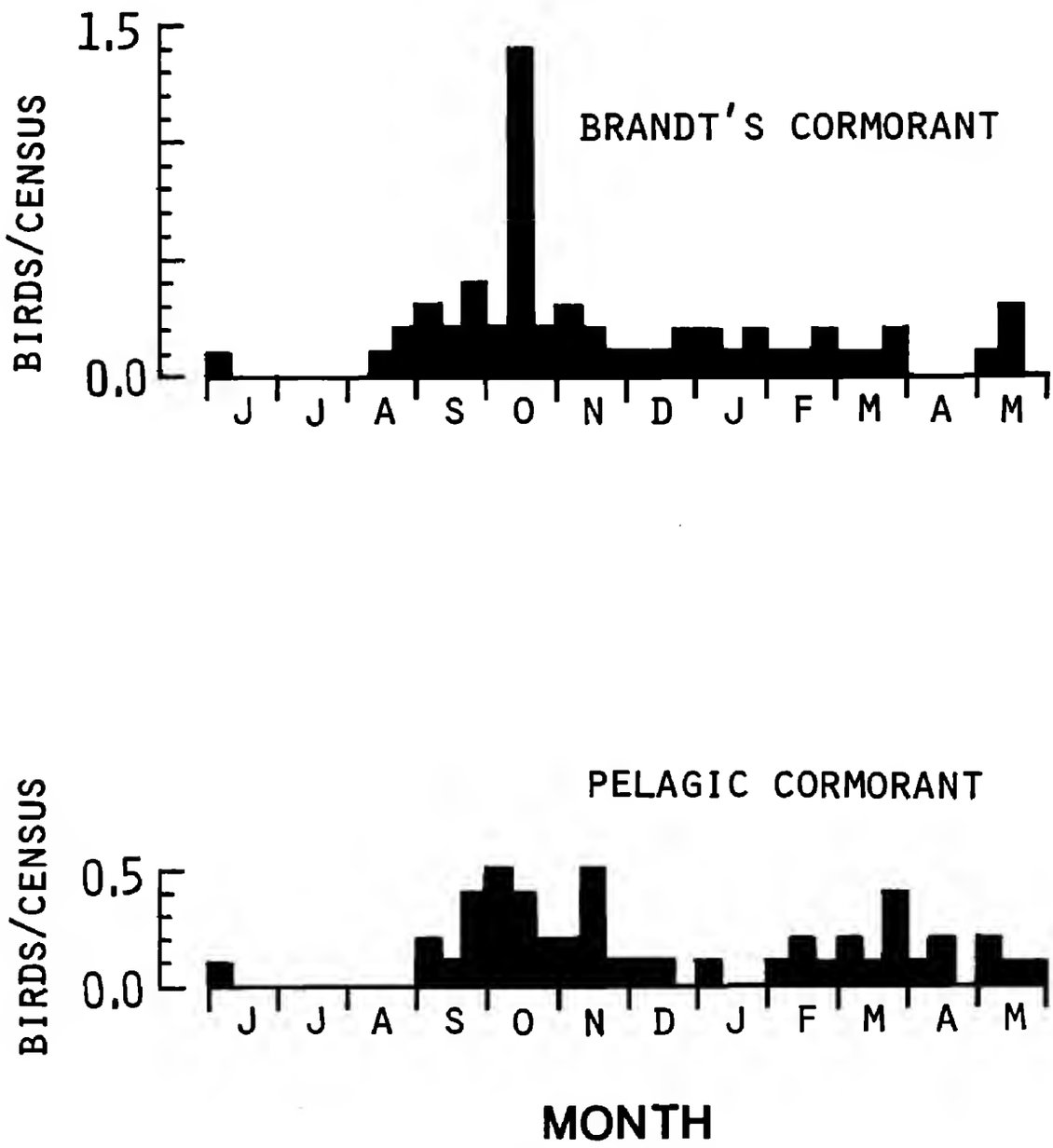


Figure 11. Mean number of Brandt's and Pelagic cormorants per census for Bolinas and Abbott's lagoons combined.

(Boekelheide, Ainley, Huber, and Lewis in press). Breeding populations declined drastically at the Farallones during the 1800s because of disturbance from commercial egg collectors but have recovered slowly since the early 1900s (Ainley and Lewis 1974).

Great Blue Heron (*Ardea herodias*)

A fairly common year-round resident (Fig. 10). Since there is little evidence for migration away from coastal California (Palmer 1962, Gill and Mewaldt 1979), seasonal changes in abundance are best explained by local movements. Variation in numbers at Bolinas (Fig. 10) corresponded with breeding at the Audubon Canyon Ranch rookery on the east side of the lagoon. The median number of adult Great Blue Herons nesting at Audubon Canyon from 1967 to 1981 was 90 birds (range 54–124; Pratt 1983). Birds begin occupying the rookery in late Jan or early Feb and commence nesting shortly thereafter (Pratt 1970, 1972a,b). Initiations of first clutches peak in mid-Mar (Pratt 1974); heron numbers on the lagoon then dropped while one of each pair was incubating. At this stage of nesting Pratt (1980) found that 45% of the departing herons went to Bolinas Lagoon to forage, while the others went elsewhere. The Jun peak on Bolinas Lagoon occurred when most chicks, at that time at least 3 weeks old, are first left unattended for part of the day (Pratt 1970) and the number of adults foraging at any one time increases. Fledglings and adults leave the heronry between late Jun and mid-Jul (Pratt 1970); at the same time numbers on the lagoon dropped. Only small numbers of herons breed close to Abbott's and Limantour (Pratt 1983), where numbers were slightly lower during the breeding season (Fig. 10). Abbott's, the only site without a heronry on its shores, had greatest numbers from mid-Aug to mid-Oct. This pattern is similar to that in fall on the Farallones (DeSante and Ainley 1980), which presumably involves wandering juveniles. Great Blue Herons may also concentrate more in estuaries and lagoons during summer and fall as ephemeral freshwater habitats dry up. They feed in the shallow waters of estuaries, freshwater ponds, marshes, flooded fields, open stream edges, and tidal reefs. They also frequent fields to prey on rodents.

American Bittern (*Botaurus lentiginosus*)

On Point Reyes, American Bitterns frequent freshwater marshes, ponds, or swales, and occasionally brackish marshes. Their status as a very rare year-round resident with a winter peak (Fig. 12) reflects the limited suitable habitat in the study area. Between 1970 and 1988 the median number of bitterns recorded on the Point Reyes CBC was 3 (range 1–10). A decline in winter sightings after early Jan (Fig. 12) may have been caused by birds dispersing over a wider area as winter rains created additional habitat. Late May to Aug records presumably pertained to local breeders or fledglings and possibly non-breeding, oversummering individuals. The only confirmed evidence for local breeding was two birds with a few tufts of down on their heads at a freshwater pond at Abbott's Lagoon on 28 Jul 1981 (DS). Bitterns begin nesting early enough in California (Bent 1926, Palmer 1962) that fledglings from outside the study area presumably could arrive here by early Jul, but data are lacking on the timing of arrival. Palmer (1962) noted that fall migration is in Sep and Oct and most spring migration is from Mar to mid-Apr but that there is "considerable wandering from late summer to early fall." Numbers are greatest on the northern California coast from early Sep to mid-May (McCaskie et al. 1979) and on the southern coast from late Sep to mid-Apr (Garrett and Dunn 1981).

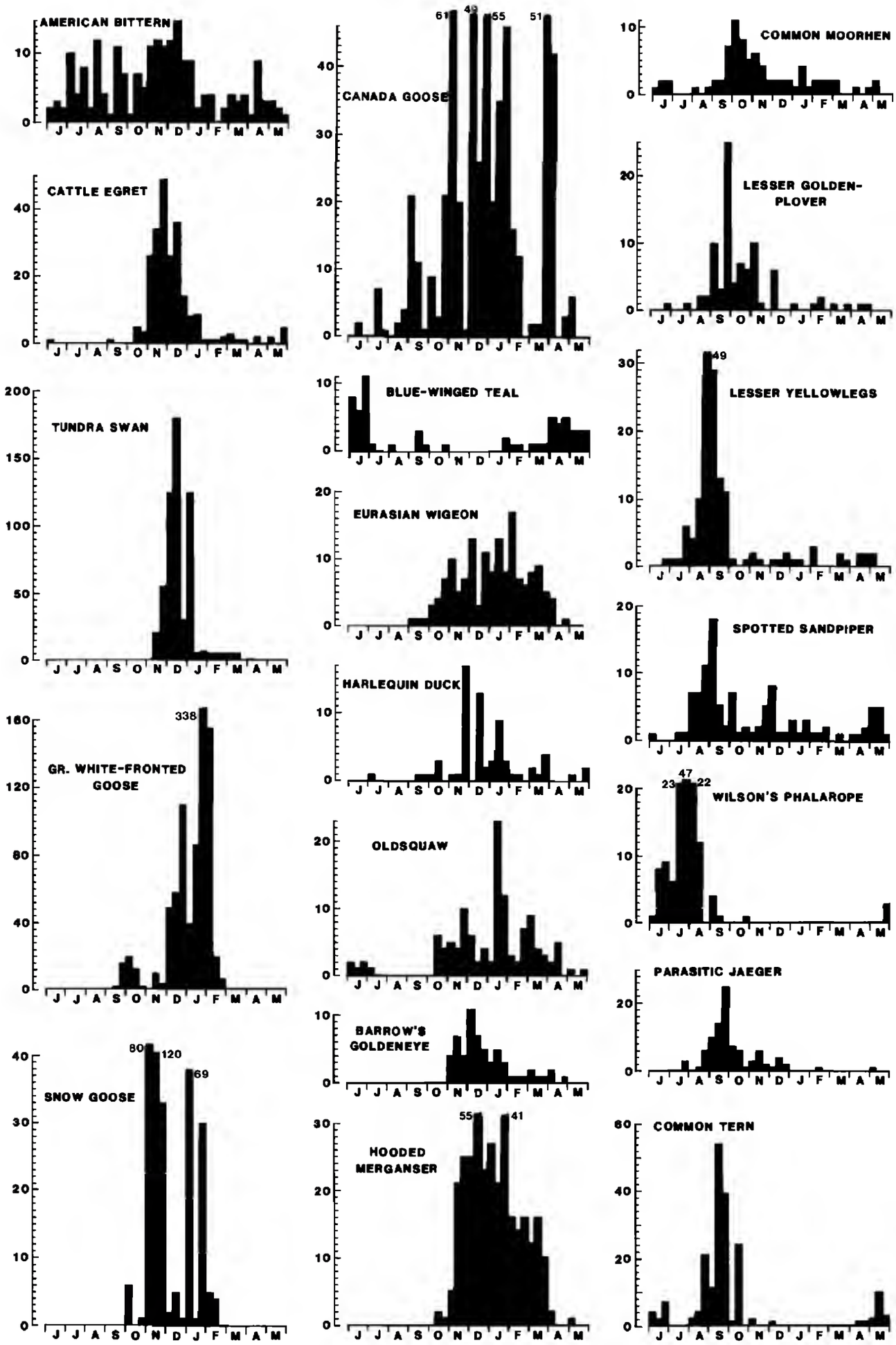


Figure 12. Occurrences of some very rare aquatic birds by 10-day periods (see Methods) from all records, 1954–1982.

Great Egret (*Casmerodius albus*)

A common summer resident and uncommon winter resident (Fig. 10). The seasonal abundance pattern at Bolinas (Fig. 10) reflected the tendency for Great Egrets from a rookery at Audubon Canyon Ranch on Bolinas Lagoon's east shore to forage on the lagoon. The median number of adult Great Egrets nesting at Audubon Canyon Ranch from 1967 to 1981 was 172 birds (range 130–296; Pratt 1983). Great Egret numbers at Bolinas built up slightly in Feb but increased sharply in Mar, when birds begin occupying the rookery (Pratt 1970). Egg laying usually peaks in early Apr, and the last egrets begin building nests by mid-Apr (Pratt 1972a,b, 1974). Numbers stabilize on the lagoon from late Mar to late May, then reach a peak from early Jun to early Aug as adults first leave their young unattended and later as the first young fledge (H. Pratt pers. comm.). The steady decline in numbers on the lagoon in Aug (Fig. 10) coincided with a reduced number of occupied nests (Pratt 1970) and was due to post-breeding dispersal of fledglings and adults from the area. Seasonal use at Limantour was generally similar to that at Bolinas but not to that at Abbott's (Fig. 10). Limantour and Abbott's are equally close to two small egret rookeries (Pratt 1983); however, Limantour is closer to the large Bolinas rookery, and birds consistently seen flying along the coast west of Bolinas during the breeding season (DS) appeared to be moving back and forth between the Bolinas rookery and Limantour. At Abbott's, the small numbers present from Aug to Dec (Fig. 10) followed post-breeding departure from Bolinas, as do the six Farallon records (21 Sep to 8 Nov, DeSante and Ainley 1980). The paucity of sightings at Abbott's between Jan and Mar may indicate poor foraging conditions caused by rising water levels after winter rains, and the paucity of sightings there from Apr through Jul corresponds to the occupation of rookeries elsewhere. The lower winter numbers at all sites are due probably to the migration of most of the population to wintering locations as distant as Baja California or the west coast of mainland Mexico (Palmer 1962).

Great Egrets appear to forage more in estuaries than do Great Blue Herons, but they also frequent freshwater ponds, marshes, streams, and, especially in the rainy season, fields and pastures. In Jun 1984, up to 56 Great Egrets fed in tidal pools of the rocky reef from Duxbury Point to Bolinas Point (RMS).

Hunters for the feather trade drastically reduced egret numbers in California in the 1880s and 1890s, but because of legislative protection the population recovered substantially from 1911 to 1943 (Grinnell and Miller 1944). Great Egrets reappeared in the San Francisco Bay area in 1924 (Stoner 1934) and the first Marin Co. sightings were of seven birds at Bolinas on 7 May 1929 (Stoner 1934) and one at Drake's Estero on 7 Jun 1931 (Stephens 1931). These birds may have been nesting at nearby rookeries at the time (Pratt 1983). Great Egrets reproduced poorly in the late 1960s and early 1970s because of DDT-induced eggshell thinning, but a decrease in egg loss during incubation since then suggests that the egrets are recovering (Pratt 1974).

Snowy Egret (*Egretta thula*)

A fairly common year-round resident (Fig. 10). A large rookery on West Marin Island near San Rafael, about 22.5 km from Bolinas, has been active since at least 1952 (Ralph and Ralph 1958, Pratt 1983). Seasonal and/or daily movements of birds from this or other San Francisco Bay rookeries may greatly influence counts at wetlands in our study area. Numbers at Bolinas (Fig. 10) were generally low during the late Apr to Jul breeding season (Stone and Rigney 1978) but increased in Aug when young and adults depart from breeding colonies in San Francisco Bay. Small numbers of Snowy Egrets wintered at Limantour from early Oct to mid-Mar and occurred irregularly at other times (Fig. 10). The few at Abbott's

from late Jul to mid-Dec (Fig. 10) may have been birds dispersing after breeding, or potential wintering birds that left the lagoon after foraging conditions changed because of winter rains. Recoveries of birds banded in San Francisco Bay suggest that juvenile Snowy Egrets migrate south for long distances to winter (as far as southern California and Mexico), while adults move short distances or winter near breeding areas (Gill and Mewaldt 1979).

Snowy Egrets forage in shallow estuaries, freshwater ponds, and marshes. They were nearly extirpated from California between 1880 and the early 1900s by the ravages of plume hunters, but because of legislative protection they recovered from 1908 to 1943 (Grinnell and Miller 1944).

Little Blue Heron (*Egretta caerulea*)

A very rare spring visitant with census records of single adults at Bolinas Lagoon from 26 May to 3 Jun 1975 (AB 29: 903, ABN) and from 11 to 24 May 1976 (AB 30: 883, ABN). The only other records for Point Reyes were of one to two birds at Bolinas Lagoon from 18 to 27 May 1984 (AB 38: 953, ABN) and an immature at Abbott's Lagoon on 2 Oct 1977 (KY, RMS). Although quite rare in coastal northern California, Little Blue Herons have been recorded in all but two years since first discovered in 1964 (Unitt 1977, ABN). There are three documented winter records for northern California, all of immatures (Jeter and Paxton 1964; AB 36: 326 and 889, AB 41: 322). Otherwise all northern California records fall between 18 Apr and 12 Oct (ABN), except for one on 26 Nov (AB 41: 137). Most are of adults near heron or egret rookeries in the San Francisco Bay area (Unitt 1977, McCaskie et al. 1979, ABN), where they presumably have been breeding since at least 1981 and apparently also hybridizing with Snowy Egrets (Morlan and Erickson 1988, AB 42: 1336). The few immatures sighted in summer may be locally produced or perhaps post-breeding dispersants from the south. In coastal southern California most records are of northward-dispersing immatures in fall, with some remaining to winter; fewer adults occur in spring and early summer (Unitt 1977, Garrett and Dunn 1981). Some have nested annually in the Tijuana River Valley since 1980 (P. Unitt pers. comm.).

Cattle Egret (*Bubulcus ibis*)

A very rare late fall to early winter dispersant. Our only census records—two birds on 1 Dec 1977, one on 4 Dec 1978, three on 7 Nov 1979, and two on 7 Dec 1979—were all from pastures bordering Pine Gulch Creek at Bolinas Lagoon. Highest non-census counts were of 18 birds on 23 Nov 1977 flying from Bolinas Lagoon north up the Olema Valley (LES, GWP, SJ), 19 birds near Olema Marsh on 17 Dec 1977 (ABN: BDP), and 19 birds on 1 Nov and 20 birds on 24 Nov 1984 at Bolinas Lagoon (DS, RMS). Between 1970 and 1988, Cattle Egrets were recorded on 15 of 19 Point Reyes CBCs; the median for the 15 years was 3 (range 1–30). Most Marin Co. records extend from mid-Oct to mid-Jan and peak strongly from early Nov to mid-Dec (Fig. 12). This peak coincides with the peak in Washington and British Columbia (Roberson 1980) but is later than that in coastal southern California, where birds are present year round with the largest numbers occurring from late Sep through early Nov (Garrett and Dunn 1981). Since Cattle Egrets breed in California from at least Apr to Aug (Cogswell 1977, AB 32: 1204) and young fledge after mid-May (AB 24: 716), one might expect initial post-breeding dispersal as early as Jun or Jul. However, noticeable northward movement on the West Coast averages much later and corresponds well with the beginning of winter rains, which may influence food availability. The importance of rainfall to the seasonal cycle of Cattle Egrets is evidenced by rainfall triggering breeding in South America (Lowe-McConnell 1967) and the post-breeding dis-

persal of birds in South Africa to areas of greater rainfall (Siegfried 1970). By Feb, most Cattle Egrets have moved south of northern California. The mid-Apr to early Jun records (Fig. 12) likely represent northward spring dispersants. At that season birds have also been found in the eastern United States far north of known breeding areas (Palmer 1962).

Cattle Egrets appear to have spread naturally from the Old World to the Western Hemisphere, occurring in South America in 1877 and in Florida by at least 1942 (Crosby 1972). They now have expanded over much of North America. The first record for Point Reyes—of one bird at Olema Marsh on 27 Dec 1970—coincided with the first widespread influx into northern California (AFN 24: 534) and followed the first sighting in California in 1964 (McCaskie 1965). Nesting was first observed in southern California in 1970 (AFN 24: 716) and in northern California in 1978 (AB 32: 1204). Despite a continuing population increase in northern California as a whole, annual numbers at Point Reyes have remained relatively stable in the 1980s (Point Reyes CBC, ABN).

Siegfried (1978) described Cattle Egret habitat as the moist ecotone between aquatic and dry upland areas. Locally, Cattle Egrets forage in moist short-grass pastures, usually around dairy cattle, and much less frequently in brackish marshes.

Green-backed Heron (*Butorides striatus*)

A very rare fall and spring visitant with the only census records being of single birds at Abbott's on 25 and 31 Aug 1966, at Bolinas on 11 Oct 1976, and at Limantour on 28 Apr 1970. This rarity reflects the limited freshwater habitat in the study area and the species' overall rarity in Marin Co. (Shuford 1982). Between 1970 and 1988, Green-backed Herons were recorded on only 4 of 19 Point Reyes CBCs, with a high count of three. Green-backed Herons occur uncommonly in northern California from early Apr to mid-Oct and rarely and locally during the remainder of the year (McCaskie et al. 1979); the average spring arrival date in Sonoma Co. is 14 Apr (G. L. Bolander and Parmeter 1978). A noticeable increase in numbers in the southern California deserts from late Mar through early May and from early Aug through mid-Oct indicates the timing of migration (Garrett and Dunn 1981). Green-backed Herons frequent the borders of streams, ponds, freshwater marshes, and, much less commonly, brackish marshes.

Black-crowned Night-Heron (*Nycticorax nycticorax*)

A rare summer resident and fairly common winter resident (Fig. 10). Bolinas was the only study site on Point Reyes with substantial numbers of night-herons. Other scattered census records, mostly from Abbott's, generally fit the Bolinas pattern. Seasonal use patterns at Bolinas probably reflected movements to and from the breeding colony at West Marin Island, Marin Co. (Ralph and Ralph 1958, Pratt 1983), or other more distant San Francisco Bay colonies. Migration is limited in California, and build-ups and declines at Bolinas were the inverse of those at coastal northern California rookeries (Ives 1972, Stone and Rigney 1978). It is also possible that the increase in winter numbers at Bolinas involves migrant birds from the interior. Although band recoveries suggest that San Francisco Bay breeders are essentially non-migratory (Gill and Mewaldt 1979), at least a few central California breeders travel to southern California and Mexico (Gill and Mewaldt 1979, Grinnell and Miller 1944). Black-crowned Night-Herons roost communally in the daytime at traditional sites near estuaries, ponds, and marshes where they feed mostly at night.

White Ibis (*Eudocimus albus*)

A very rare spring and summer visitant. An adult on Bolinas Lagoon from 14 to 19 May 1971 (AB 25: 794) and on a 23 Jun 1971 census represents the only Point Reyes record. Apparently the same bird was present in San Rafael, Marin Co., from 27 Jun to 9 Sep 1971 (AB 25: 901, AB 26: 113). This is the only northern California record, but the AOU (1983) and the CBRC (Morlan 1985) have concluded it was of an escaped captive. Others, however, favor a wild origin (AB 25: 794, McCaskie et al. 1979, Roberson 1980). Jon Winter, in a report on file with the California Bird Records Committee, summarized White Ibis sightings from *American Birds* for the rest of the country for the spring and summer of 1971. He found that an unprecedented northward surge of several species of ciconiiforms, including the White Ibis, was attributed to drought conditions in the southeast and southwest. This pattern, the lack of any escapees reported from northern California, the bird's wariness, and the known tendency of ciconiiforms to wander to the north, all argue for a natural origin of this individual.

Tundra Swan (*Cygnus columbianus*)

A very rare winter visitant with a total of 63 birds on six censuses from 16 Nov to 9 Jan. Non-census records extend the continuous date span to 7 Apr (ABN, Fig. 12); an outlying record of a bird at Bolinas Lagoon for one week in "late May" 1983 (fide RMS) was exceptional. On the northern California coast most Tundra Swans occur from mid-Nov to mid-Mar. Extreme dates are 1 Sep and 22 May, but records before late Oct or after early Apr are exceptional (ABN).

Our high census count was 27 birds at Limantour on 8 Dec 1980, and the high count from the study area was 125 birds at Bolinas Lagoon on 13 and 14 Dec 1967 (AFN 22: 473, ABN). Most sightings in the study area have been of transient flocks; however, up to 20 birds have wintered irregularly since 1979 in a pasture at the south end of Tomales Bay (ABN). From 1970 to 1988 Tundra Swans were recorded on 14 of 19 Point Reyes CBCs; the median number for the 14 years was 6 (range 1–90). Despite some recovery, numbers in California have been greatly reduced over former times (Grinnell and Miller 1944), even on the coast where they have always been scarce (Willett 1933, Garrett and Dunn 1981).

A bird thought to be a Bewick's Swan (*C. c. bewickii*) was observed at Bolinas Lagoon on 12 and 13 Dec 1982 (AB 37: 333). This is the only coastal record of this Asiatic subspecies which has been casual in California in the winter since first recorded in Jan 1975 (AB 29: 736).

Locally, wintering Tundra Swans have been found on freshwater ponds and wet pastures, but most have been seen in flight or for short periods on margins of estuaries or lagoons.

Greater White-fronted Goose (*Anser albifrons*)

A very rare fall and winter visitant with 87 birds on eight censuses from 15 Sep to 21 Jan; additional Point Reyes records follow a similar pattern (Fig. 12) and extend from 3 Sep to 18 Apr (ABN, PRBO). Extreme dates for coastal northern California are 3 Sep and 31 May (ABN, Yocum and Harris 1975), except for a 10 Jul 1988 record on San Francisco Bay (AB 42: 1336). Most records extend from late Sep to early Mar, and ones in early Sep or May are exceptional. Our high census count was of 36 birds at Bolinas on 14 Dec 1973, and the high count for the study area was of 250 at Bolinas Lagoon on 25 Jan 1971 (AB 25: 621). White-fronted Geese have been recorded on only 7 of 19 Point Reyes CBCs from 1970 to 1988; the median number for the 7 years was 13 (range 1–30). Most Point Reyes records are of transient flocks, but occasionally a few birds winter on

pastures or grass-bordered freshwater ponds. Historically, numbers in California have declined greatly both overall (Grinnell and Miller 1944) and on the coast, especially in southern California (Willett 1933).

Snow Goose (*Chen caerulescens*)

A very rare winter visitant with 15 birds on nine censuses from 25 Nov to 10 Feb; additional Point Reyes records extend from 3 Oct to 14 Mar (Fig. 12, ABN). Coastal northern California records extend from 25 Sep to 23 May, except for three Jul–Aug records. Most birds occur from mid-Oct to early Mar, and records before Oct and after early Apr are exceptional (ABN). Snow Geese were recorded on 8 of 19 Point Reyes CBCs from 1970 to 1988; the median number for the 8 years was 3 (range 1–32). The high non-census count was of 120 birds flying over Bolinas Lagoon on 16 Nov 1980 (DS). Snow Geese on Point Reyes have been observed in pastures, at grass-bordered ponds, and around lagoon and estuary margins. Historically, numbers of Snow Geese have declined greatly in California both overall (Grinnell and Miller 1944) and on the coast, especially in southern California (Willett 1933).

Ross' Goose (*Chen rossii*)

A very rare visitant with a single census record of one bird at Abbott's on 13 May 1976. There are seven additional Point Reyes records of one to four birds lingering for a few days between 30 Nov to 10 Feb (ABN) near freshwater inflows to estuaries or lagoons, at sewage ponds, and in agricultural fields. Additionally, there are records of migrants over the ocean of two birds at the Cordell Banks on 11 Oct 1986 (ABN: SFB) and of 11 birds 8 km northwest of Tomales Point on 1 Nov 1986 (AB 41: 137). Coastal northern California records extend from 24 Sep to 16 Jun, with perhaps one bird oversummering; most records are from mid-Nov to late Mar (ABN). Although much reduced from former times (Grinnell and Miller 1944), the population has increased substantially since the 1950s (Bellrose 1980). Numbers remain reduced on the southern California coast (Willett 1933, Garrett and Dunn 1981), but Ross' Geese were apparently never regular on the northern coast (Grinnell and Wythe 1927). A slight increase in sightings along the northern California coast in recent years (ABN) is just as likely a result of increased observer coverage and awareness as it is an indication of population trends.

Emperor Goose (*Chen canagica*)

A very rare winter visitant with Limantour census records of one on 27 Dec 1967 (also seen from 28 to 31 Dec, AFN 22: 473; CBRC) and two on 26 Dec 1968 and 7 Jan 1969 (one to two from 12 Dec 1968 to 9 Jan 1969, AFN 23: 515, PRBO). Details of these records, as well as those for non-census records of one bird at Tomales Bay on 18 Dec 1948 (AFN 3: 183) and of three birds flying south off Limantour on 7 Dec 1966 (AFN 21: 453), have not been submitted to the CBRC. The three Point Reyes (all Limantour) records accepted by the CBRC are of one bird on 13 Dec 1928 (Orr 1944), three that wintered from 28 Dec 1977 to 4 Feb 1978 and seen again from 9 to 22 Apr 1978, and another bird that joined the latter three on 22 Apr (AB 32: 395, AB 32: 1050, ABN).

The Emperor Goose is casual in California. The accepted Point Reyes records are among 48 (24 coastal) for the state spanning 8 Oct to 26 Apr, 1884 to 1988; most birds do not arrive before Nov or linger past Feb (CBRC). The unsubmitted records above are among a backlog of 39 such records; as this goose is so distinctive, most of these are probably valid. Most of the Point Reyes records since the 1960s have been in flight years when birds were also seen at other coastal California localities (AB 32: 395, AB 32: 1050, Roberson 1980, Garrett and

Dunn 1981), though the strong philopatric tendencies of geese in general (Johnsgard 1978) suggest that the same individuals may have returned to Limantour from 1966 to 1969.

Black Brant (*Branta bernicla nigricans*)

A rare summer visitant, an uncommon fall transient and winter resident, and a very common spring transient (Fig. 13). On the surveyed wetlands, Black Brant occurred regularly only at Limantour, which is contiguous with Drake's Estero, a major staging area for the species. More than 50 Brant were recorded at Bolinas (Fig. 13) only in spring 1973; one to three Brant were recorded on only seven censuses at Abbott's, with the exception of 39 on a 14 Nov 1981 census. Although rarely 100 to 200 birds have been seen at Limantour in mid-Jun, later in the summer it is unusual to see as many as 10 to 20 birds; a non-census count of 131 birds at "Point Reyes" on 29 Aug 1968 (AFN 23: 100) was exceptional. In fall Black Brant migrate along the California coast primarily well "offshore," so southbound migrants are only occasionally sighted from coastal promontories (Garrett and Dunn 1981, ABN, authors' pers. obs.; however, compare Roberson 1985). The occasional early fall arrivals in the Point Reyes area from 29 Sep to mid-Oct (Moffitt 1941, ABN) may represent migrants headed farther south (Moffitt 1941, ABN). Fall migration begins in earnest in early Nov and continues through early to mid-Dec (Moffitt 1932). Local wintering birds usually return to the Point Reyes area about 10–20 Nov (Moffitt 1941, ABN). Only small numbers paused on the estuaries during fall (Fig. 13), and currently numbers remain low through the winter (see below).

Large numbers of spring migrants can be seen regularly from shore during the strong northwesterly winds characteristic of spring. During offshore or slack winds they occur widely over inshore, offshore, and oceanic waters. Black Brant were seen at least 190 km off central California in Apr 1987 (D. G. Ainley pers. comm.). On Point Reyes spring migrants are most visible from the beach at Limantour. At this location many birds veer into Drake's Estero to rest or feed or continue northwest over Drake's, by-passing the Point Reyes headlands (DS). Drake's Estero and Tomales Bay are the main spring staging areas at Point Reyes (Table 2). Our censuses and those of the California Deptartment of Fish and Game do not support the report by Briggs et al. (1987) that Bolinas Lagoon is an important staging area, though hundreds of birds sometimes concentrate nearby at Duxbury Reef (RMS). Although Moffitt (1932) formerly counted thousands of wintering Black Brant in Tomales Bay on 10 Feb censuses (Table 2), he detected spring migrants as early as 11 Feb in some years. A flock of 2000 birds on Tomales Bay on 3 Feb 1988 (ABN: RS, DWm) probably represented early migrants as wintering numbers there now average about 200 birds (Table 2). During our study, numbers on the estuaries increased in late Feb, peaked from mid-Mar to early May (Fig. 13), and declined to summer lows by mid-Jun (Fig. 13). The low numbers at Limantour in late Mar (Fig. 13) reflected the high between-year and within-season variation, as pulses of migrants on estuaries may go undetected at 10-day census intervals (cf. Bayer 1983). Dates of peak spring migration over the inshore zone in central California range from 30 Mar to 20 Apr (ABN: BSa et al.).

Decreases in numbers of Black Brant wintering in California were evident by the early 1900s, especially in southern California (Grinnell et al. 1918). Historically Tomales Bay, Drake's Estero, and Bodega Harbor supported large wintering populations, but since the 1950s numbers there have declined substantially (Table 2). The local winter decline was part of a larger trend in which the bulk of the California wintering population shifted to Mexico (Bellrose 1980). The

average number of migrants in Apr in Drake's Estero, Tomales Bay, Bolinas Lagoon, and Bodega Harbor decreased from 8000 birds between 1961 and 1965 to 3000 between 1966 and 1970 (Calif. Dept. Fish and Game unpubl. data). Depletion of estuarine eelgrass (*Zostera marina*), the Brant's main food source, and human disturbance are thought to be the key factors responsible for the Brant's decline here (Moffitt and Cottam 1941, Cottam et al. 1944, Einarson 1965).

Canada Goose (*Branta canadensis*)

A very rare winter visitant with a minimum of 116 birds on 39 censuses from 19 Sep to 1 May; most birds are transients but a few winter. The highest census count was of 33 flying birds at Limantour on 26 Jan 1974, and the highest non-census count was of 170 over Palomarin on 24 Dec 1984 (PRBO). Most Canada Geese were found on Point Reyes from Sep to Apr (Fig. 12). The infrequent and abbreviated occurrence of the birds at estuaries reflects the species' preference for freshwater habitats and adjoining grassy fields, which are scarce on Point Reyes. From 1970 to 1988 the median number of Canada Geese on the Point Reyes CBC was 41 (range 0–384); most of these birds were at freshwater habitat inland. In coastal California, Canada Geese are primarily winter residents or transients. A small breeding population, perhaps of *B. c. moffitti*, has been established in the San Francisco Bay area at least since 1959 (Lidicker and McCollum 1979, ABN) and perhaps as early as 1932 (Moffitt 1939, Sibley 1952), and it is still increasing (ABN). These breeders may have originated from a recent semi-captive flock of *moffitti* at Lake Merritt, Oakland (AFN 10: 276, AB 27: 913), or from birds bred

Table 2 Numbers of Black Brant at Coastal Estuaries in Winter[a]

Years	Tomales Bay	Drake's and Limantour esteros	Bodega Harbor
1931-1942[b]	5620 ± 854 (n = 12)	2657 ± 611[c] (n = 9)	1425 ± 325 (n = 11)
1952[d]	7900	2170[e]	235[f]
1956-1968[g]	1330 ± 264 (n = 13)	—	—
1966-1969[h]	—	242 ± 226	—
1961-1971[i]	118 ± 110 (n = 9)	338 ± 148 (n = 7)	0 (n = 9)
1970-1988[j]	207 ± 44 (n = 19)	(Tomales, Drake's, and Limantour combined)	—

[a] Counts for mid-December to mid-February reported as the mean ± 1 standard error; n = sample size.
[b] Moffitt (1943); counts made 10 February each year.
[c] Counts made in Drake's every year, in Limantour only in some years.
[d] Leopold and Smith (1953); counts made 6-13 January 1952.
[e] Unclear if Limantour counted this year.
[f] Bodega Harbor has had only occasional wintering Brant since 1953 (B.D. Parmeter unpubl. data).
[g] Tomales Bay Christmas Bird Count (CBC), late December to early January each year.
[h] Drake's Bay CBC, late December each year.
[i] California Department of Fish and Game unpublished data from January censuses each year.
[j] Point Reyes Peninsula CBC, mid to late December each year.

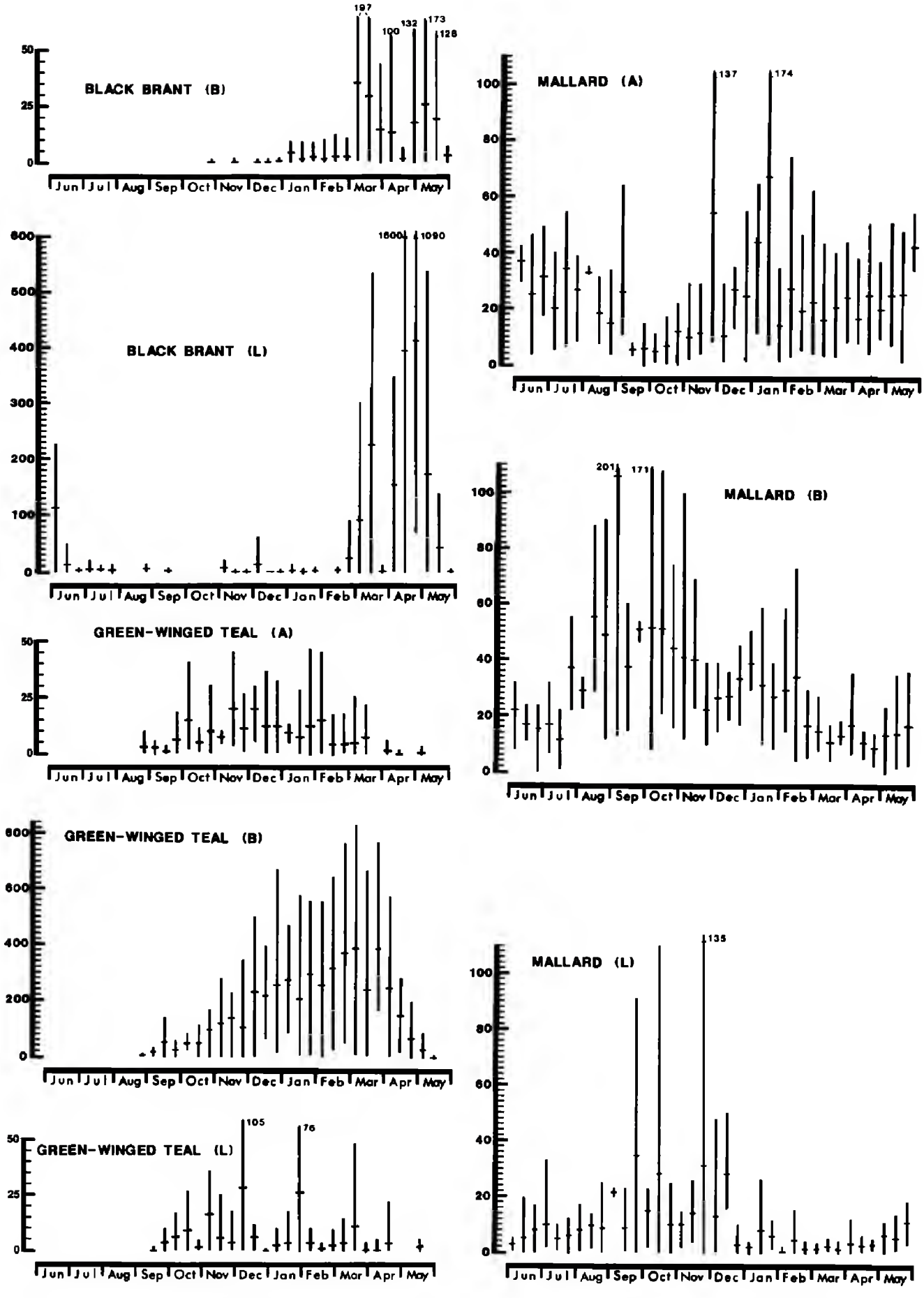


Figure 13. Seasonal abundance of the Black Brant, Green-winged Teal, and Mallard in wetlands of Point Reyes. See Figure 4 for details.

in captivity in the Bay Area in the early 1900s from eggs collected at Lake Tahoe (Grinnell et al. 1918). Canada Geese found on the Point Reyes estuaries in mid-summer, e.g., up to 35 birds at Bolinas Lagoon in Jun and Jul each year since 1984 (RMS, ABN), may represent dispersants from the San Francisco Bay breeding population.

Wood Duck (*Aix sponsa*)

A very rare visitant to surveyed wetlands with only one census record on 8 Nov 1979 from the upper Glenbrook pond behind Limantour Estero. Small numbers of Wood Ducks reside year round on Point Reyes, primarily in the Olema Valley, where ducklings were seen at Mill Pond on 5 May 1980 (DS) and at Five Brooks Pond from late May through Jul from 1987 to 1989 (ABN). On Point Reyes numbers increase only slightly in winter, in contrast to the state-wide pattern of numbers increasing 37-fold in winter because of an influx of about 90% of the Pacific Flyway population (Naylor 1960). From 1970 to 1988 Wood Ducks were recorded on only 12 of 19 Point Reyes CBCs; the median number for the 12 years was 7 (range 2–78). A high winter count was of 55 birds at Point Reyes Station on 23 Mar 1988 (ABN: RS). Because of the small numbers involved and the species' retiring habits, the timing of the local winter increase is unclear. However, a bird at a ranch pond in open grassland on outer Point Reyes on 5 Sep 1974 (ABN: WMP) was either a post-breeding wanderer or a fall migrant. Southern California records, away from areas with summer populations, reveal a winter build-up primarily from mid-Sep to mid-Apr (Garrett and Dunn 1981). Wood Ducks declined markedly in California prior to 1915 and were considered extirpated in the San Francisco Bay area (Grinnell and Wythe 1927, Grinnell and Miller 1944). Despite subsequent increases, historical levels have not yet been reached (Naylor 1960, ABN). Wood Ducks prefer bodies of slow-moving fresh water with overhanging vegetation along the margins and extensive nearby forests on the floor of which birds forage for acorns. This habitat is sparse in our study area.

Green-winged Teal (*Anas crecca*)

A very common winter resident (Fig. 13). Numbers at Bolinas increased slowly in fall but declined more rapidly in spring, a pattern not evident at Abbott's and Limantour, where the species is scarcer (Fig. 13). Extreme dates for Point Reyes were 8 Aug and 30 May (DS, ABN), except for a male at the Bolinas sewer ponds on 25 Jun and 30 Jul 1989 (DS). Winter numbers at Bolinas increased from 1972–73 to 1976–77 but declined in 1977–78 and subsequently remained low (Fig. 14). The upward trend corresponds to a continental increase of breeding and wintering numbers (Bellrose 1980). However, numbers at Bolinas were highest during the two winters of the state-wide drought, 1975–76 and 1976–77, when birds displaced from dried-up freshwater habitats may have increased the usual numbers at estuaries. On Point Reyes Green-winged Teal prefer the shallowest portions of estuaries and freshwater ponds (especially early in the fall). Four or five individuals of the Eurasian race of the Green-winged Teal (*A. c. crecca*) have been recorded on Point Reyes from 19 Nov to 4 Mar (AFN 21: 453, AB 29: 114, AB 31: 368, ABN, PRBO). First recorded in the state in 1962 (AFN 16: 364), this race is a very rare but annual winter visitant in coastal California from 2 Oct to 5 May (ABN).

Mallard (*Anas platyrhynchos*)

Year-round resident, varying from fairly common in spring and summer, to common in fall, to fairly common in winter (Fig. 13). Small numbers breed on

estuarine borders; larger numbers breed at freshwater ponds and marshes. Of any of the study sites, the upper portions of Abbott's Lagoon, which are primarily fresh water, supported the largest number of breeding Mallards. In the two estuaries Mallards were most numerous in fall and early winter, but at Abbott's numbers were lowest in fall (Fig. 13). The fall to early winter peaks at Limantour and Bolinas may have reflected the concentration of birds on estuaries after the dry season. The subsequent decline may have represented dispersal to take advantage of freshwater habitat enhanced by winter rains and/or simultaneous or progressive dispersal to potential breeding sites. At Abbott's, low fall numbers reflected post-breeding dispersal and the subsequent increase reflected the arrival of wintering birds, some of which perhaps remained to breed. Although Mallards prefer freshwater ponds, they also use tidal flats (especially near freshwater inflows), saltmarsh channels, flooded pastures, and ephemeral pools.

Northern Pintail (*Anas acuta*)

A very rare summer visitant and an abundant winter resident (Fig. 15). A record of a pair at Home Bay on 17 June 1981 (DS) suggests the possibility of occasional breeding on Point Reyes. Irregular non-census records of up to 30 birds in mid-Jul (PRBO) perhaps represent post-breeding dispersants from San Francisco Bay (ABN), since migrants traditionally arrive in early Aug (Fig. 15). At Bolinas "spring" departure usually was abrupt (a drop of 75 to 95% or 700 to 2500 birds) and variable from year to year, with the bulk of the population leaving as early as Jan in 1978 (Fig. 16). Only in the drought years of 1975–76 and 1976–77 did large numbers of Pintails remain into Mar. In all other years from 1972–73 to 1981–82, abrupt departure from early Jan to mid-Feb coincided with periods of 16 cm or more of rain in a 10-day period, or 20 cm or more in a 20-day period. Heavy rainfall in late fall did not trigger departure of large numbers of birds. At Abbott's and Limantour most Pintails departed by late Jan or Feb in all years (Fig. 15). Protracted fall migration and abrupt spring departure characterize the species throughout its winter range (Bellrose 1980). Although abrupt departure at Bolinas followed periods of heavy winter rains, it is unclear whether Pintails were fleeing adverse conditions, such as the inundation of estuarine feeding areas, or whether they were moving to newly flooded freshwater areas inland. High winter numbers during the 1975–76 and 1976–77 drought years (Fig. 14) may have been due to the lack of alternate freshwater habitats. On Point Reyes, Pintails forage in shallow estuarine waters, on tidal flats, and in freshwater ponds, and sometimes raft on deeper bays or even inshore waters during migration.

Blue-winged Teal (*Anas discors*)

A very rare spring transient with eight records on seven censuses from 13 Feb to 8 May. Although most additional records were of spring migrants, some fell in every month of the year (Fig. 12, ABN, Point Reyes CBC). Three Blue-winged Teal have been recorded on only two of 19 Point Reyes CBCs from 1970 to 1988. Fall records were probably under-represented because of the difficulty of separating the Blue-winged from the more numerous Cinnamon Teal at that time of year; non-breeding-plumaged teal of these species were generally assumed to be Cinnamon Teal (however, see Phillips 1975). Although Blue-wingeds are not known to breed on Point Reyes, at least seven reports of from one to six birds at scattered sites between 18 May to 23 Jun, 1975 to 1988, suggest they may breed here rarely. Coastal breeding has been reported from western Oregon (Wheeler 1965) and northern California (Yocum and Wooten 1956, ABN), but most records are based on male Blue-wingeds associating with unidentified females with broods, thus not eliminating the possibility of mixed Blue-winged/Cinnamon pairs.

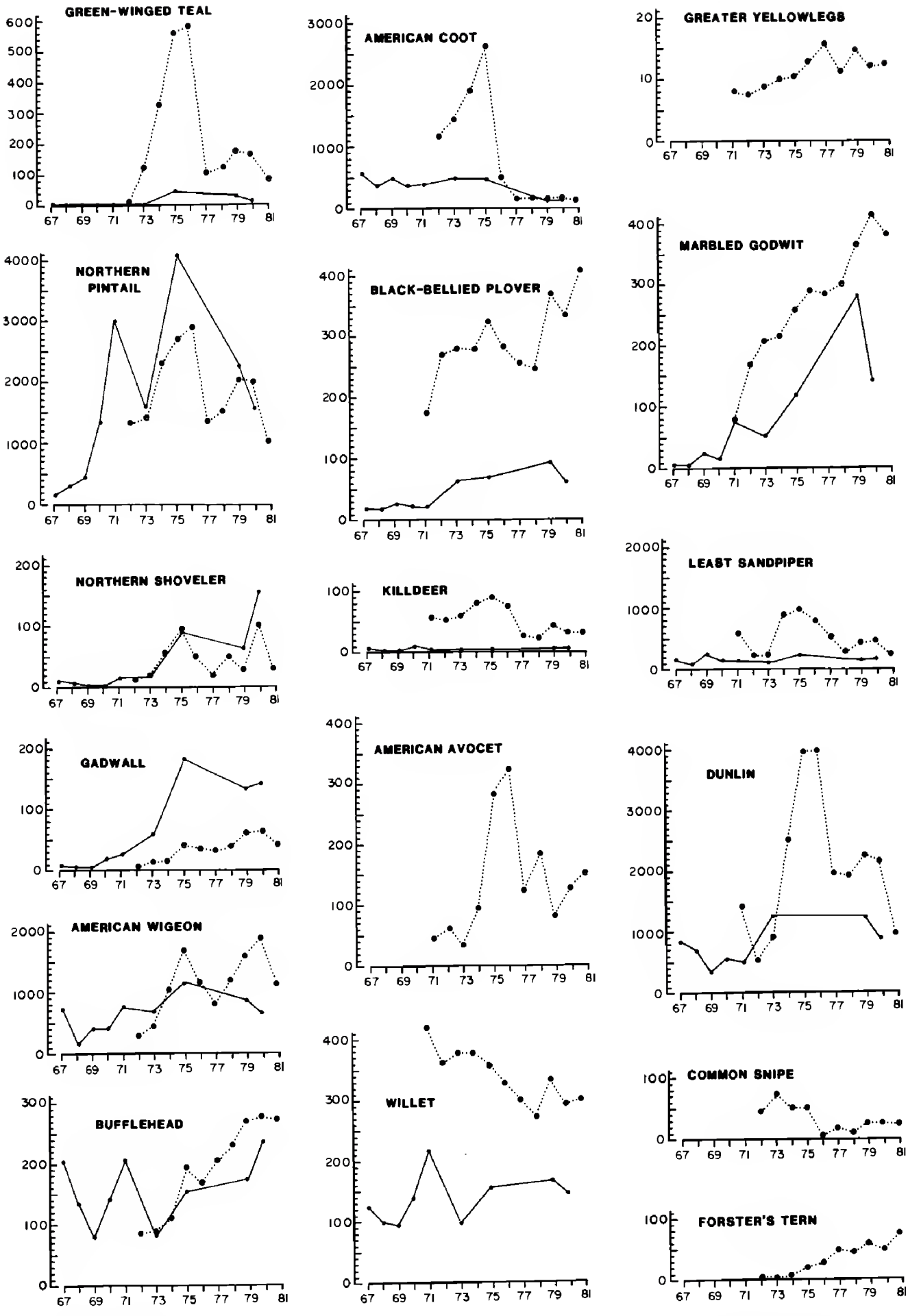


Figure 14. Mean numbers of some wintering aquatic birds at Limantour Estero (solid line) and Bolinas Lagoon (dotted line) between 1967–68 and 1981–82. Note gaps in the census record for Limantour.

Wheeler (1965) and Connelly (1978) reported that from the 1930s to the 1960s the Blue-winged Teal pioneered new breeding areas and increased in number on the Pacific Coast, especially north of California. The species tends to abandon drought-stricken areas to pioneer habitat far from the center of its

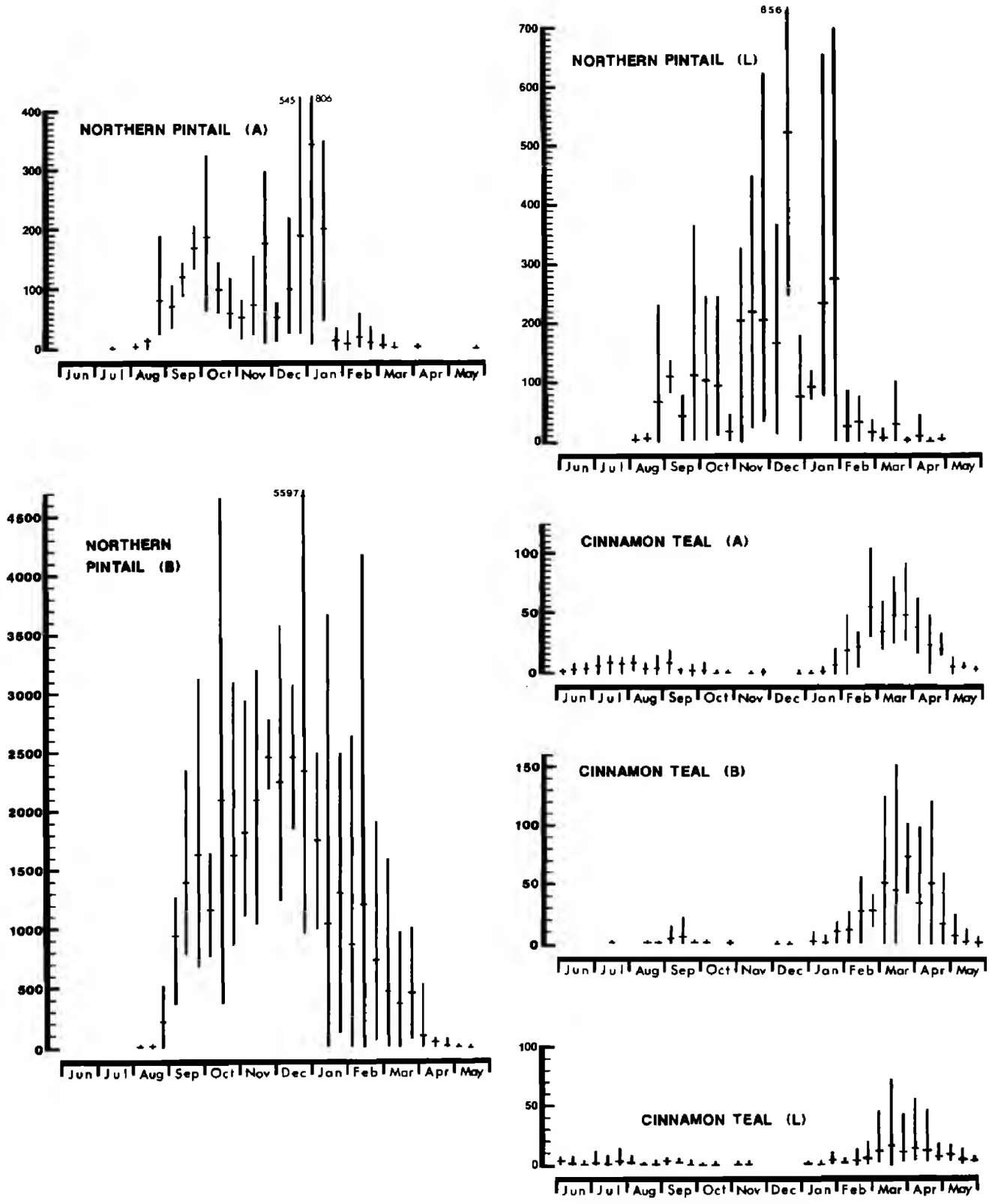


Figure 15. Seasonal abundance of the Northern Pintail and Cinnamon Teal in wetlands of Point Reyes. See Figure 4 for details.

breeding range (Bellrose 1980), perhaps explaining periodic influxes, both locally (23 birds in Marin Co., May–Jun 1980, DS) and throughout coastal northern California (e.g., AB 34: 926). Blue-winged Teal inhabit shallow freshwater ponds and marshes and, less frequently, estuaries near freshwater inflow or fresh to brackish impoundments. Although overlapping broadly in habitat use with Cinnamon Teal, Blue-wingeds are less likely to feed in water with emergent vegetation (Connelly and Ball 1984).

Cinnamon Teal (*Anas cyanoptera*)

Although found year round, the Cinnamon Teal was principally a spring transient in the study area. Census data indicate that it is uncommon in summer and fall, rare in winter, and common in spring (Fig. 15). Spring arrival began in Jan, with numbers peaking in Mar and declining through Apr and May. A few remained to breed on freshwater ponds, as reflected by the Jun and Jul numbers at Abbott's and Limantour (Fig. 15). Additional breeding sites in the study area include the Bolinas sewer ponds and other ponds at Limantour and Drake's

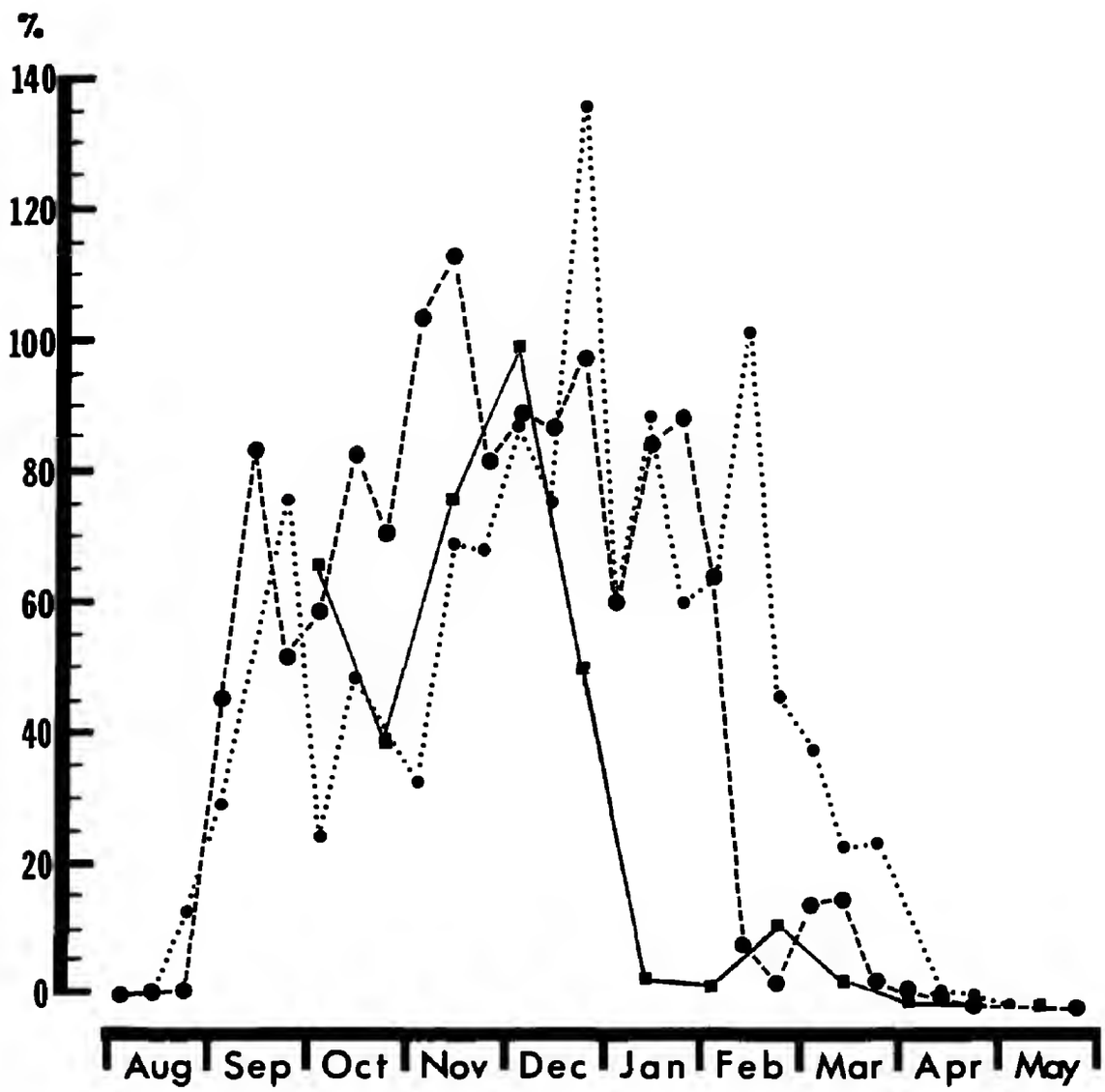


Figure 16. Numbers, expressed as a percentage of the winter mean, of the Northern Pintail at Bolinas Lagoon during 1974–75 (broken line), 1975–76 (dotted line), and 1977–78 (solid line).

esteros but not tidal marshes, which are used in San Francisco Bay. Cinnamon Teal forage primarily in shallow fresh water (cf. Blue-winged Teal) but also use estuaries and brackish impoundments.

Northern Shoveler (*Anas clypeata*)

A common winter resident (Fig. 17). The earliest fall arrival date for Point Reyes was 5 Aug 1962 (ABN: HLC). Numbers increased from late Sep through early Dec (Fig. 17) at the two estuaries. Migration continues perhaps until mid-Dec (Palmer 1976a). At Bolinas numbers decreased steadily from Jan through Apr, in contrast to Limantour where birds departed abruptly between late Jan and the end of Feb (Fig. 17). Shovelers used Abbott's to only a limited degree, mostly from early Sep to mid-Jan. Irregular high counts at Limantour and Abbott's may have represented Shovelers that had been flushed from nearby ponds and settled in our census areas for brief periods. It is unclear why Shovelers left Limantour by Feb because birds concentrated there on estuarine rather than on pond habitat, which was most subject to change during winter rains. Shoveler numbers increased at Limantour during the study (Fig. 14). A few May sightings and a pair seen near Drake's Beach on 16 Jun 1981 (DS) suggest that Shovelers may nest occasionally in the study area, as they do rarely around San Francisco Bay (Grinnell and Miller 1944, ABN). At Point Reyes, Shovelers feed in shallow freshwater ponds, brackish ponds or impoundments, sewage ponds, and estuaries near freshwater inflow, especially in muddy areas such as the Pine Gulch Creek delta on Bolinas Lagoon.

Gadwall (*Anas strepera*)

An extremely rare summer and common winter resident (Fig. 17). Although Gadwalls breed in moderate numbers around San Francisco Bay (Gill 1977), they are irregular in Jun and Jul on Point Reyes where there is only one breeding record (AB 35: 974). Fall arrival begins in late Aug and probably continues until Dec. At Limantour freshwater ponds hosted greater numbers than the estuary before Nov, but later, after the commencement of winter rains, virtually all birds shifted to the estuary (near freshwater inflow), perhaps because of rising pond levels or depletion of food in the ponds (Fig. 18). Rising water levels or food depletion perhaps also explain the departure of Gadwalls from Abbott's in early winter (Fig. 17). A preference for ponds may explain why arrival began two months earlier at Limantour and Abbott's than at Bolinas, where freshwater habitat is mostly lacking. At Bolinas Gadwalls concentrated at the mouth of Pine Gulch Creek, the area of greatest freshwater inflow. An upward trend in winter numbers at Bolinas and Limantour (Fig. 14) paralleled a "dramatic" post-1950s rise in the breeding and wintering population (Johnsgard 1978, Bellrose 1980) and an expansion of the species' breeding range (Palmer 1976a). Gadwalls occur in freshwater ponds and the innermost reaches of estuaries where the substrate is soft and muddy.

Eurasian Wigeon (*Anas penelope*)

A very rare winter resident (Fig. 12). Eurasian Wigeons occurred most frequently at Bolinas, the wetland study site which also supported the largest numbers of American Wigeons. At Bolinas, Eurasian Wigeons wintered every year from 1975–76 to 1981–82. The total of 15 birds on 38 Bolinas censuses from 4 Nov to 1 Apr probably overestimates the total, because high counts there were of four birds on a 2 Feb 1976 census and five on 5 Feb 1977 (ABN: RS) and many birds probably returned annually. However, single females were recorded on only

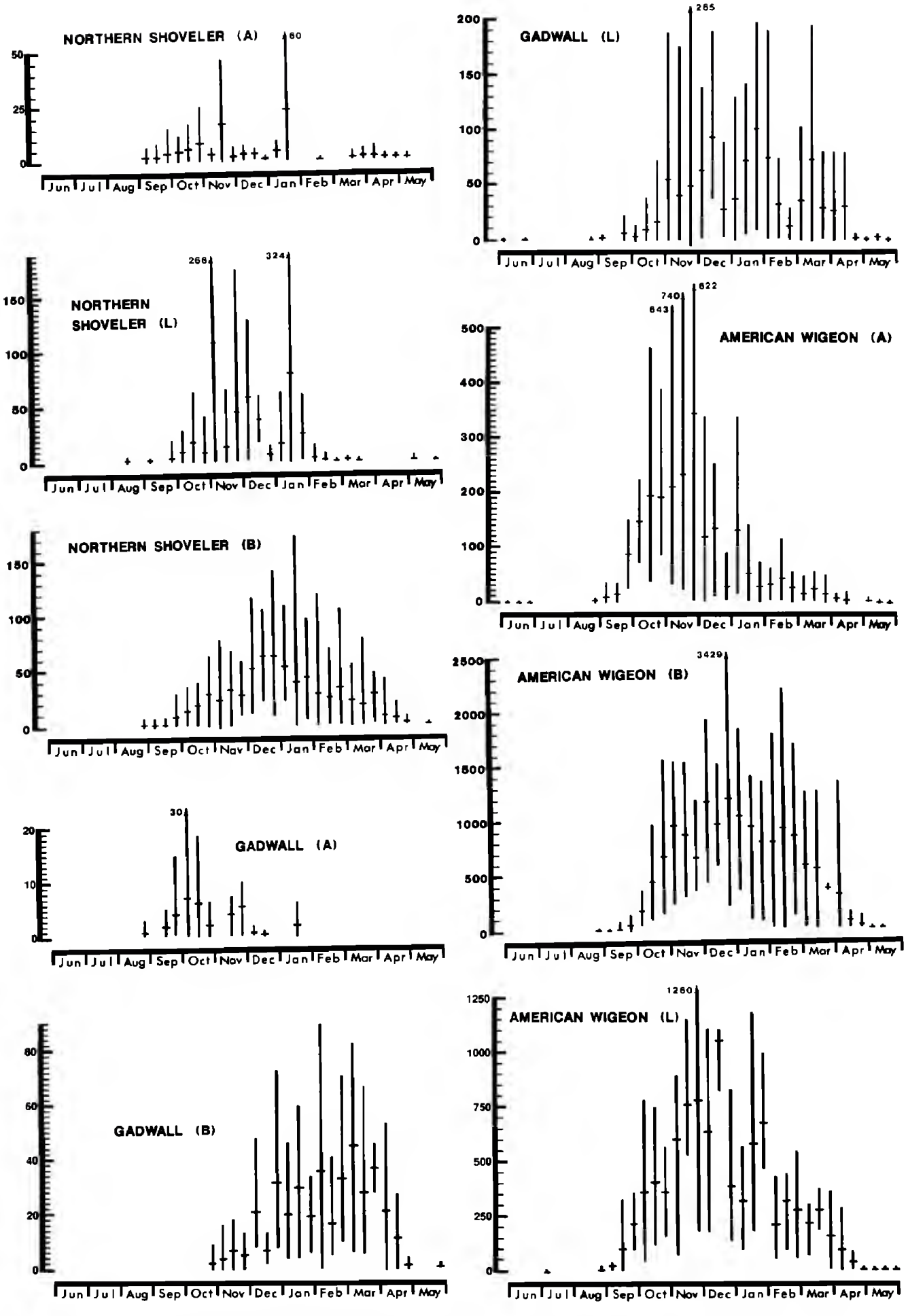


Figure 17. Seasonal abundance of the Northern Shoveler, Gadwall, and American Wigeon in wetlands of Point Reyes. See Figure 4 for details.

two censuses and a number of others were probably overlooked. Seven records on seven censuses from 27 Oct to 15 Mar at Limantour and Abbott's were all of transients. Eurasian Wigeons were reported on 14 of 19 Point Reyes CBCs from 1970 to 1988 with a high count of 4. At Point Reyes, extreme dates of occurrence were 10 Sep and 30 Apr. Except for one 8 Jul to 7 Aug 1979 record at Palo Alto (Morlan and Erickson 1988), extreme dates for coastal northern California are 9 Sep and 15 May (ABN). An apparent increase in Eurasian records at Bolinas over the course of the study may have been a result of high American Wigeon populations in later years (Fig. 14).

Eurasian Wigeons appear to have habitat preferences identical to those of American Wigeons (see that species), with which they associate. Locations of most frequent sightings of Eurasians in the study area include the Pine Gulch Creek mouth at Bolinas Lagoon, Bolinas sewer ponds, Walker Creek mouth on Tomales Bay, Muddy Hollow pond at Limantour, and the ponds at Abbott's Lagoon.

American Wigeon (*Anas americana*)

A very rare summer visitant and an abundant winter resident (Fig. 17). Summer census records were of one at Limantour on 10 Jul 1975 (GWP) and one at Abbott's until 24 Jun 1980 (DS). Non-census summer records were of one at a pond near Drake's Bay 6 Jul 1964 (ABN: GM) and one at Horseshoe Pond on 10 Jul 1982 (DS). Fall arrival on Point Reyes sometimes begins as early as 8 Aug (1987, DS), but typically it commences in late Aug (Fig. 17). At Bolinas, numbers peaked from Nov to Feb and birds departed from Mar to May (Fig. 17). Numbers declined sharply (by 35 to 75% or 350 to 550 birds) at Bolinas between late Dec and mid-Feb in 1972–73, 1974–75, 1977–78, and 1981–82 when 20 cm or more of rain fell in a 10-to-20-day period; numbers there remained high until Mar in the dry years of 1975–76, 1976–77, 1978–79, and 1980–81 (Fig. 2). Anomalous years were 1973–74 and 1979–80 when numbers remained high despite more than 20 cm of rain in late Dec and early Jan. These data suggest that cumulative and short-term rainfall may affect departure but that other factors may also be involved. At both Limantour and Abbott's, numbers typically declined markedly by Jan or Feb and remained low until final departure in May (Figs. 17 and 18). The early decline at the latter sites occurred at the same time some birds shifted from freshwater ponds to the estuaries and water levels in the ponds rose following winter rains (Fig. 18). Other birds left the area probably because the wetlands could not support as large a population of wigeons without suitable pond habitat. Wigeons at Bolinas did not rely as heavily on freshwater ponds but were the only dabbling ducks there that grazed intensively in moist pastureland and salt marsh. American Wigeons prefer shallow water where aquatic vegetation is available and are most numerous on freshwater ponds and on estuaries in areas of freshwater inflow. Wigeons often associate with American Coots, which they rob of vegetation obtained by diving.

Canvasback (*Aythya valisineria*)

A very rare summer visitant and a common winter resident (Fig. 19). The only two mid-summer census records were from Abbott's on 27 Aug 1973 (RMS, RPH) and 28 Jul 1981 (DS). In fall birds arrived a few weeks earlier at Abbott's and Limantour than at Bolinas (Fig. 19). The winter of 1975–76 produced an all-time high count of Canvasbacks at Abbott's (winter mean 610), probably because of the drought-related shortage of habitat elsewhere. Within the study area, freshwater ponds support the highest Canvasback concentrations, followed by bays, estuaries, and lagoons.

Redhead (*Aythya americana*)

A rare winter resident with census records from 23 Sep to 5 Apr at Limantour and Abbott's (Fig. 19). Except for an unseasonal high count of 14 birds at Abbott's on 17 Jul 1988 (ABN: LJP), non-census records extend from 11 Aug to 26 Apr (ABN, PRBO). Redheads at Abbott's (Fig. 19) were either transients or wintering birds that shifted habitats, perhaps because of changing water levels from winter rains or depletion of food. The median number of Redheads, primarily from a flock wintering near Walker Creek's mouth on Tomales Bay, was 295 (range 0–1006) on the Tomales Bay CBC from 1956 to 1968 and 298 (range 1–784) on the Point Reyes CBC from 1970 to 1981. The Tomales Bay flock was not seen on the Point Reyes CBC from 1982 to 1988, when Redhead numbers ranged from 0 to 15. Otherwise, high counts in the study area of fall transients on freshwater ponds have exceeded 20 birds only four times, with a maximum of 43 birds at Limantour on 10 Nov 1965 (TVV et al.). Away from Tomales Bay, Redheads are found on Point Reyes on freshwater ponds.

Redheads were formerly quite common in California but by the early 1900s had been greatly reduced in number at all seasons (Grinnell et al. 1918, Grinnell and Miller 1944). On the North American continent as a whole, the Redhead population has decreased drastically because of drainage of breeding habitat (Cogswell 1977) and overshooting (Palmer 1976b).

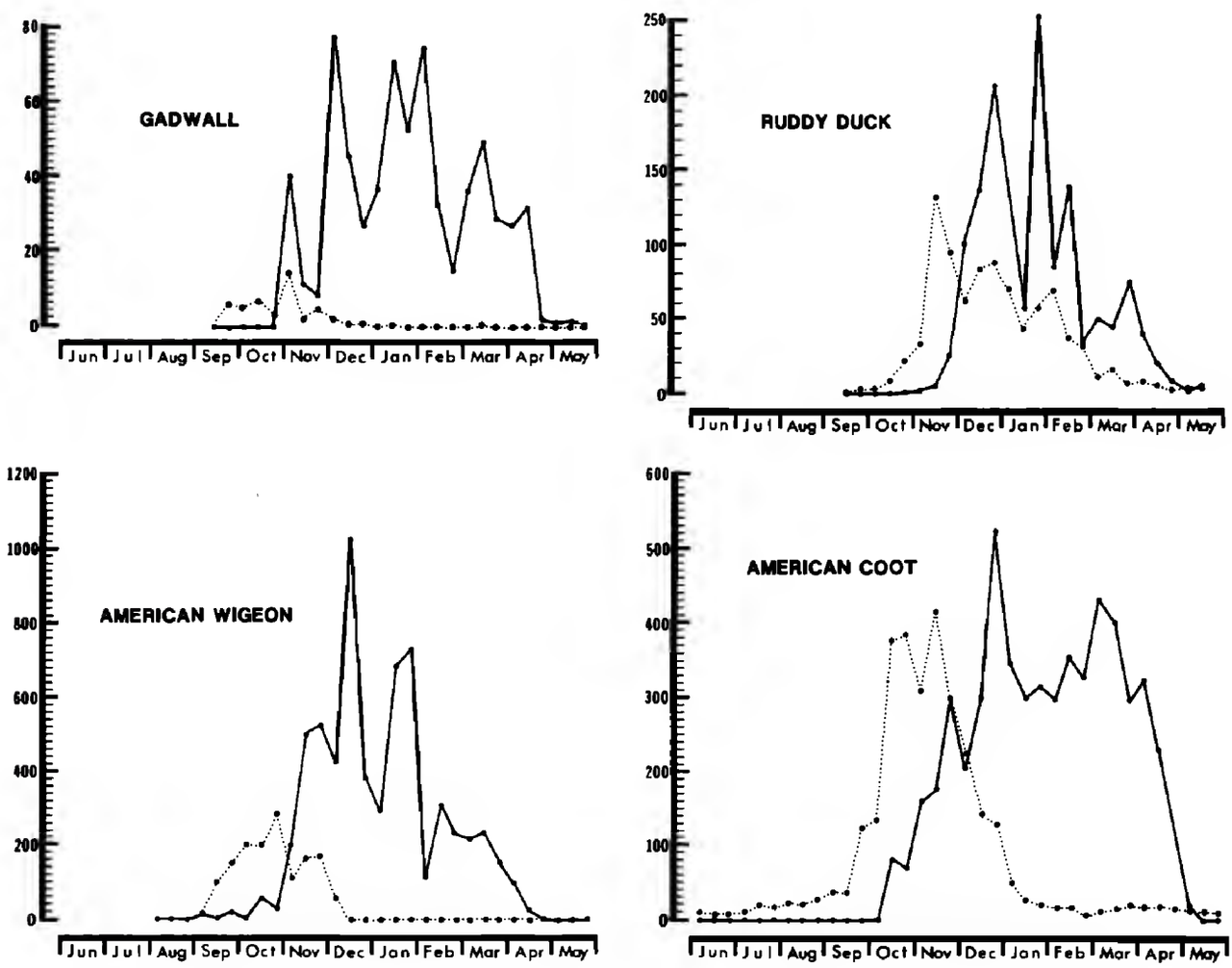


Figure 18. Mean numbers of the Gadwall, American Wigeon, Ruddy Duck, and American Coot in Limantour Estero (solid line) and ponds associated with Limantour (dotted line) between 1967 and 1974.

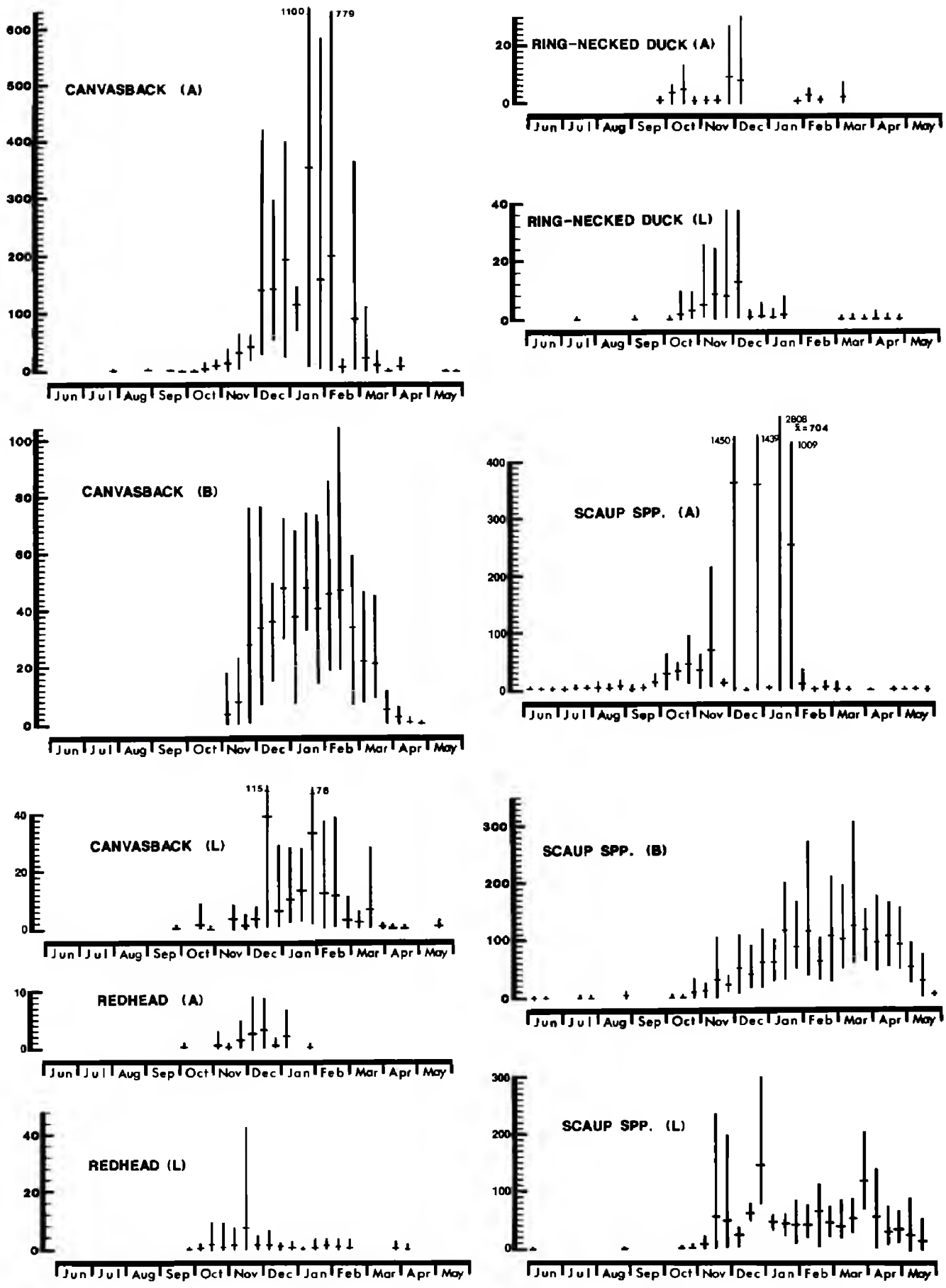


Figure 19. Seasonal abundance of some diving ducks in wetlands of Point Reyes. See Figure 4 for details.

Ring-necked Duck (*Aythya collaris*)

A very rare summer visitant, an uncommon fall transient, and a rare winter resident at freshwater ponds at Limantour and Abbott's (Fig. 19). The only summer records are of a female on 16 Jul 1980 at Muddy Hollow Pond (AB 34: 926), two males and a female there on 20 Jul 1981, and a female on 28 Jul 1981 at Horseshoe Pond (DS). Otherwise, extreme dates of occurrence in the study area are 5 Sep and 3 May (ABN). On Point Reyes most birds occur from Oct to early Dec (Fig. 19). This pattern may have reflected passage of migrants or a local shifting of birds to non-censused ponds as habitat suitability changed during winter rains. A flock of 87 Ring-necked Ducks at Five Brooks Pond on 21 Dec 1979 (JGE) was an unusual concentration for the study area. The Mar and Apr records at Limantour suggest a limited spring passage (Fig. 19). Ring-necked Ducks show a strong preference for shallow freshwater lakes, ponds, and reservoirs. The only local records for estuaries were of one bird on 7 Dec 1985 (DS), 26 on 27 Dec 1986 (RMS, DS), and one on 15 Nov 1988 (RMS, PA), all on Bolinas Lagoon near the mouth of Pine Gulch Creek.

Tufted Duck (*Aythya fuligula*)

A very rare winter visitant with sightings of two to three birds on seven censuses from 7 Oct to 3 Mar, 1979 to 1982, at Limantour and Abbott's. Because birds return in successive years and may move between sites both in the same and in successive years, it is difficult to assess the exact number of individuals involved (Dunn 1988). The CBRC currently accepts two records of the Tufted Duck for Point Reyes: (1) one male at Limantour from 7 Jan to 17 Apr 1978 that returned 23 Nov 1978–10 Mar 1979, 29 Sep 1979–12 Jan 1980, and 3 Oct–27 Dec 1980; in 1981 it was first seen at the Horseshoe Pond, Drake's Beach, from 26 Oct to 14 Nov, then returned again to Limantour from 5 to 19 Dec; (2) a second male at Limantour from 9 Nov to 2 Dec 1980 that returned to the Horseshoe Pond on 8 Nov 1981 then again to Limantour from 5 Dec 1981 to 3 Jan 1982. A pair at Limantour on 7 Nov 1981 was rejected by the CBRC. The Limantour birds were seen mostly at Muddy Hollow Pond and occasionally at the larger Glenbrook pond. A record at Abbott's of a male from 5 Feb to 3 Mar 1980 (felt to represent the second male that was seen the following fall at Limantour) was accepted by the CBRC (Dunn 1988). It is currently being reviewed again along with more recently submitted Abbott's records for 14 Jan 1981 and 7 Oct 1981–22 Feb 1982. A 7 Nov 1982 record for Abbott's and a 15 Feb 1987 record for Tomales Bay have not been submitted to the CBRC. *All* the records for Abbott's may be rejected as representing possible hybrids (D. Roberson in litt.).

Tufted Ducks have been expanding their palearctic breeding range (Palmer 1976b), and sightings of vagrants to North America have increased since the early 1970s (Bellrose 1980, Roberson 1980, ABN). The first California record was in the winter of 1948–49 (Orr 1950, 1962, Dunn 1988), and the species has been recorded annually in the state since 1968 (CBRC). Except for one of oversummering, the 40 currently accepted records for California (mostly coastal slope) span 29 Sep to 11 May; most are for Nov–Mar (CBRC).

Scaup spp. (*Aythya* spp.)

Because many Greater Scaups (*A. marila*) and Lesser Scaups (*A. affinis*) were indistinguishable on censuses, we present data for both species combined. Scaups were rare summer visitants and very common winter residents (Fig. 19). Careful non-census identifications revealed that the seasonal abundance pattern at Bolinas (Fig. 19) was based primarily on the Greater Scaup, which apparently arrives later

and departs earlier from the wintering grounds than does the Lesser Scaup (McCaskie et al. 1979, Bellrose 1980). The scaups on fresh water at Abbott's Lagoon in 1975–76 were mostly Lessers (Fig. 20). Typically, the increase in numbers of both species in fall was more gradual than the decrease in spring (Figs. 19 and 20).

Greater Scaups use deep bays, estuaries, lagoons, and, to a limited extent, freshwater ponds. Although Lessers overlap with Greaters on saltwater, they occur much more frequently on freshwater ponds and generally prefer fresher and shallower waters than do Greaters (Palmer 1976b).

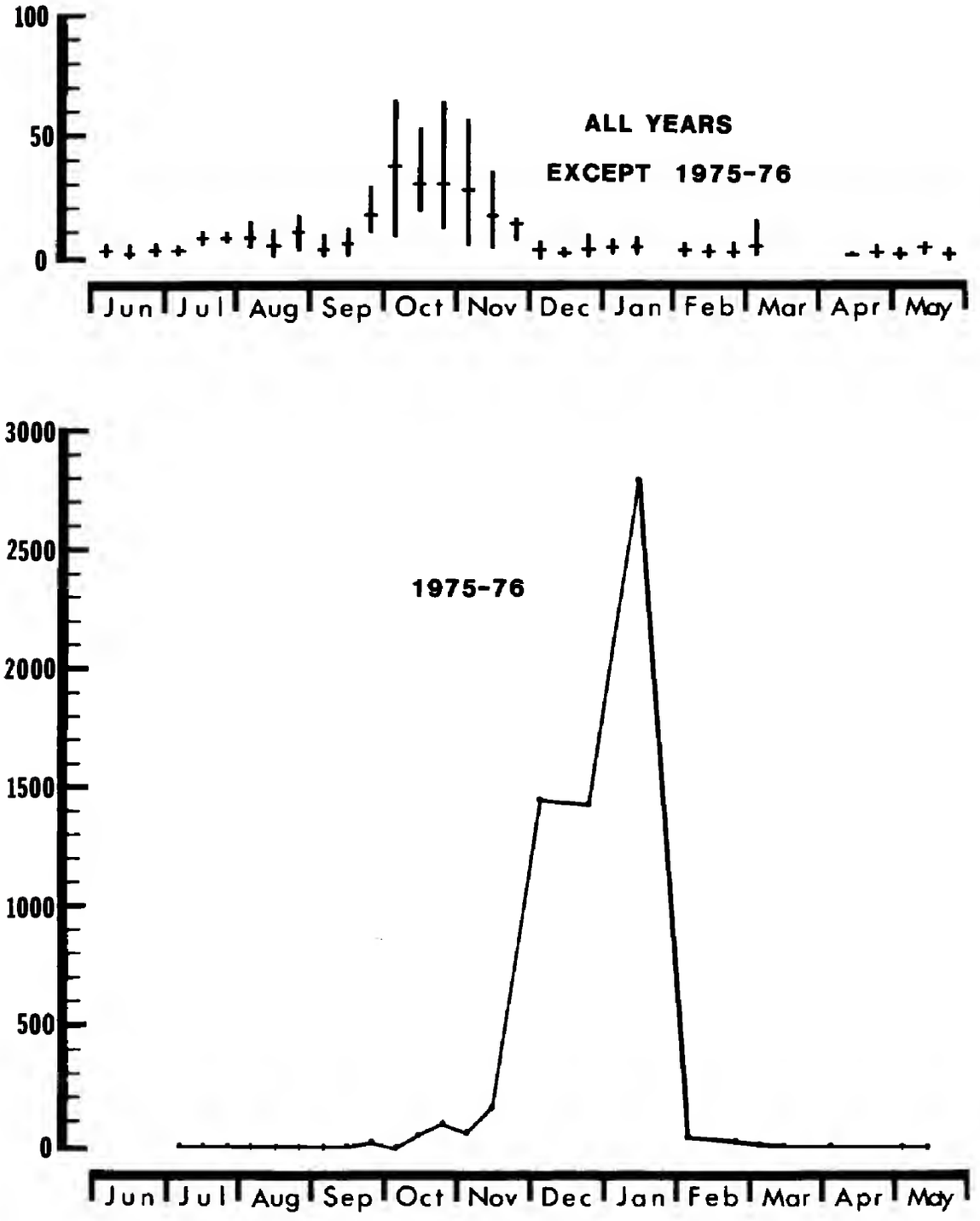


Figure 20. Numbers of scaups at Abbott's Lagoon in 1975–76 and all years except 1975–76. See Figure 4 for details.

From careful identifications we can report the following:

Greater Scaup. Although of irregular occurrence, a few oversummering Greater Scaup can be found almost every year somewhere on Point Reyes. High summer census counts were 9 and 12 birds at Abbott's on 15 Jul and 4 Aug 1981 (DS), respectively. The winter build-up of Greaters began in late Sep or early Oct, and most birds had departed by mid-May. A high winter number for the study area was 8000 on Tomales Bay on 18 Jan 1987 during a run of Pacific Herring (ABN 41: 323).

Lesser Scaup. Although the only summer census records were of two to three birds at Abbott's throughout the summer of 1981, numbers on additional counts there increased steadily from 10 to 50 birds from 6 Jul to 12 Aug 1965 (PRBO). A flock of 40 at Abbott's on 21 Aug 1979, if not oversummering, was a month earlier than the usual arrival date for central California (AB 34: 195). Regardless, Lesser Scaups were not seen most summers in the Point Reyes area, despite their breeding irregularly in the San Francisco Bay area (Grinnell and Miller 1944, AB 40: 1250, AB 42: 1336). At Abbott's, in most years Lessers occurred primarily as fall transients (Fig. 20). An unusually large concentration of 2800 birds on the large upper freshwater arm on the 14 Jan 1976 census (Fig. 20) was composed perhaps of refugees from freshwater habitat that had dried up because of drought. Within the study area Lesser Scaups were usually present from late Sep to mid-May.

King Eider (*Somateria spectabilis*)

A very rare fall visitant with only one census record of an immature male at Abbott's Lagoon from 13 to 28 Nov 1980 (AB 35: 220, Binford 1985). The only other accepted record for Point Reyes is a specimen of a juvenile female collected from among a group of three eiders at the mouth of Tomales Bay on 16 Dec 1933 (Moffitt 1940, Dunn 1988). Records of a dying female at Bolinas on 26 Oct 1973 and another dead female at Bolinas on 2 Nov 1973 (AB 28: 100) have not been submitted to the CBRC. Individuals of this circumpolar, high-latitude species occur only irregularly as far south as California (Roberson 1980, AOU 1983). The 23 accepted records for California, 1933 to 1986, are of single birds spanning all months of the year (CBRC). Most birds occur from Nov to Mar on coastal bays, estuaries, lagoons, or inshore waters.

Harlequin Duck (*Histrionicus histrionicus*)

A very rare winter visitant with one census record of a male at Drake's Estero on 2 May 1980. Midsummer study area records are of "flocks" in Jun 1880 at Point Reyes (Maillard 1904), a female at Stinson Beach on 10 Jul 1980 (ABN: CoB), and a male at Bolinas on 25 Jun and 12 Aug 1988 (ABN: RD, DAH). Most local records fall between Sep and Mar with a peak from late Nov to mid-Jan (Fig. 12). Winter numbers have decreased at Point Reyes. In the Tomales Bay area there were "hundreds" in the fall of 1913 (Grinnell et al. 1918), "flocks" on 22 Dec 1929 and 28 Nov 1936 (Grinnell and Miller 1944), at least 10 birds on 13 Dec 1955 (AFN 10: 277), and 16 on 25 Nov 1956 (AFN 11: 54). On Tomales Bay CBCs from 1956 to 1961 the median number of Harlequin Ducks was 8 (range 1–15), and from 1962 to 1968 it was 1.7 (range 0–6). From 1970 to 1988 Harlequins were recorded on only 8 of 19 Point Reyes CBCs (high count 2), although this count excludes the area around the mouth of Tomales Bay where numbers were seen in the past (ABN). The species has declined markedly as a breeder in California (Remsen 1978, McCaskie et al. 1979), but sightings in the breeding season in the Yosemite region have increased in the last 10 years (Gaines 1988). The decline in winter numbers in the Point Reyes area may be a reflection

of the decreased size of the California breeding population, although the source of wintering birds is unknown. Wintering Harlequin Ducks are found in the inshore zone in turbulent waters along rocky coastlines and in bays and estuaries, particularly larger ones.

Oldsquaw (*Clangula hyemalis*)

A very rare winter resident with only 9 birds on 14 censuses from 15 Oct to 9 May. Most birds in the Point Reyes area were present from mid-Oct to mid-Apr (Fig. 12). The highest census count was two at Limantour on 14 Mar 1969, and the highest non-census count was 15 off Tomales Point on 14 Jan 1976 (GWP, DS, NS). From 1970 to 1988 Oldsquaws were recorded on 12 of 19 Point Reyes CBCs with counts ranging from one to five birds except for a high count of 13 in 1975. The only Point Reyes records for mid-summer are of single birds at Bolinas Bay on 3 Jun 1968 (AFN 22: 644), Tomales Bay on 28 Jun 1981 (AB 35: 974) and from 21 Jun to 8 Jul 1986 (AB 40: 1250), and Drake's Bay from 23 May to 10 Jul 1982 (ABN: JGE et al.) and from 5 May until at least 5 Jul 1988 (AB 42: 1336, ABN); a bird at Abbott's on 9 Sep 1984 may have summered locally also (AB 39: 97). Oldsquaws inhabit inshore waters, bays, estuaries, and lagoons.

Black Scoter (*Melanitta nigra*)

A very rare summer visitant and winter resident with about 61 birds on 53 censuses, mostly at Limantour from Nov to May (Fig. 21). All census records of Black Scoters fell between 14 Nov and 15 May except for one at Abbott's on 27 May and 5 Jun 1980, one at Limantour on 7 Jul 1970, one there on 2 Aug 1971, and two there on 14 Sep 1969. The high census count was 18 birds at Limantour on 28 Apr 1968. Although Black Scoters were not recorded regularly on censuses until Nov, fall migration appears to start by early to mid-Oct (ABN), or rarely by late Sep (e.g., AB 39: 97). Black Scoters are more numerous in deeper and larger bays such as Tomales Bay, where the highest count was 93 birds on 21 Dec 1985 (BB). The bulk of the Point Reyes population inhabits inshore waters and has a seasonal occurrence pattern (Fig. 5) similar to that of estuarine birds (Fig. 21). A high winter count in the inshore area from Drake's Bay to Point Reyes Lighthouse was 150 birds on 13 Jan 1981 (AB 35: 332), and a high spring count was 200 birds on 6 Apr 1971 (ABN: BMc); typically fewer than 100 birds occur there (ABN, DS). Up to eight birds were observed in Drake's Bay in early Jun 1976, but only one or two have been found there later in the summer (ABN). Another concentration area is the rocky shoreline from Dillon Beach to Estero San Antonio, where 75 were counted on 18 Feb 1978 (DS). From 1970 to 1988, the median number of Black Scoters on the Point Reyes CBC, which does not include outer Point Reyes or the mouth of Tomales Bay, was 59 (range 16–115).

Limited numbers of Black Scoters migrate over inshore waters of central California in spring, primarily in Apr and May (ABN: BSa et al.). Black Scoters prefer inshore waters near the mouths of estuaries, along stretches of rocky shoreline, and inside larger bays; smaller numbers frequent estuaries and lagoons. They appear to forage over coarse gravel, boulders, and rock substrate in the intertidal zone (Vermeer and Bourne 1984).

Surf Scoter (*Melanitta perspicillata*)

A fairly common summer resident and a very common winter resident (Fig. 21). The fall influx began in late Sep or early Oct and continued into Nov at Bolinas and Limantour and into Dec at Abbott's (Fig. 21). Winter numbers were erratic at Bolinas (Fig. 21) perhaps because of the frequent interchange of birds

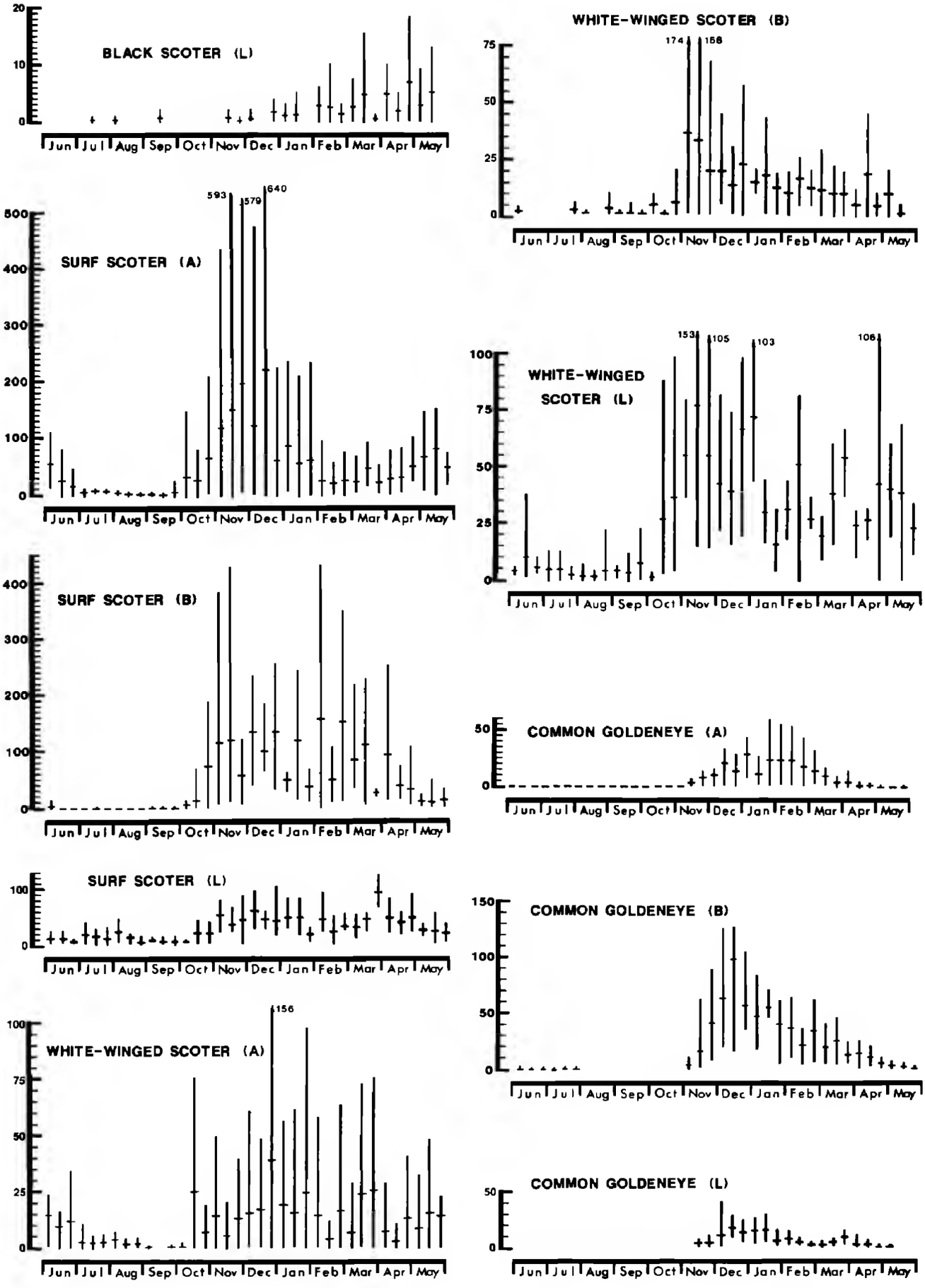


Figure 21. Seasonal abundance of scoters and goldeneyes in wetlands of Point Reyes. See Figure 4 for details.

between estuarine and inshore waters. Surf Scoters maintained highest average numbers at Bolinas from early Nov to mid-Mar. At Limantour numbers were relatively stable from Nov through Apr (Fig. 21). At Abbott's numbers peaked in Nov and Dec and to a lesser extent in Apr and May; birds lingered through Jun (Fig. 21).

Peak movement in fall over inshore waters is during the first two weeks of Nov (Ralph 1969). An estimated 110,000 Surf Scoters off Point Reyes Beach from 31 Oct to 25 Nov 1987 was an exceptionally large flock of staging migrants (AB 42: 129). Along the south shore of Point Reyes, Surf Scoters were concentrated mostly in Drake's Bay (Fig. 7). In inshore waters numbers rose from Oct through Dec, stayed at a plateau through May, then declined to reach yearly lows in Sep (Fig. 5). To the north in cooler waters off Cape Mendocino, numbers rise in Aug and Sep, peak in Oct or Nov, and usually decline gradually through the winter (Briggs et al. 1987). Spring migration in the wetlands extended mainly from late Mar through May (Fig. 21), bracketing peak migration dates over inshore waters off central California, which range from 16 to 23 Apr (ABN: BSa et al.). Our summer inshore counts (Fig. 5) of 796 birds (1204 adjusted for unidentifieds) from 1 to 4 Jul 1981, and 580 birds (904 adjusted) on 17 and 18 Aug 1981, dwarfed those on the estuaries (Figs. 7 and 21). Declining numbers through Jun at Abbott's (Fig. 21) and from Jun to Sep in inshore waters off southern Point Reyes (Fig. 5) suggested even more protracted movement after the main spring passage.

At Point Reyes, Surf Scoters inhabit inshore waters, bays, estuaries, and, rarely, freshwater ponds. Large numbers concentrate on Tomales Bay, presumably eating eggs of Pacific Herring (Briggs et al. 1987). Estimates from Tomales Bay of 11,000 Surf Scoters on 28 Feb 1987 (AB 41: 323) and 10,000 on 28 Oct 1988 (ABN: JW) fell, respectively, during and before the annual period of herring spawning, suggesting that Tomales Bay serves as both a major migratory staging area and a concentration area during times of seasonally abundant food. Of the three scoters, the Surf forages over the widest variety of substrates, from fine sand to boulder and rock (Vermeer and Bourne 1984). In the inshore zone off California they generally prefer waters over sandy substrate lying in the lee of a promontory (Briggs et al. 1987).

White-winged Scoter (*Melanitta fusca*)

An uncommon summer resident and a common winter resident (Fig. 21). Fall migration, concentrated between mid-Oct and mid-Nov, may continue into Dec (Fig. 21, Bellrose 1980, AB 34: 196). Influxes to the wetlands began in Oct (Fig. 21). At Limantour numbers reached highs in Nov and Dec and declined abruptly to moderate numbers in Jan. At Bolinas numbers peaked in Nov and declined gradually thereafter. After the fall influx in Oct, numbers at Abbott's remained relatively stable through the winter. Irregular increases in numbers at all sites in mid-winter may have reflected movement between inshore and estuarine waters, and from late Mar to mid-May may have represented pulses of migrants. Wetland numbers declined through May to summer lows by early Jun at Limantour and Bolinas or by early Jul at Abbott's; Bolinas was the only site where Surf Scoters were irregular in summer.

Numbers of White-winged Scoters on inshore waters off Point Reyes increased from Oct to Dec, maintained a mid-winter plateau from Dec to Feb, and declined somewhat in Mar and Apr (Fig. 5). In spring White-winged Scoters migrate over inshore waters between late Mar and May (ABN), though on our monthly inshore counts we detected staging migrants *on* inshore waters only in May (Fig. 5). Peak migration dates over inshore waters in central California range from 1 to 23 Apr (ABN: BSa et al.). Summer numbers remained relatively high on inshore waters

(Fig. 5), in contrast to the pattern on the estuaries (Fig. 21). At Point Reyes, White-winged Scoters frequent bays, estuaries, inshore waters, lagoons, and, rarely, freshwater ponds. In the inshore zone off southern Point Reyes, White-wingeds concentrated in Drake's Bay (Fig. 7). The ratio of the number on estuaries to the number on inshore waters was higher for the White-winged than for the Surf Scoter (Fig. 7, Table 1). Elsewhere, White-winged Scoters feed in deeper water than do the other scoter species and forage over silt, mud, sand, and fine gravel (Vermeer and Bourne 1984). On inshore waters along the California coast, White-winged and Surf scoters occupy similar habitat (see account, Briggs et al. 1987).

Common Goldeneye (*Bucephala clangula*)

A very rare summer visitant and a common winter resident (Fig. 21). Our only summer census records at Point Reyes were of two birds lingering until 25 Jun and one lingering until 28 Jul 1975 at Bolinas. The only non-census records for summer were of one bird on 2 Aug 1964 at Bolinas (ABN: TAC, ZCh), one bird on 18 Jul 1965 (RS) at Abbott's, and two birds there on 17 Jul 1988 (ABN: LJP). The earliest fall arrival was 3 Nov at Bolinas. Although numbers at Bolinas built up abruptly through Nov, peaked in Dec, and subsequently declined steadily, at Abbott's and Limantour both the fall increase and spring decline were gradual (Fig. 21). Most goldeneyes in the Point Reyes area were found on estuaries, bays, and lagoons, with smaller numbers in the inshore zone and on freshwater ponds, impoundments, and sewage ponds.

Barrow's Goldeneye (*Bucephala islandica*)

A very rare winter resident with about eight individuals on 18 censuses (17 at Bolinas, 1 at Limantour) from 9 Nov to 8 Mar. Non-census records from Point Reyes extended from 31 Oct to 28 Apr (ABN) with most records between Nov and Jan at Bolinas Lagoon or Tomales Bay (Fig. 12). The earliest record for coastal northern California is 28 Oct (Grinnell and Miller 1944), except for the unprecedented arrival of six birds at Foster City, San Mateo Co., on 26 Sep 1982 (ABN: DPM). Barrow's Goldeneyes were reported on 10 of 19 Point Reyes CBCs from 1970 to 1988; 12 birds in 1978 was the only count over 3. Although the species has always been rare and local in the state in winter (Grinnell and Miller 1944), its extirpation as a breeder from Colorado (Palmer 1976b) and California (Cogswell 1977, Remsen 1978) may have caused coastal wintering populations to decline. However, as recently as 1987 winter numbers appeared to be rebounding in the San Francisco Bay area (J. Morlan pers. comm.), where most coastal birds reside (Cogswell 1977, ABN). Barrow's Goldeneyes use bays, estuaries, lagoons, freshwater ponds, and sewage ponds.

Bufflehead (*Bucephala albeola*)

A rare summer resident and a very common winter resident (Fig. 22). Up to seven birds oversummered at Abbott's in four of five years with summer censuses, whereas none oversummered at Limantour or Bolinas, despite longer census records. Numbers increased abruptly from late Oct to late Nov, but thereafter occurrence patterns at the various wetlands differed substantially. At Bolinas numbers remained relatively stable from Nov to Apr; at Limantour numbers declined slowly from Dec through May; at Abbott's numbers remained relatively stable from Nov to Feb, but increased in Mar and Apr (Fig. 22). These patterns suggest complex local movements at least one facet of which is the use by Buffleheads of ephemeral ponds created by winter rains. An estimated 4000 + Buffleheads

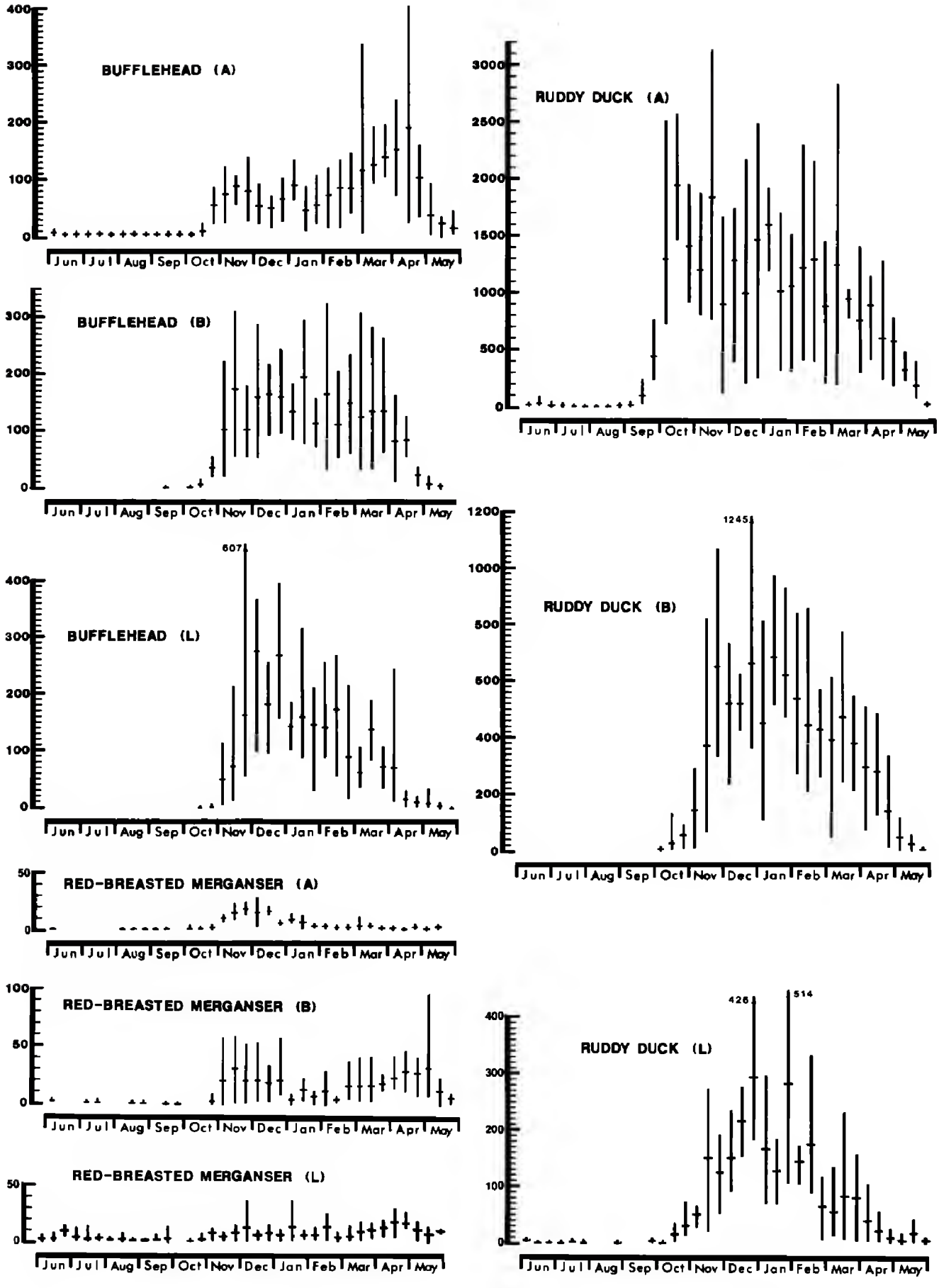


Figure 22. Seasonal abundance of the Bufflehead, Red-breasted Merganser, and Ruddy Duck in wetlands of Point Reyes. See Figure 4 for details.

were on Tomales Bay on 18 Jan 1987 during the annual period of spawning for Pacific Herring (AB 41: 323). Over the course of the study there was an increase in the population wintering at Bolinas (Fig. 14). Regional declines in the West at least through the mid-1960s (Grinnell and Miller 1944, Erskine 1972) suggest Buffleheads may be less abundant in Point Reyes estuaries than formerly. However, our census data and local CBCs since 1956 indicate that recently numbers have been relatively stable. Buffleheads frequent estuaries, bays, lagoons, freshwater ponds, and sewage ponds.

Hooded Merganser (*Lophodytes cucullatus*)

A very rare winter resident with about seven individuals on 17 censuses from 8 Nov to 4 Mar. Non-census records extend from 4 Oct to 3 May (ABN, PRBO) with most records from mid-Nov to late Mar (Fig. 12). Outside the area of breeding near Lake Earl, Del Norte Co. (Yocum and Harris 1975), the earliest arrival to coastal northern California is 3 Oct (ABN), the latest departure is 30 May (AB 42: 478), and the only record of oversummering is of a bird at Rodeo Lagoon, Marin Co., from 25 Jun to 25 Sep 1966 (AFN 20: 596, 21: 73). The highest count at a single site on Point Reyes was 30 birds at Five Brooks Pond on 14 Dec 1979 (AB 34: 303, ABN). The median number of Hooded Mergansers on the Point Reyes CBC from 1970 to 1988 was 5.6 (range 0–32). Hooded Mergansers occur primarily on freshwater ponds and slow-moving streams, especially those bordered with vegetation, and occasionally on estuaries at stream mouths.

Common Merganser (*Mergus merganser*)

A very rare visitant with only one census record of three individuals at Abbott's Lagoon on 28 Aug 1981 (DS). Except for CBC reports there are only four non-census records for Point Reyes: one bird at Five Brooks Pond from 3 Dec 1976 to 8 Jan 1977 (DS et al.), one bird at Schooner Bay, Drake's Estero, on 12 Nov 1978 (DS, JW), five birds at Abbott's on 13 Aug 1987 (ABN: ASH), and four birds at Abbott's on 30 Aug 1988 (DS, SCc). Common Mergansers have been recorded on 16 of 19 Point Reyes CBCs from 1970 to 1988 with a median number of 5 (range 1–54) for those 16 years. Many of the CBC records pertain to birds sighted just east of the Point Reyes Peninsula on streams and reservoirs in watersheds where the species breeds (AB 35: 974). We suspect some CBC reports from Point Reyes proper are misidentifications. In coastal California the species occurs primarily as a winter resident from Nov to Mar (McCaskie et al. 1979, ABN, Garrett and Dunn 1981), but it is rare from Marin Co. south (breeding south to Monterey Co.). In California the species inhabits primarily freshwater lakes, reservoirs, and rivers, but salt water only occasionally during migration or winter.

Red-breasted Merganser (*Mergus serrator*)

A rare summer resident and a fairly common winter resident (Fig. 22). In summer, Red-breasted Mergansers were recorded most frequently at Limantour (Fig. 22), where high census counts were 14 birds on 25 Jun and 16 Jul 1980. Seasonal changes in abundance at the wetlands indicated that fall migration extends from Oct through Dec and spring migration extends from Apr through May (Fig. 22). The small numbers of Red-breasted Mergansers migrating over inshore waters of the central California coast peak in mid-Apr (ABN: BSa et al.). At Point Reyes Red-breasted Mergansers use bays, estuaries, lagoons, inshore waters, and, much less frequently, freshwater ponds.

Ruddy Duck (*Oxyura jamaicensis*)

A fairly common summer resident and an abundant winter resident (Fig. 22). Most oversummering birds, on either salt or fresh water, are non-breeders. The only breeding records for Point Reyes are of a female with young at a pond at Drake's Beach visitors' center on 10 Jul 1982 (JGE) and at Cypress Grove near Marshall, Tomales Bay, on 19 May 1989 (SK). In fall Ruddy Ducks arrived and reached peak numbers earlier at Abbott's Lagoon (Fig. 22) and on freshwater ponds (Fig. 18) than at Bolinas or the tidal areas of Limantour (Fig. 22). At Limantour numbers increased more rapidly on the freshwater ponds than on the estero proper, but, with the advent of the rainy season, numbers on the ponds decreased steadily through winter, while numbers on the estero initially increased and then remained high until Feb (Fig. 18). An estimated 3380 Ruddy Ducks were on Tomales Bay on 28 Feb 1987 during the period of spawning for Pacific Herring (AB 421: 323). The spring exodus from Mar to May (Fig. 22) encompassed the mid-Apr period of peak spring migration in North America (Bellrose 1980). Grinnell and Miller (1944) felt that numbers in California were much reduced from former times, a condition Palmer (1976b) attributed to market hunting in the late 1880s. Ruddies in the Point Reyes area are found primarily on Tomales Bay, Abbott's Lagoon, and freshwater ponds, secondarily on the other estuaries, and only occasionally on protected inshore waters.

Black Rail (*Laterallus jamaicensis*)

A very rare winter visitant on censuses with only one record of three birds at Bolinas Lagoon on 14 Dec 1981. Non-census records indicate the species is a year-round resident and that birds disperse more widely after breeding (ABN). Non-census records at Bolinas Lagoon were of one bird calling along the west shore on 10 and 11 Mar 1979 (RS et al.), up to five individuals roosting together in the Pine Gulch Creek delta during fall and winter extreme high tides from 1980 through 1987 (ABN: RS et al.), one to two calling birds at Pine Gulch from 2 Mar to 20 May 1987 (ABN: DDeS,DAH), and one to two calling on the east shore on various dates from 29 Mar to 11 Jul, 1983 to 1986 (ABN: CC et al.). A probable transient was flushed from *Salicornia* marsh at Limantour on 27 Nov 1979 (AB 34: 196). Although Kehoe Marsh, 3 km north of Abbott's Lagoon, supported up to four wintering birds as late as 1975 (Point Reyes CBC), none has been reported there since 16 Dec 1978 (AB 33: 310). In Oct and Nov 1897, C. A. Allen collected 22 Black Rails at the south end of Tomales Bay (Brewster 1907); others were collected on Tomales Bay through at least 1940 (Manolis 1978). Just how numerous the Black Rail was there is suggested by the 53 winter specimens from "Point Reyes" and Tomales Bay at the American Museum of Natural History, New York (fide SNGH). Even though subsequent conversion of much of the marsh to pastures, starting in 1945 (D. Livingston pers. comm.), has greatly reduced the amount of tidal marsh habitat, 17 Black Rails were captured there at high tides by Great Egrets and Great Blue Herons over 11 days of observation from 21 Nov 1984 to 19 Jan 1985 (Evens and Page 1986), and recent summer surveys yielded a high summer count of seven calling birds there on 16 May 1986 (JGE).

Recent work has documented a substantial breeding population of Black Rails in the tidal marshes of San Pablo and Suisun bays (Manolis 1978, Evens et al. 1989), though historically this population appears to have declined greatly. The species is listed as threatened in California and is a candidate for federal listing. On Point Reyes, nesting was confirmed on Tomales Bay near Inverness in the summer of 1966 (AFN 21: 73). Olema Marsh records of a single calling bird from 7 Apr to 18 May 1975 (AB 29: 903), one calling on 5 Apr 1977 (Manolis 1978), and up to four calling from 17 Jun to 30 Jul 1980 (JGE, DS), and the Bolinas and

Tomales Bay spring and summer records listed above all suggest local breeding birds. An observation of two at Olema Marsh on 21 Sep 1930 (Stephens and Pringle 1933) suggests birds also winter there. At all seasons Black Rails inhabit salt, brackish, and freshwater marshes. In salt marshes they are usually found above the mean high tide line, and while breeding appear to favor areas that have a dense overstory of *Salicornia* or low-growing forms of *Scirpus* (Manolis 1978, PRBO unpubl.).

Clapper Rail (*Rallus longirostris*)

A very rare fall and early winter visitant with only one census record, of a single bird on Kent Island, Bolinas Lagoon, on 4 Dec 1981. Additional non-census records are of singles at Bolinas on 22 Dec 1967 (PL), 31 Dec 1978 (GWP), 15 Nov 1980 (AB 35: 221), and in spring 1972 (GWP); at Limantour on 31 Oct 1971 [Gull 54(1): 3]; at Tomales Bay in Oct 1965 (ABN: GB), from late Jul to 24 Sep 1969 (GB fide PL), and on 12 Sep 1982 (AB 37: 220); and at Schooner Bay, Drake's Estero, on 31 Dec 1966 (RS). Records of birds in northern California found out of habitat in fall extend from 3 Sep to 18 Nov (Evens and Page 1984). Most records in northern California away from known breeding areas have been during fall and early winter and presumably involve post-breeding dispersal. There is a pronounced southward shift in winter of Clapper Rails in the San Francisco Bay area (P. R. Kelly pers. comm.). It is possible that some winter records involve birds dispersing from marshes inundated by exceptionally high storm tides.

Although the California Clapper Rail (*R. l. obsoletus*) is still a locally fairly numerous year-round resident and breeder around San Francisco Bay (Grinnell and Miller 1944, Gill 1979, Evens and Page 1984), it has declined dramatically since the late 19th century and is currently protected as an endangered species by state and federal governments. Initial reductions were due to market hunting (Grinnell et al. 1918), but the loss of 60–95% of the bay's tidal marshes (Nichols and Wright 1971, Josselyn 1983) has been the primary cause of decline and failure to return to historical levels. The species still faces pressures from habitat fragmentation and introduced predators. The decline of the San Francisco Bay population has probably reduced the number of fall and winter dispersants to our study area. The historical status of this species at Tomales Bay, where marsh habitat has also been reduced (see Black Rail), is not clear. It was first recorded there on 22 Nov 1914 (T. I. Storer 1915, MVZ 24915), and single birds were collected there on 1 Nov 1936 and 11 Nov 1939 (CAS 66755, 66751). Since an adult female with an enlarged ovary was also collected there on 21 Feb 1936 (MVZ 100396), and Clapper Rails can begin laying in early Mar (Evens and Page 1983), it is possible they once bred and were resident at Tomales Bay. Intensive rail surveys from 1984 to 1986 at the south end of Tomales Bay failed to reveal any birds (JGE, GWP). California Clapper Rails inhabit salt marshes, particularly those with extensive tidal channels and sloughs.

Virginia Rail (*Rallus limicola*)

A very rare year-round resident with at least 23 birds on 48 censuses. Its true status is masked by difficulty of detection—the Virginia Rail is probably an uncommon winter resident and a rare summer resident. Away from the censused wetlands Virginia Rails occur more commonly on Point Reyes at scattered marshes. Overall the local breeding population is inflated from Sep through Mar by wintering birds that swell numbers in freshwater and brackish marshes and expand into salt marshes. The median number on Point Reyes CBCs from 1970 to 1988 was 55 (range 14–101). Censuses at Olema Marsh, the largest fresh-

water marsh on Point Reyes, yielded an average of 20 birds in winter 1985–86 and 11 pairs in summer 1986 (Evens and Stallcup 1986a,b). Breeding has been confirmed on Point Reyes by the presence of chicks at Olema Marsh on 1 May 1980 (DS) and on the west shore of Tomales Bay on 30 Apr 1967 (PL). Breeding habitat is probably restricted to swales and freshwater and brackish marshes.

Sora (*Porzana carolina*)

A very rare year-round resident with about 11 birds on 14 censuses. Its true status is masked by difficulty of detection—the Sora is probably an uncommon winter resident and a very rare summer resident. All census records fell between 27 Aug and 25 Apr except for those of single birds at Bolinas on 26 Jul 1973 and at Limantour on 10 Jul 1975. Away from the censused wetlands Soras occur more commonly at freshwater marshes scattered around Point Reyes. Numbers swell in fall and winter and some birds extend then into tidal marshes (JGE, GWP). The median number on Point Reyes CBCs from 1970 to 1988 was 8 (range 2–32). Although infrequently reported on Point Reyes in the breeding season, at Olema Marsh one to two pairs occur regularly at that time versus one to six birds there in winter (Evens and Stallcup 1986a,b). Two juveniles at the Bolinas sewer ponds on 2 Aug 1983 were probably locally produced (JGE). Like Virginia Rails, Soras are probably restricted while breeding to swales and freshwater and brackish marshes.

Common Moorhen (*Gallinula chloropus*)

A very rare summer visitant and winter resident with about seven birds on 11 censuses. All census records were from freshwater ponds at Limantour between 6 Oct and 27 Dec, except for singles on 2 May 1980 and 2 Aug 1971. Point Reyes records, which peak from late Sep to mid-Nov (Fig. 12) are mostly from Olema Marsh, Muddy Hollow Pond, and Five Brooks Pond. Moorhens have been found on 11 of 19 Point Reyes CBCs from 1970 to 1988 with the highest count being of three birds. Breeding on Point Reyes is irregular but has been confirmed by sightings of small young accompanied by adults at Olema Marsh on 31 Aug 1967 (AFN 22: 85) and at the Bolinas sewer ponds on 12 Jul 1983 (AB 37: 1023). Breeding is also suggested by six or seven immature birds at a Limantour pond on 7 Oct 1964 (ABN: GM, KSc), one immature there on 16 Jun 1966 (PRBO), and a "pair" 3 miles south of McClure's Beach on 25 Jun 1972 (ABN: WBG). At Point Reyes, moorhens are restricted to freshwater marshes and ponds edged with emergent vegetation.

American Coot (*Fulica americana*)

A fairly common summer resident and an abundant winter resident (Fig. 23). Coots breed on freshwater ponds at Limantour and Abbott's where a small increase in numbers during summer (Fig. 23) was due to the fledging of young. Occasional birds at Bolinas in summer were non-breeders or early dispersing failed breeders from nearby freshwater habitat.

Coot numbers peaked earlier and declined much sooner in Limantour ponds than on the estero proper (Fig. 18), perhaps because some coots shifted to the estero when water levels in the ponds increased during the rainy season. However, there was a net exodus of coots from Limantour (ponds and estuary combined) from Dec to Jan (Fig. 23). At Abbott's, where water levels also typically rise beginning in late fall, coots also peaked in fall and subsequently declined. Funderburk and Springer (1989) noted a similar fall peak and early winter decline of coot numbers at lakes Earl and Talawa. At Bolinas, where freshwater habitat is

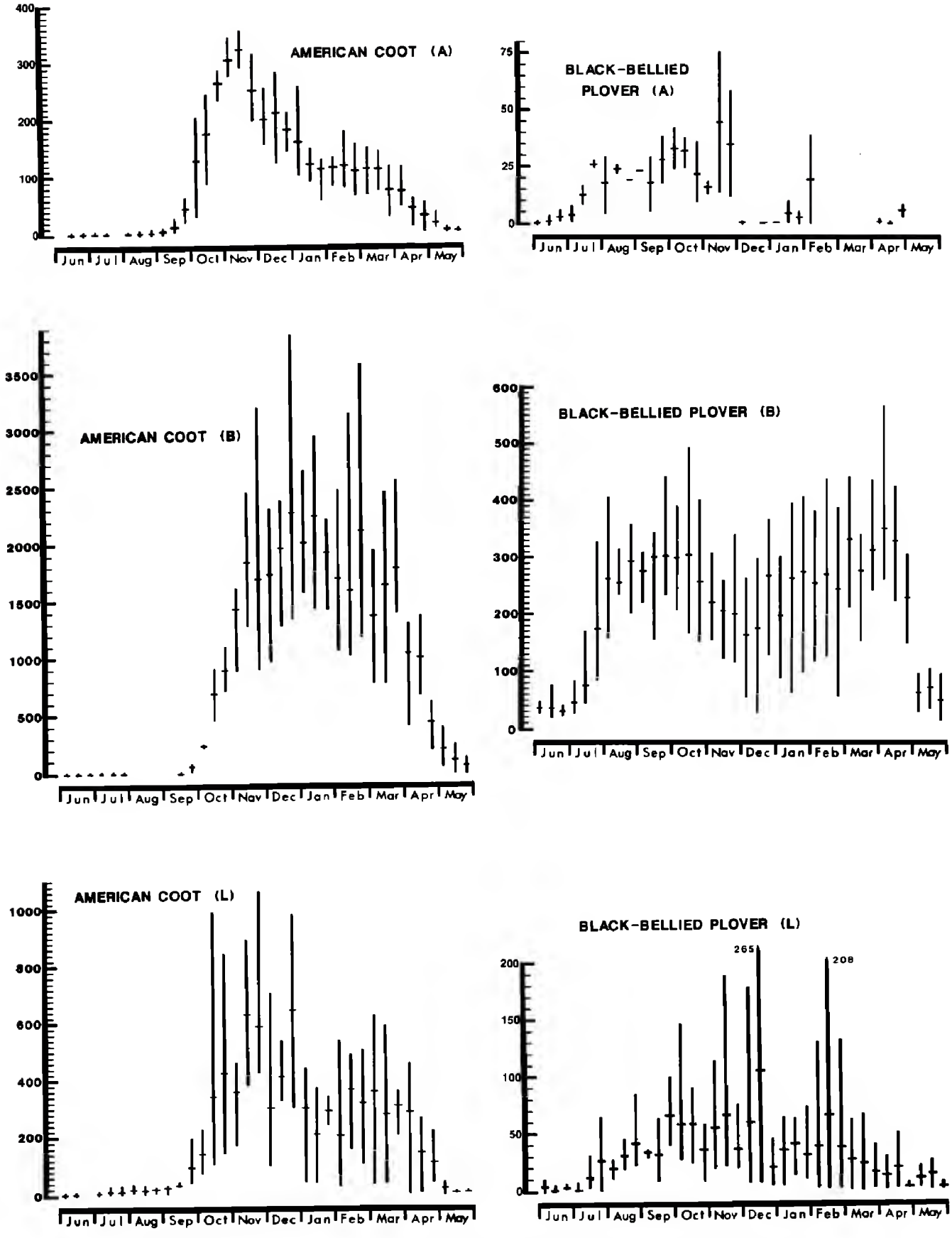


Figure 23. Seasonal abundance of the American Coot and Black-bellied Plover in wetlands of Point Reyes. *See* Figure 4 for details.

lacking but extensive fresh green grass is avilable in winter for grazing, coots did not decline in Dec and Jan (Fig. 23).

Winter numbers at Limantour declined after 1975–76 (Fig. 14). At Bolinas, winter numbers increased from 1972–73 to 1975–76, then declined sharply in 1976–77 and 1977–78 (Figs. 14 and 24). Coots also declined from 1975 to 1976 on the Marin Co. (southern) CBC while increasing in 1975 and decreasing in 1976 on the Point Reyes CBC. The sharp decline in peak numbers from the first to second year of a major drought may have reflected a concentration of birds on the estuaries during the first winter, as freshwater habitat dried up, followed by drought-induced reproductive failure that caused a significant regional decline in numbers. Subsequently, coot numbers in our coastal study did not recover to pre-drought levels but instead declined further during the recent drought years of 1986–87 and 1987–88 (PRBO unpubl. data).

In winter on Point Reyes, coots inhabit bays, lagoons, estuaries, freshwater marshes, and ponds, and graze on adjacent grassy fields. They breed at freshwater ponds and marshes edged with dense emergent vegetation.

Sandhill Crane (*Grus canadensis*)

A very rare visitant with a census record of one bird at Bolinas Lagoon on 12 May 1975, apparently the same bird seen later that day on outer Point Reyes (BC). Other recent Point Reyes records were of 13 flying birds at Bear Valley on 16 Nov 1963 (ABN: CJR), two birds at Palomarin on 24 May 1979 (KH, DDeS), one on Point Reyes on 27 Feb 1984 (AB 38: 353), one near Five Brooks from 29 Dec 1984 to 1 Jan 1985 (AB 39: 206), and single birds at Bolinas in "early fall" 1987 (NW, KH), on 11 Dec 1987 (PA et al.), and on 12 May 1989 (BHe). A bird on pastures at the south end of Tomales Bay from 16 Sep 1983 to 9 Mar 1984 (JGE et al.) is the only recent record of a crane wintering on the coastal slope of northern California (ABN). Sandhill Cranes formerly wintered as close as San Rafael and San Francisco, but numbers declined in California in the early 1900s (Grinnell and Miller 1944), and they are now extremely rare on the California coast (McCaskie et al. 1979, Garrett and Dunn 1981, ABN). Since the 1950s Sandhill Cranes have visited the coastal slope of northern California irregularly, mostly between 6 Sep and 18 Jan (ABN). The only other coastal spring records besides those for Point Reyes are of singles at Año Nuevo, San Mateo Co., on 9 May 1976 (AB 30: 884) and Oakland, Alameda Co., on 3 Apr 1988 (AB 42: 478). A Sandhill Crane also summered in Humboldt Co. in 1974 (Yocum and Harris 1975).

Black-bellied Plover (*Pluvialis squatarola*)

A fairly common summer resident and a very common winter resident (Fig. 23). Fall migration extended from mid-Jul through Oct (Fig. 23), possibly through Nov or later (Jurek 1973, DeSante and Ainley 1980), and numbers peaked from early Aug to late Oct (Fig. 23, Jurek 1973). Juveniles arrived at least by Sep (DS); an early date for Oregon is 26 Aug (Paulson 1983). Low numbers at Bolinas in Nov and Dec (Fig. 23) probably were due to daily local movements rather than a departure of migrants; once winter rains commenced, some Black-bellied Plovers left the lagoon as the tide was rising (often before our censuses were completed) to forage later at high tide in nearby pastures. At Abbott's numbers declined markedly after late Nov and remained generally low but irregular thereafter (Fig. 23). This decline may have been caused by regional movements of birds away from Abbott's as runoff from winter rains inundated the lagoon's flats, rather than by the departure of long-distance migrants. Winter inter-site movement in our study area, perhaps explaining the irregular high winter counts at Abbott's and

Limantour (Fig. 23), can be expected since Black-bellied Plovers arrive on and depart from the Farallones then (DeSante and Ainley 1980). Spring migration extends from mid- or late Mar through May (Jurek 1973, ABN), although this was not readily apparent from numbers on the Point Reyes wetlands (Fig. 23). Numbers at Bolinas dropped suddenly in late Apr and reached yearly lows in Jun (Fig. 23). During the study, winter numbers increased at Bolinas and Limantour (Fig. 14). Exposed tidal flats are the most important habitat for this species, and at Bolinas flats of intermediate substrate texture are used more than sandier or muddier ones (Page et al. 1979). Sand beaches, flat rocky shores such as Duxbury Reef, and rain-soaked pastures at high tide are also used.

Lesser Golden-Plover (*Pluvialis dominica*)

A very rare fall transient, winter resident, and spring transient (Fig. 12). Two subspecies of Golden-Plovers, perhaps separate species (Connors 1983), are found in California: *P. d. fulva*, which breeds in Alaska and Siberia, and *P. d. dominica*, which breeds in Alaska and arctic Canada (AOU 1983). Fall migrants were detected from late Jul to mid-Nov (Fig. 12). Six birds (race unknown) at Abbott's on 8 Dec 1965 may have been late migrants or wintering birds from nearby. Juveniles, *dominica* as early as 22 Aug (SNGH) and *fulva* by 13 Sep (JM), predominated over adults during the peak of fall migrants from early Sep to early Nov (Fig. 12, unpubl. data). Apparently the latest California specimen of *dominica* was collected on 11 Nov (Chaniot 1966). However, sight records suggest this race may remain with wintering *fulva* until mid-Dec (DS). Migrants (race unknown) have lingered to 31 Dec 1975, 14 Dec 1982, and 3–8 Jan 1981 at the Farallon Islands, where the species does not winter (DeSante and Ainley 1980, ABN). Maximum census counts of fall migrants were 11 birds on 29 Sep 1969 and 8 birds on 8 Nov 1979 at Limantour. Our only estuarine wintering records were of single birds at Bolinas on censuses through the winter of 1974–75, and at

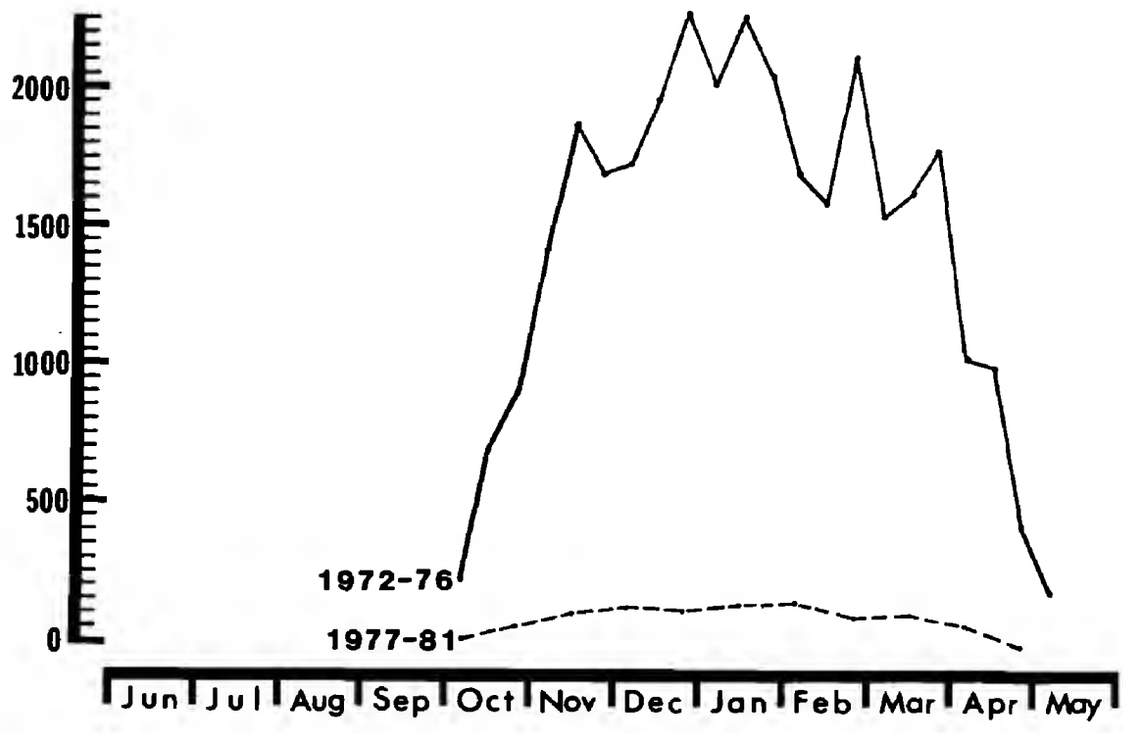


Figure 24. Mean number of American Coots at Bolinas Lagoon from 1972 to 1976 and from 1977 to 1981.

Limantour through the winter of 1968–69 (JS et al.) and on 20 Dec 1986 (JGE). Although small numbers of *fulva* winter annually at scattered sites on the coastal slope of California (ABN, Garrett and Dunn 1981), two sites in the Point Reyes area are among the few long-standing wintering sites. As many as 27 *fulva* (usually 5–10) winter annually in the plowed fields and pastures on the Hall and Spaletta ranches west of Drake's Estero (ABN). Up to 15 birds (usually 4–6) have wintered since at least the late 1960s at a moist, marshy-edged pasture at Lawson's Landing, Dillon Beach, Tomales Bay (ABN); these birds also sometimes use adjacent tidal flats. Wintering birds have lingered at Lawson's Landing until 6 May (AB 42: 478) and on outer Point Reyes until 5 May (AW). During spring migraton in Apr and May (Jurek 1973, ABN), Golden-Plovers occur much less regularly than in fall. *P. d. fulva* is the only race confirmed in California in spring, although specimens exhibiting intermediate characters have also been collected and *dominica* has been collected at that season on the Pacific coast of Mexico (Chaniot 1966). The only local summer record is of one bird at Abbott's Lagoon on 22 Jun 1966 (PRBO), reflecting the species' extreme rarity at that season anywhere in California (McCaskie et al. 1979, Garrett and Dunn 1981, ABN). Golden-Plovers are found on plowed fields and grazed pastures, estuarine tidal flats, and occasionally on sand beaches during migration.

Snowy Plover (*Charadrius alexandrinus*)

An uncommon summer resident and breeder and a common winter resident (Fig. 25). The California coastal wintering population is about 2.6 times the size of the breeding population (Page et al. 1986). The local population is made up of year-round residents, migrant breeders, and winterers (Warriner et al. 1986). Migrant breeders may arrive in early Jan but most come from early Feb to late Apr. Others arrive later, for second nesting attempts, from early May to early Jul. Breeders depart between late Apr and late Nov, the earliest moving to other sites for second nesting attempts and the later ones to molting and/or wintering areas. Surveys in 1977 and 1989, respectively, found 1 and 0 adults at Bolinas, 8 and 0 at Limantour, 2 and 7 at Drake's Beach, and 29 and 17 on Point Reyes Beach, mostly around Abbott's Lagoon (Stenzel et al. 1981, PRBO unpubl.). Wintering birds arrive between early Jul and early Nov (most in Jul) and depart from mid-Feb to early May. From 1979 to 1984 an average of 38 Snowy Plovers wintered at Dillon Beach, 64 at Point Reyes Beach (mostly around Abbott's Lagoon), 92 on Drake's Bay (Limantour and Drake's esteros combined), and 29 at Bolinas (Page et al. 1986). Color-marking has shown that wintering birds are derived from the Great Basin and the coast north and south of Point Reyes and that individuals shift between areas so that the composition of wintering birds at any location varies temporally.

In historical times human development, recreational use of beaches, and plantings for dune stabilization have lowered the size of the coastal breeding population, especially in southern California (Page and Stenzel 1981), where the wintering population has also declined since at least 1962 (Page et al. 1986). The coastal breeding population is currently being considered for federal listing as threatened or endangered.

Snowy Plovers roost in flocks in open places on wide beaches with birds often huddling in human footprints or behind debris to get out of the wind. Both breeding and wintering plovers prefer spits adjoining wetlands, dune-backed beaches, and pocket beaches over bluff-backed beaches (Stenzel et al. 1981, Page et al. 1986). They forage on sand beaches and on tidal flats when available.

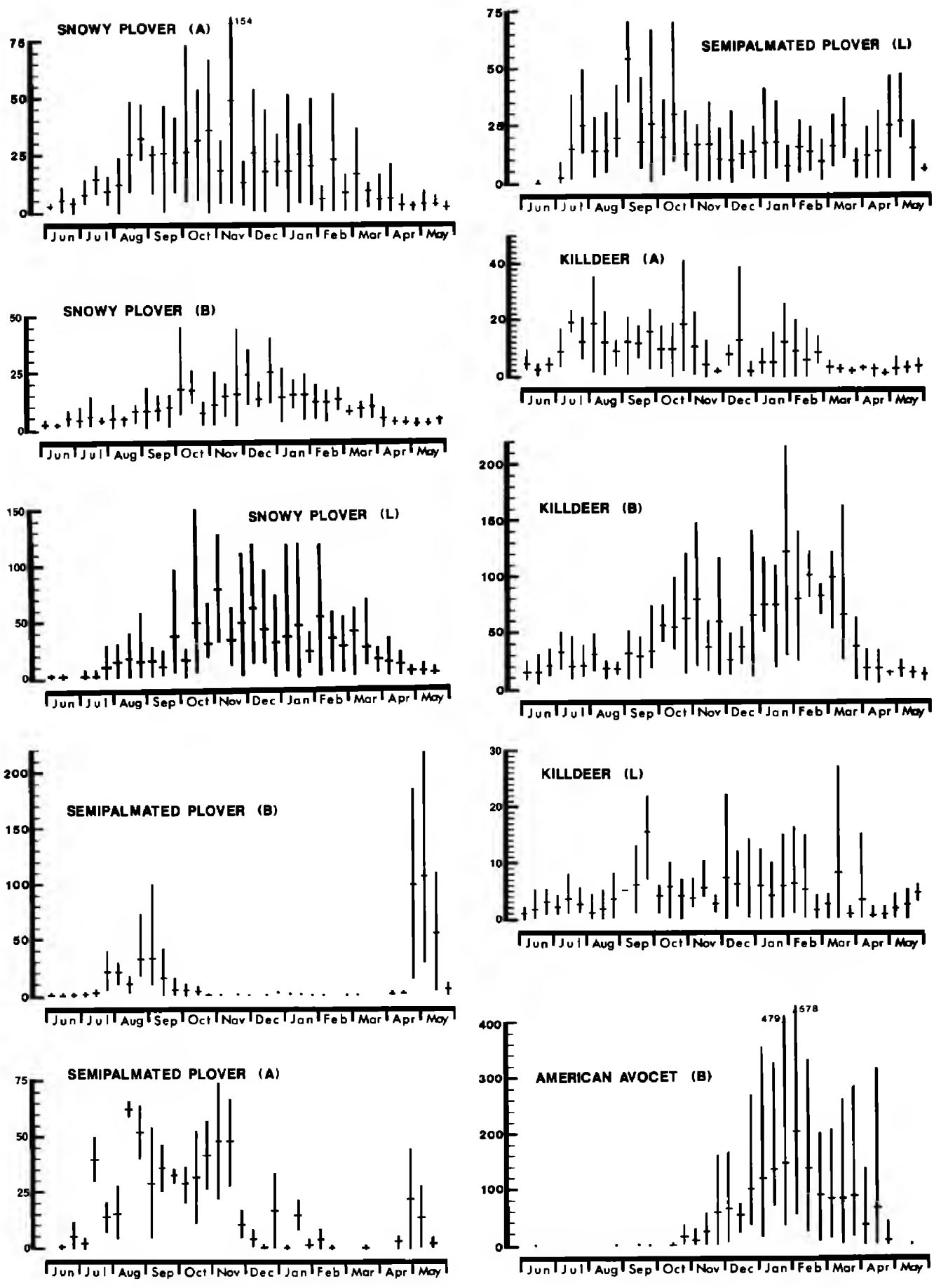


Figure 25. Seasonal abundance of some plovers and the American Avocet in wetlands of Point Reyes. See Figure 4 for details.

Semipalmated Plover (*Charadrius semipalmatus*)

A rare summer visitant, a common fall transient, a fairly common winter resident, and a common spring transient (Fig. 25). During fall migration adults arrive in early Jul and juveniles arrive as early as 2 Aug (Page et al. 1979). Numbers peaked in late Aug and early Sep, and migration was evident until mid-Oct at Bolinas and Limantour (Fig. 25). The late Nov decline in numbers at Abbott's (Fig. 25) may have represented a local shift of birds due to rising water levels after the onset of winter rains rather than a departure of migrants. In winter Semipalmated Plovers were virtually absent at Bolinas and irregular at Abbott's but regular at Limantour (Fig. 25), Drake's (Dec–Feb 1979–80 and 1980–81 mean 2.6), and Tomales Bay (DS). The highest winter census count was 41 birds at Limantour on 3 Jan 1970, and the highest non-census count was 45 at the south end of Tomales Bay on 23 Jan 1981 (DS). From 1970 to 1988, the median number on the Point Reyes CBC, which provides a reasonable estimate of the entire Point Reyes wintering population, was 51 (range 13–124). Spring migration spanned Apr and May (Fig. 25). At Bolinas spring migration was more pronounced than fall migration, in contrast to Limantour and Abbott's, where fall migration was more apparent (Fig. 25). In general, the spring peak is greater at interior California sites and the fall peak is greater at coastal sites (Jurek 1973). On the Farallones, Semipalmated Plovers occur only in fall (DeSante and Ainley 1980). On Point Reyes they inhabit mainly tidal flats but also use sand beaches (especially near estuaries and lagoons), plowed fields and pastures, and, during migration, pond margins. Numbers of wintering Semipalmated Plovers in the San Francisco Bay area increased in the 1940s (Storer 1951).

Killdeer (*Charadrius vociferus*)

A fairly common summer resident and breeder and common winter resident (Fig. 25). Killdeers breed from mid-Mar until at least Jul on wetland margins and widely in the interior of Marin Co. (pers. obs.). Local breeders and their offspring probably made up the population from early Apr to mid-Sep (Fig. 25), when numbers were lowest. A Jun to Jul increase, especially noticeable at Abbott's (Fig. 25), may have represented a movement of locally raised juveniles, and possibly adults, from breeding sites nearby. A larger fall build-up at Bolinas from Sep to early Nov (Fig. 25) coincides with a late Sep to mid-Oct migratory peak on the Farallones (DeSante and Ainley 1980) and falls within the state-wide Aug to Nov migration period (Jurek 1973). The limited evidence of a fall peak at Abbott's and Limantour (Fig. 25) indicates a low carrying capacity for Killdeers there at any season. A Nov to Dec dip in numbers at Bolinas and Abbott's (Fig. 25) may reflect a temporary shift to agricultural lands, enhanced as Killdeer habitat by the onset of winter rains (see Black-bellied Plover). The shift from Abbott's may have been augmented by rising water levels and that from Bolinas by high tides. However, this pattern might also be explained by a passage of long-distance migrants followed later by a second influx of hard-weather migrants. Movement on the Farallones continues until at least Dec (DeSante and Ainley 1980). Winterers leave Point Reyes' wetlands chiefly in Mar (Fig. 25), as noted for other coastal sites (Gerstenberg 1972), but departure may begin by late Feb and continue into Apr (Jurek 1973, Fig. 25). During the study, winter numbers at Bolinas were relatively high during the drought years of 1975–76 and 1976–77 and declined thereafter (Fig. 14).

Killdeers frequent flat or gently rolling open terrestrial habitats such as cultivated fields, heavily grazed pastures (particularly when rain-soaked), and lawns. They also use pond and stream margins, tidal flats, where they seem to prefer muddy over sandy substrates (Page et al. 1979), and sandy beaches in the vicinity

of estuaries or creek mouths. They often nest near a source of fresh water. Killdeers have probably increased historically because of agricultural practices that open up the land.

Black-necked Stilt (*Himantopus mexicanus*)

A very rare visitant with only three census records of single birds at Bolinas Lagoon on 21 Jan 1976 and 4 Apr 1977 and at Drake's Estero on 5 May 1981. Including census records, on Point Reyes there are six fall records from 29 Jun to 20 Sep, nine winter records from 20 Nov to 4 Feb, and six spring records from 4 Apr to 23 May, 1969 to 1988. All birds except possibly one were transients. Although Jurek (1973) reported that the stilt's migratory periods in California are from Aug to Oct and from mid-Mar to May, the above records indicate that fall movement (perhaps including post-breeding dispersal) begins earlier and that some birds wander in winter. Early in the 1900s only small numbers of Black-necked Stilts could be found around San Francisco Bay, from spring through fall and irregularly in winter (Grinnell and Wythe 1927, Grinnell and Miller 1944). In the 1950s and 1960s both nesting and wintering populations increased substantially in south San Francisco Bay (Gill 1977, Cogswell 1977, Rigney and Rigney 1981). Nesting probably did not begin in north San Francisco Bay until after the mid-1960s (R. Gill pers. comm.), and the number of breeders there still appears to be increasing (ABN). In the Monterey Bay area stilt numbers have increased in winter since at least 1959 (Roberson 1985). Continued expansion of the coastal population is evident from a spring 1984 influx of about 40 birds north to Humboldt and Del Norte counties and the extension of the breeding range to near Humboldt Bay in 1985 (AB 39: 958). The scarcity of stilts on Point Reyes probably reflects a lack of suitable habitat. Stilts have lingered briefly here at sewer ponds, freshwater ponds, and estuarine margins. Elsewhere on the central California coast stilts forage in the shallow waters of salt evaporation ponds, sloughs, freshwater and brackish ponds, sewer ponds, and flooded fields.

American Avocet (*Recurvirostra americana*)

A very rare summer visitant, rare fall transient, and common winter resident (Fig. 25). In California, fall migration extends from Jul through Nov and spring migration extends from Mar through May, with the peak from late Mar through Apr (Jurek 1973). In the Point Reyes area avocets wintered regularly only at Bolinas, Schooner Bay (Drake's Estero), and Bodega Harbor. On monthly winter censuses in 1979–80 and 1980–81, up to 29 avocets were found at Schooner Bay and up to 12 were found at Bodega Harbor. From 1970 to 1988 avocet numbers on the Point Reyes CBC (mostly at Schooner Bay) ranged from 0 to 20 (median 3.5) except for high counts in three years ranging from 52 to 66. Other high counts at Schooner Bay of 95 birds on 4 Oct 1966 and 102 on 14 Oct 1968 (PRBO) may have been mostly of fall transients. Counts of up to 81 birds at Abbott's between 7 Jul and 4 Oct 1966 were atypical; in subsequent years we saw a total of four avocets there on three censuses between 14 Aug and 23 Dec. At Limantour we recorded a total of 12 on 16 censuses between 28 Jul and 26 Feb.

Formerly, avocets were considered irregularly common fall and winter visitors to San Francisco Bay (Grinnell and Wythe 1927), where nesting was first recorded in 1926 (Gill 1977). Although avocets had begun to use San Francisco Bay area salt ponds by at least 1899 (Grinnell et al. 1918), not until the early 1940s did the population begin to expand there to include large numbers of wintering and breeding birds (R. W. Storer 1951, Gill 1972b, 1977). Avocets have also increased in winter in Humboldt Bay since 1958, especially from 1961 to 1968 (Gerstenberg 1972). A rough comparison of breeding (Gill 1977) and wintering

(R. W. Storer 1951) numbers in San Francisco Bay indicates that the winter population is substantially greater, as it is around Monterey Bay (Roberson 1985). At Bolinas avocets have wintered regularly at least since 1971, and numbers there increased over the study period (Fig. 14). Numbers were highest during drought years presumably because of a shift of avocets from dried-up freshwater habitats to marine habitats.

In all years we suspect the winter influx reflected a local shift of avocets from San Francisco Bay to Bolinas Lagoon feeding areas. These birds probably move daily to nighttime roosts in San Francisco Bay since early in the morning they can be seen arriving at Bolinas from the south (Blick 1980). In the study area avocets use estuaries and lagoons, and at Bolinas they concentrate on muddy rather than sandy substrates (Page et al. 1979).

Greater Yellowlegs (*Tringa melanoleuca*)

A very rare summer visitant and uncommon winter resident (Fig. 26). Fall migration extends from early Jul to Nov; spring migration extends from Mar to May (Jurek 1973, Fig. 26). The earliest juvenile recorded at Point Reyes was seen on 8 Aug (SNGH). The greater regularity of winter sightings at Abbott's and Limantour after Jan (Fig. 26) suggests local movements, perhaps influenced by changing water levels in freshwater habitats during winter rains. Spring passage was only weakly evident on Point Reyes wetlands. Coastal birds forage in shallow ponds, at marsh edges, and along stream margins, as well as in saltmarsh pools and water over tidal flats and channels, especially near freshwater inflows.

Lesser Yellowlegs (*Tringa flavipes*)

Lesser Yellowlegs are very rare at all times, occurring primarily as fall migrants. One or two wintered at Bolinas from 1973–74 to 1979–80. Other census records were of one at Bolinas from 16 Jul to 24 Sep 1973 and one there on 12 Apr 1974, one at Abbott's from 7 to 25 Aug 1975, one at Limantour on 13 Sep 1972, one there on 29 Mar 1968, and one to four there between 11 and 27 Sep 1973. Cumulative Marin Co. records (Fig. 12) indicate an early Jul to early Oct fall migration, as in the rest of the state (Jurek 1973). A sharp peak from mid-Aug to late Sep (Fig. 12) corresponds with the passage of juveniles (Garrett and Dunn 1981), which begins as early as 29 Jul on Point Reyes (ABN: RS), or 21 Jul elsewhere on the northern California coast (AB 42: 1337). Single Lesser Yellowlegs have been recorded on only three of 19 Point Reyes CBCs from 1970 to 1988. A small spring passage in California extends primarily from late Mar to early May with an occasional bird lingering through Jun (Jurek 1973, McCaskie et al. 1979, Garrett and Dunn 1981). Lesser Yellowlegs were not recorded wintering in the San Francisco Bay area by Grinnell and Miller (1944), but they may have been overlooked among the similar but more numerous Greaters. Lesser Yellowlegs inhabit the same range of habitats as Greaters though presumably Lessers exploit somewhat shallower water.

Willet (*Catoptrophorus semipalmatus*)

A common summer resident and a very common fall transient and winter resident (Fig. 26). A fall peak at Abbott's and Bolinas, from late Jun to late Oct (Fig. 26), was not apparent at Limantour, where numbers increased gradually from Jun until Sep, when they reached winter levels. Fall migration in California extends from late Jun to early Nov (Jurek 1973), and juveniles arrive on the coast as early as 13 Jul (SNGH). Kelly and Cogswell (1979) reported an Oct peak in San Francisco Bay and suggested that peaks of fall migrants occur progressively

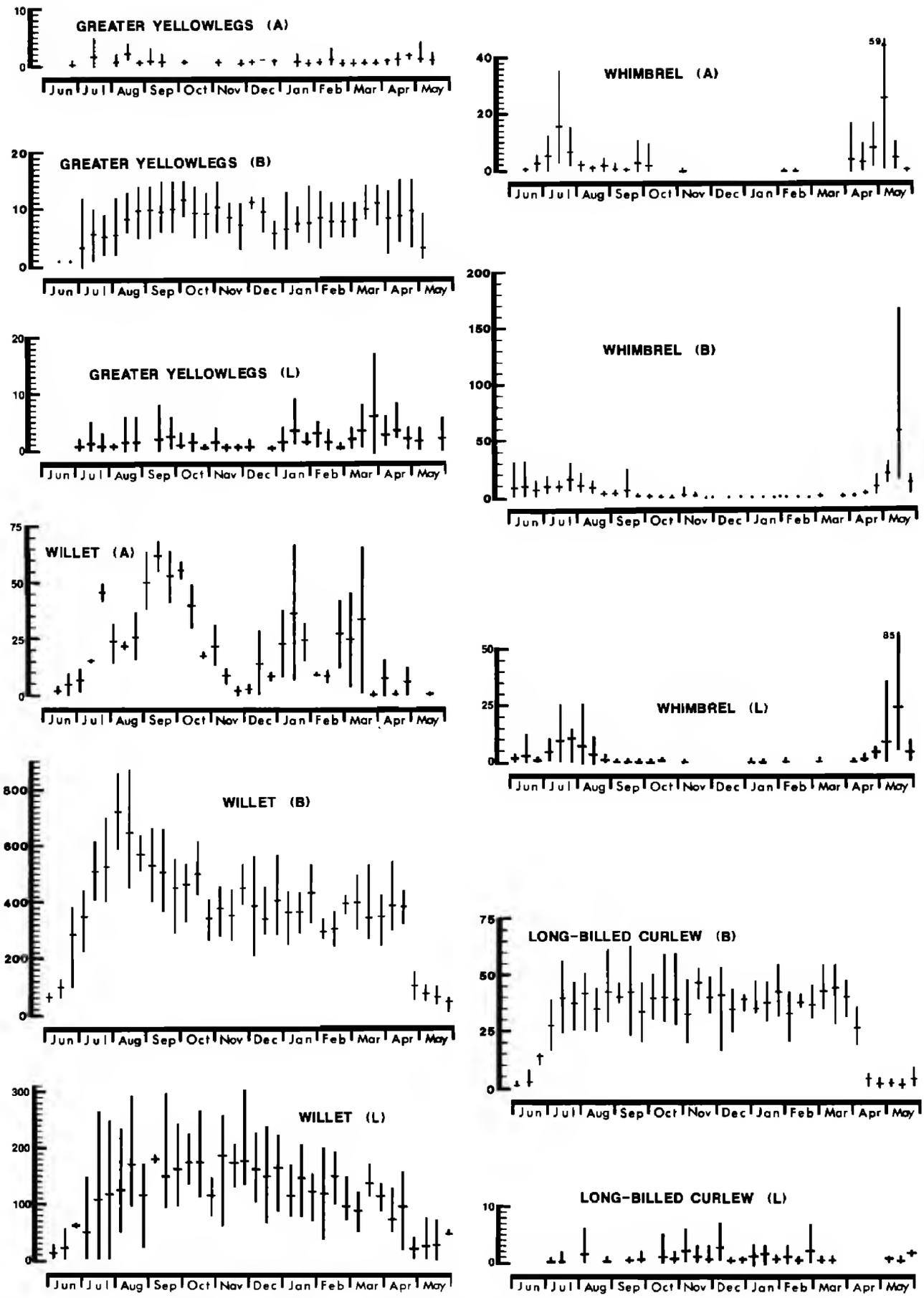


Figure 26. Seasonal abundance of the Greater Yellowlegs, Willet, and curlews in wetlands of Point Reyes. See Figure 4 for details.

later from north to south along the California coast. This hypothesis is not corroborated by our study since peaks at Bolinas and Abbott's were in Aug and Sep (Fig. 26), respectively, although both sites are at roughly the same latitude as San Francisco Bay. Any latitudinal trends could be masked, however, by the birds staging at different times at sites at the same latitude. Winter numbers at Abbott's fluctuated (Fig. 26), perhaps reflecting high seasonal and yearly variation in water levels in the lagoon. Winter numbers at Bolinas decreased during the study (Fig. 14). At Limantour and Bolinas there was a sudden spring exodus in mid- to late Apr. The lack of a spring migratory peak in any of the wetlands coupled with the scarcity of spring migrants on the Farallones (DeSante and Ainley 1980) suggests there is little spring movement of Willets along the coast at this latitude; spring migrants may move directly from the coast to interior breeding sites. For the state as a whole, spring migration extends from Mar to late Apr (Jurek 1973). Willets feed on sandy and muddy substrates of tidal flats (Page et al. 1979), sandy and rocky beaches, and lagoon margins; unlike most shorebirds, they regularly feed in salt marshes (Stenzel et al. 1976).

Wandering Tattler (*Heteroscelus incanus*)

Because tattlers prefer rocky shores along the outer coast, they were very rare fall and spring transients on the estuaries and lagoon. Fall census records included one bird at Bolinas on 1 Aug 1973, up to 11 at Limantour on four dates from 28 Jul to 26 Oct (7 on 31 Aug 1972), and at least 13 at Abbott's on seven dates from 28 Jul to 4 Sep (11 on 25 Aug 1975). Of the few juveniles identified, our earliest was 14 Aug (DS), which compares with the earliest date of 9 Aug in Oregon (Paulson 1983). Our only spring census record was of two birds at Abbott's on 1 May 1980. Fall migration on the northern California coast extends primarily from mid-Jul through Oct with an Aug to Sep peak (Jurek 1973, ABN). Spring migration extends primarily from early Apr through May. The only Point Reyes records for Jun and early Jul are of two birds at Abalone Flat near Palomarin on 4 Jun 1981 (JGE) and one at Chimney Rock on 10 Jul 1982 (JGE). Migrants and the small Point Reyes wintering population use primarily low rocky reefs and sea stacks at scattered sites along the outer coast. Wandering Tattlers were formerly considered to winter north only to Monterey Bay (Grinnell and Miller 1944). We suspect the discovery that they now winter regularly north to Marin and Sonoma counties and irregularly north to Humboldt and Del Norte counties (ABN) is a result of more thorough coverage rather than a true change in status.

Spotted Sandpiper (*Actitis macularia*)

A rare fall transient, winter resident, and spring transient (Fig. 12). Up to three Spotted Sandpipers regularly used Bolinas, where extreme dates of occurrence were 28 Jul (early fall) and 9 Jun (late spring). Small numbers also winter on Tomales Bay and on rocky beaches of Point Reyes' outer coast. The median number on the Point Reyes CBC from 1970 to 1988 was 14 (range 4–31). Fall migratory movement was apparent from counts of at least six birds on nine censuses from 28 Jul to 16 Sep at Abbott's and Limantour. Spring movement was apparent from high counts of eight birds in early and mid-May at Bolinas and three birds on three dates from 11 May to 5 Jun at Abbott's and Limantour. In California, fall migration probably extends from early Jul through Oct and spring migration extends from mid-Apr to early Jun (Fig. 12, Jurek 1973, Garrett and Dunn 1981). Although Spotted Sandpipers are not known to nest in the study area, they have bred twice in Marin Co.—both times along the shoreline of San Francisco and San Pablo bays (PRBO unpubl.). They frequent rocky or gravelly

shorelines at estuaries, lagoons, and stream mouths, rocky reefs and beaches along the outer coast, and the margins of freshwater ponds and sewage ponds. Although Spotted Sandpipers may use channel margins in estuaries, they avoid expansive tidal flats.

Whimbrel (*Numenius phaeopus*)

A fairly common summer visitant, fairly common fall transient, rare winter resident, and fairly common spring transient (Fig. 26). Non-breeders in summer overlapped with fall migrants, which arrived by at least early Jul. The abbreviated Jul to mid-Aug peak of migrants (Fig. 26) suggests that few juveniles pass through the area; passage of juveniles begins at least by 22 Aug (SNGH). Fall movement continued through Nov, and small numbers wintered irregularly at Bolinas and regularly on the rocky outer coast of Point Reyes. The median number on the Point Reyes CBC from 1970 to 1988 was 3.4 (range 1–9). Spring migration extended from late Mar through May (Fig. 26). Our early to mid-May spring peak is somewhat later than the mid- to late Apr peak reported for southern California (AFN 24: 644, Jurek 1972). At Point Reyes migrant Whimbrels feed on tidal flats, salt marshes, sandy or rocky beaches, and in pastures or ungrazed fields with low-growing vegetation. In winter they inhabit primarily marine habitats.

Long-billed Curlew (*Numenius americanus*)

An uncommon summer resident and a fairly common winter resident (Fig. 26). Throughout California fall migration extends from mid-Jun to Oct and spring migration extends from late Mar to early May (Jurek 1973). There were no peaks of migrants at Limantour or Bolinas, but census records at Abbott's of 10 birds on four dates from 16 Jun to 4 Sep indicate a small passage of fall migrants through the area. Identification problems have hindered the study of the timing of juveniles' passage, but juveniles arrive by at least 10 Aug (SNGH). The absence of a spring peak at Point Reyes (Fig. 26) supports Jurek's (1973) suggestion that coastal wintering Long-billed Curlews fly east in spring toward interior breeding areas rather than north along the coast. We cannot explain why Bolinas has the only regular winter curlew population in the Point Reyes area because the curlews' main prey items (Stenzel et al. 1976) are also available on the other large estuaries. On Point Reyes curlews feed on tidal flats (except for the sandiest substrates), occasionally in salt marshes (Stenzel et al. 1976, Page et al. 1979), and rarely in plowed fields or pastures. Historically, curlews have declined in California (Grinnell et al. 1918) and throughout much of their breeding range because of hunting and habitat loss (Palmer 1967, Johnsgard 1981). Although there has been some recovery from the effects of hunting, numbers remain below historic levels (Grinnell and Miller 1944, Palmer 1967). In recent years curlews have apparently declined in numbers to the north in Humboldt Bay (Gerstenberg 1972, Yocum and Harris 1975), but our census data show a stable population on Point Reyes.

Bar-tailed Godwit (*Limosa lapponica*)

Our only record of this vagrant to California is of a single bird at Bolinas from 26 Oct to 2 Dec 1973 (AB 28: 101, Winter and McCaskie 1975, Page et al. 1979). A non-census record for Schooner Bay, Drake's Estero, on 28 Sep 1975 (AB 30: 120) was rejected by the CBRC, and a 20 Sep 1988 record (AB 43: 163) is currently under review by the CBRC. The accepted Bolinas record is among only six for California, 1968 to 1984: four fall records of adults and juveniles, 11 Jul to 2 Dec, one winter record, 11 Feb to 2 Mar 1976, and one spring record,

3–5 Jun 1984 (CBRC). *Limosa l. baueri*, breeding in northern and western Alaska and in northeastern Asia (AOU 1957, Johnsgard 1981), normally migrates south along the west side of the Pacific in fall (Palmer 1967).

Marbled Godwit (*Limosa fedoa*)

A common summer resident and very common winter resident (Fig. 27). Peaks of migrants were not evident at Limantour or Bolinas, but at Abbott's there was a fall peak from late Jun to early Nov (Fig. 27), corresponding to the 8 Jul to 18 Oct span for fall transients at the Farallones (DeSante and Ainley 1980). Juveniles, difficult to age in the field, appear in fall by at least 28 Jul (SNGH). The fall birds at Abbott's could have been southbound migrants or potential winterers forced out by rising winter water levels. Although little migration was evident at our census sites, birds may have been staging in spring at more favored sites such as Tomales and San Francisco bays, where spring influxes have been noted (Jurek 1973, 1974). Jurek (1973, 1974) reported a noticeable northward movement in spring along the southern and central California coast as far north as the Point Reyes/Bodega area and that overland migration is directed to the northeast. Overall, godwit migration in California extends from Jul to about Oct in fall and from Mar to early May in spring (Jurek 1973).

Declining godwit numbers from Jan to Feb at Limantour (Fig. 27), from Nov 1978 (2781) to Feb 1979 (899) and from Jan 1980 (1902) to Feb 1980 (820) at Bodega, and from Nov 1979 (1225) to Feb 1980 (761) at Drake's Estero confirmed winter godwit movements in this area. At Humboldt Bay, Gerstenberg (1972) also found a post-Dec decline in godwit numbers. Kelly and Cogswell (1979) reported progressively later fall and winter peaks toward the south along the California coast, suggesting regional winter godwit movements. Winter numbers at Bolinas and Limantour increased over the course of our study (Fig. 14). Godwits forage on tidal flats (at Bolinas they prefer areas of intermediate substrate texture, Page et al. 1979) and sandy beaches of the outer coast, infrequently in salt marshes, and periodically in rain-soaked pastures. Many godwits feed at Bolinas Lagoon during the day and probably roost in San Francisco Bay at night. We have observed flocks heading south over the ocean in the evening, and Blick (1980) reported godwits arriving at Bolinas from the south at sunrise.

Ruddy Turnstone (*Arenaria interpres*)

A rare summer visitant, uncommon fall transient, rare winter resident, and uncommon spring transient (Fig. 27). Non-breeders occurred in Jun, and fall migrants occurred from early Jul until mid-Oct (Fig. 27). At both Bolinas (Fig. 27) and Humboldt Bay (Gerstenberg 1972) there are two peaks of fall migration, in late Jul and from late Aug to Sep. The first presumably reflects the passage of adults, the second, that of juveniles, which arrive as early as 15 Aug (Page et al. 1979). Bodega Harbor, Tomales Bay, and Drake's Estero were the only sites in the Point Reyes area with regular wintering populations. Bodega's wintering population averaged 29 birds in 1978–79 and 45 in 1979–80; Drake's averaged 2 from 1979 to 1981. From 1970 to 1988 the median number of Ruddy Turnstones on the Point Reyes CBC was 17 (range 1–34); most birds were on Tomales Bay or Drake's Estero. Spring migration extends from mid-Apr through May. A flock of 97 Ruddy Turnstones at Limantour on 8 May 1980 was the largest we recorded at any season. On Point Reyes Ruddy Turnstones frequent gravel or rocky beaches, gravelly areas in estuaries, mussel beds, algae-covered tidal flats, oyster-farm middens, and occasionally sand beaches littered with kelp. They sometimes forage in pastures at Bodega at high tide (DS).

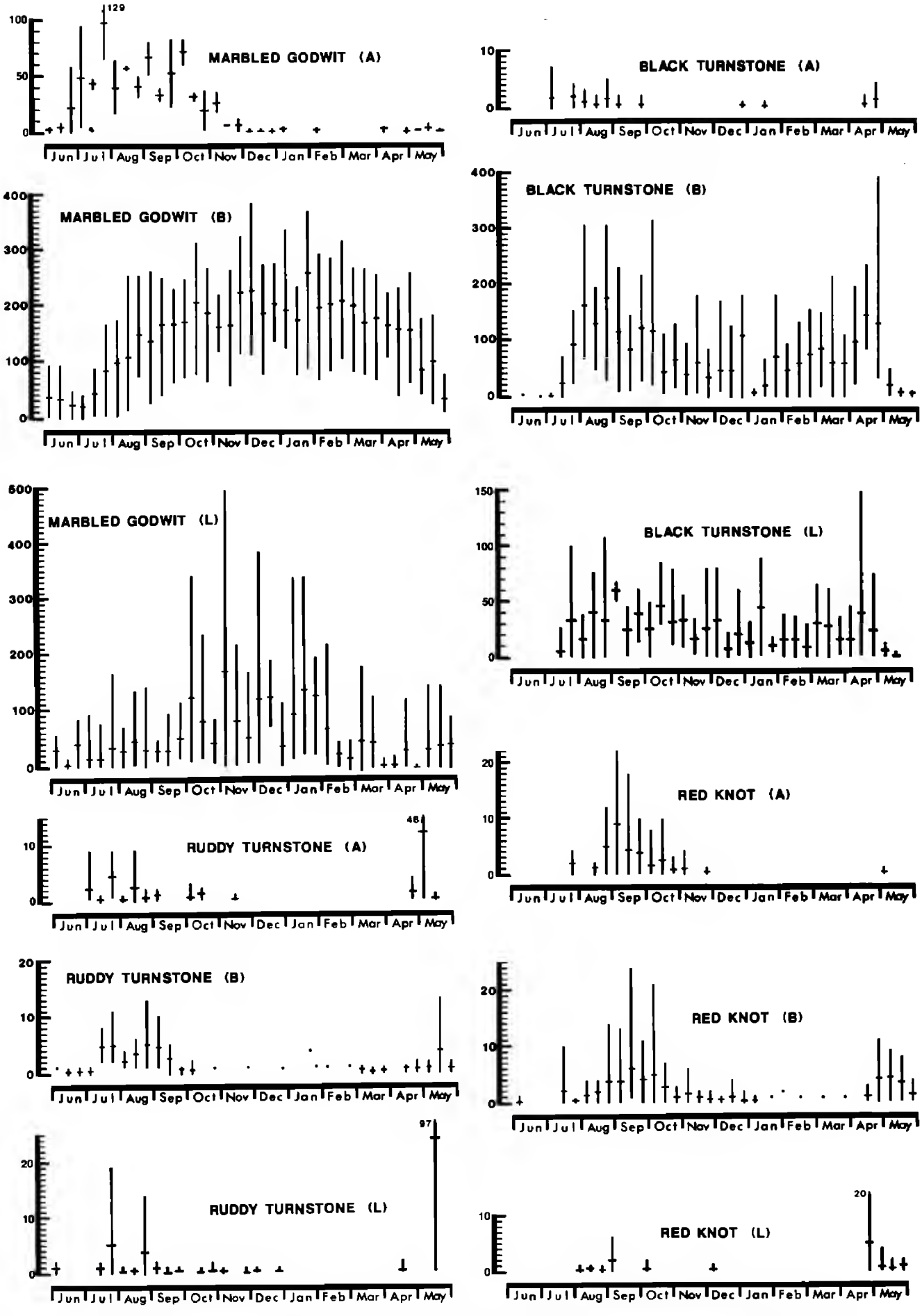


Figure 27. Seasonal abundance of the Marbled Godwit, turnstones, and Red Knot in wetlands of Point Reyes. See Figure 4 for details.

Black Turnstone (*Arenaria melanocephala*)

A very rare summer visitant and a common fall transient, winter resident, and spring transient (Fig. 27). Non-breeders occurred sporadically through Jun, and fall migrants occurred from early Jul through early Oct (Fig. 27); juveniles arrived as early as 20 Aug (Page et al. 1979). Abbott's was the only study-area wetland not used by wintering birds (Fig. 27). Spring migration occurred mostly in Apr (Fig. 27). Black Turnstones use rocky reefs and sea stacks along the outer coast, estuarine tidal flats (especially around algal mats), and occasionally sand beaches littered with kelp.

Surfbird (*Aphriza virgata*)

This rocky-coast species is a very rare fall and spring transient on the estuaries. Our only census records were of one bird at Bolinas on 9 Oct 1971 and eight at Limantour on 21 Apr 1974. In the Point Reyes vicinity extreme dates for Surfbirds are 12 Jul and 14 May; data on local fall arrival of juveniles are lacking but in Oregon juveniles arrive as early as 26 Jul (Paulson 1983). Roughly 30 to 50 Surfbirds winter in the Point Reyes–Bodega area (ABN, DS pers. obs.). Migration in California extends from mid-Jul through Oct in fall and from late Mar through early May in spring; Surfbirds are sighted only irregularly from mid-May to early Jul (Jurek 1973, McCaskie et al. 1979, Garrett and Dunn 1981). In spring, flocks of 20 to 60 birds have been seen regularly on Point Reyes, but a flock of 155 birds at Drake's Beach on 29 and 30 Apr 1975 (EP, DS) was exceptional. Fall and winter flocks consist usually of under 20 birds. Surfbirds primarily frequent rocky reefs, sea stacks, jetties, and occasionally tidal flats and sandy beaches during migration.

Red Knot (*Calidris canutus*)

An uncommon fall transient, very rare winter resident, and rare spring transient (Fig. 27). The only local (non-census) mid-summer record was of two birds at Schooner Bay, Drake's Estero on 16 Jun 1981 (DS). In fall adult females migrate before males, which migrate before juveniles (Harrington 1982). On Point Reyes fall migration began in mid-Jul, juveniles arrived as early as 14 Aug (DS), peak numbers extended from late Aug to early Oct, and small numbers lingered to late Nov or Dec (Fig. 27); a high fall count was 200 at Bolinas on 29 Oct 1973 (ABN: PJM). At Bodega, at least four knots wintered in 1978–79 and two wintered in 1979–80; at Drake's Estero, two wintered in 1979–80. Small numbers of knots also winter irregularly on Tomales Bay, as indicated by the Point Reyes CBC. Knots were recorded on 9 of 19 counts between 1970 and 1988; the median number for the 9 years was 8 (range 1–28). Thirty at the south end of Tomales Bay on 21 Jan 1979 (ABN: LCB) is the high mid-winter count for the Point Reyes area. Spring migration extended from mid-Apr to early Jun (Fig. 27); the highest spring count (non-census) was of 57 birds at Bolinas on 18 Apr 1976 (GWP, LES). During migration knots typically stage in large numbers at restricted locations (Morrison et al. 1980, Morrison 1984), but the Pacific Coast population is small and knots largely by-pass the Point Reyes area. On Point Reyes, Red Knots usually frequent tidal flats but they sometimes feed in pastures when tidal flats are inundated.

Sanderling (*Calidris alba*)

A rare summer visitant and very common fall transient, winter resident, and spring transient (Fig. 28). Small numbers of non-breeders occurred irregularly in

Jun (Fig. 28). A pronounced fall peak extended from mid-Jul to mid-Nov at all wetlands with juveniles arriving as early as 21 Aug (Page et al. 1979). Winter numbers were relatively stable at Bolinas and Limantour (Fig. 28). At Abbott's, mid-winter and spring peaks (Fig. 28) reflected local rather than migratory movements. These peaks were caused mostly by storm-created breaches in the barrier bar which temporarily expose sizable sand flats where large foraging flocks concentrate. In six instances on censuses from 1973 to 1982, we recorded Sanderling numbers at Abbott's suddenly jumping from 200 to 500 birds above the previous census total when water levels dropped after storms opened the lagoon mouth. As many as 1300 Sanderlings, a number of them banded at Bodega Harbor, converged on Abbott's in Mar 1980 within four days of the lagoon breaking open to the sea (Myers 1980). There was a small peak of spring migrants at Bolinas from mid-Apr to late May (Fig. 28) but none at Limantour. Sanderlings on the Pacific Coast largely by-pass the Point Reyes area in spring and stage in large numbers in Oregon and southern Washington (Myers et al. 1984).

Numbers of Sanderlings at Bodega reach a peak in Dec, decline slowly through the winter, then drop rapidly in spring (Myers et al. 1985). The fall increase there involves the direct arrival of long-distance migrants, the return of birds that have staged for a month or more on Point Reyes, or the return of birds that were wandering widely on the central California coast after their initial arrival at Bodega. A Mar decline in numbers at Bodega results from local movement of a large portion of the population to Point Reyes rather than from migration, which extends from Apr or early May through the end of May. At Bodega intense storms may sometimes cause numbers to plummet in mid-winter apparently because eroding beaches offer Sanderlings little food (Myers 1980).

Census studies by J. P. Myers and associates from 1976 to 1983 provide information on numbers of Sanderlings wintering in the Bodega to Bolinas area. The population varies between 500 and 700 birds in the Bodega Bay area, 225 and 450 at Dillon Beach, 400 and 675 at Point Reyes Beach (including Abbott's Lagoon), and 400 and 650 in Drake's Bay (including Limantour and Drake's Estero); it is under 200 along Bolinas Bay (including Bolinas Lagoon). Sanderlings primarily inhabit sand beaches, sandy tidal flats and, to a limited degree, rocky beaches. Densities are highest on sand beaches linked with estuaries, and away from estuaries they are higher on extensive beaches than on short beaches (Myers et al. 1984). Around estuaries, birds typically concentrate on sandy beaches at high tide, but on tidal flats at moderate and low tides (Connors et al. 1981).

Semipalmated Sandpiper (*Calidris pusilla*)

A very rare fall and spring transient. The three fall census records were all from Abbott's: one adult on 4 Aug 1980 (DS), two juveniles from 16 to 18 Aug 1980 (DS), and one juvenile on 14 Aug 1981 (DS). The only spring records were of single birds at Bolinas on 25 Apr 1979 (AB 33: 803) and at Abbott's on 16 and 17 Jun 1976 (AB 30: 884, Luther et al. 1979). Additional non-census records extend the date span of Point Reyes fall records from 19 Jul to 24 Sep (ABN). First recorded in coastal northern California in 1968 (AFN 22: 644), Semipalmated Sandpipers have been sighted regularly in small numbers since 1977 because of observers' increased awareness (ABN). Fall records for the northern California coast, mostly of juveniles, extend from 4 Jul to 2 Oct, with most sightings from mid-Aug to mid-Sep (ABN). Overall, in fall adults (females before males) precede juveniles (Morrison 1984). On the northern California coast juveniles have arrived as early as 18 Jul (AB 37: 1023), but they typically first arrive from 22 to 25 Jul (ABN). There are six spring records for the northern California coast from 19 Apr to 24 May (ABN), the mid-Jun Bolinas record

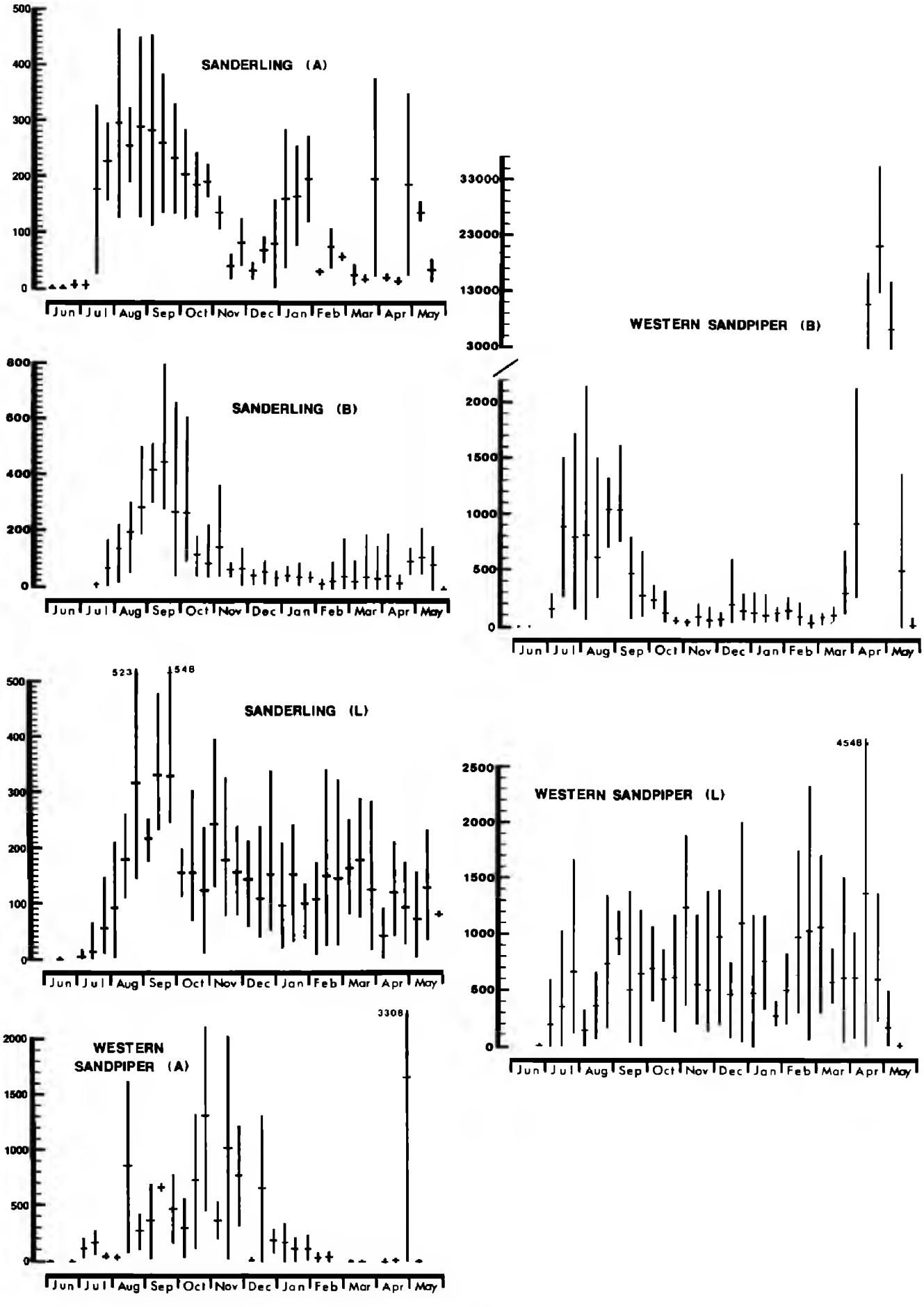


Figure 28. Seasonal abundance of the Sanderling and Western Sandpiper in wetlands of Point Reyes. See Figure 4 for details.

(above), and another of a bird at the Pajaro River mouth, Monterey Co., which remained through the summer of 1979 (AB 33: 803 and 894). Coastal Semipalmated Sandpipers are found on lagoon margins, in estuaries, and at sewage ponds.

Western Sandpiper (*Calidris mauri*)

An uncommon summer visitant and an abundant fall transient, winter resident, and spring transient (Fig. 28). Non-breeders occurred irregularly in Jun at all sites; otherwise seasonal patterns differed markedly from area to area. Bolinas had a well-defined peak of fall migrants from early Jul to mid-Oct and a very pronounced peak of spring migrants from late Mar to mid-May (Fig. 28). In fall, juveniles have been sighted at Point Reyes by 28 Jul (DS). Elsewhere on the northern California coast juveniles have arrived as early as 19 Jul (ABN: KFC), but they normally first arrive from 23 to 26 Jul (ABN). A very high count on one mid-Apr census was the only evidence of the passage of migrants at Limantour (Fig. 28). At Abbott's a small Jul peak (Fig. 28) coincided with the passage of adults, and was followed by a higher peak in mid-Aug that coincided with the passage of juveniles. A decline in use of Abbott's from Dec to Feb (Fig. 28) coincided with the flooding of sand flats as runoff filled the lagoon. Spring migrants used Abbott's irregularly in Apr. Males precede females in spring migration (Page et al. 1972).

Female Western Sandpipers winter farther south than males, and in California the latter greatly outnumber the former (Page et al. 1972). Most wintering Westerns at Bolinas are immature males, while most at Limantour are adult males (Page et al. 1972, unpubl. data). In the study area Western Sandpipers primarily forage on estuarine tidal flats and lagoon margins and secondarily on low rocky reefs, on beaches (especially at the margins of ephemeral pools left by high tides), and in rain-soaked pastures. At Bolinas, Westerns forage in sandier areas than do Least Sandpipers (Page et al. 1979).

Least Sandpiper (*Calidris minutilla*)

An abundant fall transient and very common winter resident (Fig. 29). We did not record Least Sandpipers on any censuses in the first two-thirds of Jun, although the species occurs irregularly then in northern California (McCaskie et al. 1979, ABN). On the basis of distinct peaks at three census sites, fall migration extended from late Jun/early Jul to mid-Nov (Fig. 29). At Point Reyes, juveniles arrive as early as 27 Jul (SNGH) and elsewhere in northern California as early as 23 Jul (ABN: RAE). This migration period is broader than the late Jun to early Oct span Jurek (1973) reported for the state as a whole. Spring migration, which begins in Mar (Jurek 1973) and continues through mid-May, was not clearly reflected by spring peaks in the study area (Fig. 29). At Bolinas, the lowest winter averages (Fig. 14) were from the wettest years, 1972–73, 1973–74, and 1981–82 (Fig. 2), suggesting that during wet years birds either fled adverse conditions on the estuary or moved to enhanced freshwater habitats, or that during dry years birds concentrated on the estuary as freshwater habitats inland dried up. Least Sandpipers forage primarily on tidal flats, where they prefer muddier substrates than do Westerns (Page et al. 1979). They also feed in salt marshes, on the margins of freshwater ponds, in wet pastures, and to a limited degree on sand beaches and flat rocky areas such as Duxbury Reef.

Baird's Sandpiper (*Calidris bairdii*)

An uncommon fall transient and very rare spring transient (Fig. 29). Fall migrants, mostly juveniles, were detected on censuses from 28 Jul to 5 Oct.

There was also a single adult on a 15 Jul 1972 Bolinas census. Peak numbers were from mid-Aug to mid-Sep (Fig. 29). Other notable local fall records were of single adults on outer Point Reyes on 20 Jul 1986 and at Abbott's on 21 Jul 1986 (AB 40: 1250) and 20 Jul 1988 (AB 42: 1337) and a late bird on outer Point Reyes on 15 Oct 1972 (ABN: DDeS). The highest counts were at Abbott's: 19 on a 14 Aug 1975 census (LES,DS) and 20 on 5 Sep 1987 (non-census; ABN:

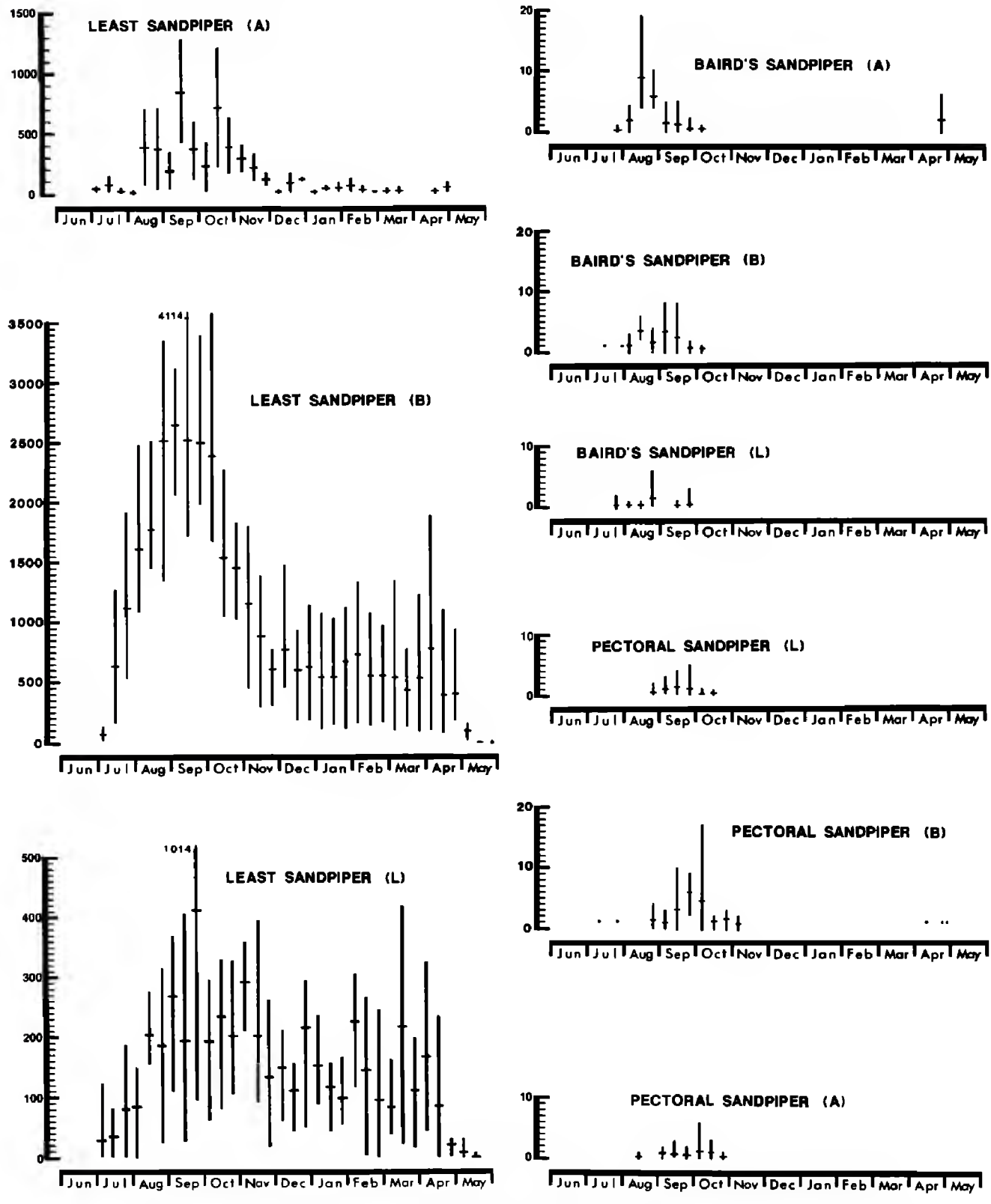


Figure 29. Seasonal abundance of the Least, Baird's, and Pectoral sandpipers in wetlands of Point Reyes. See Figure 4 for details.

MFe). In fall, adults migrate mostly from mid-Jul to early Aug (females precede males) and are followed by juveniles (Jehl 1979). Fall records for coastal northern California span the period 28 Jun–27 Nov (earliest record of a juvenile, 18 Jul), but Baird's Sandpipers occur irregularly before late Jul and after early Oct (ABN); there are only two Nov records (AB 32: 252).

Our only spring census records were of one bird at Bolinas on 8 Apr 1981 (AB 35: 859) and six birds at Abbott's on 21 Apr 1982 (AB 36: 890). The only other substantiated Point Reyes spring records are of one to three birds at Abbott's from 14 to 27 Apr 1977 (AB 31: 1043) and one at the Bolinas sewer ponds on 10 May 1985 (RS). Baird's Sandpipers are now reported almost annually in spring on the northern California coast from 27 Mar to 12 May (ABN); also, there are three records of single birds from 2 to 18 Jun (AB 37: 1023, 41: 1483, 42: 1337). Coastal Baird's Sandpipers use tidal flats, lagoon and pond margins, and sewage ponds primarily and sandy beaches of the outer coast occasionally.

Pectoral Sandpiper (*Calidris melanotos*)

An uncommon fall transient and very rare spring transient (Fig. 29). Fall migrants, mainly juveniles, were recorded on censuses from 17 Aug to 6 Nov with a peak from mid-Sep to early Oct (Fig. 29); non-census records extended the occurrence period to 16 Nov (ABN). The high census count was 17 birds at Bolinas on 5 Oct 1973, and the high non-census count was 32 at the Bolinas sewer ponds on 25 Sep 1982 (GWP, LES). On censuses the only verified fall records of adults were of single birds at Bolinas on 13 Jul 1971 and 25 Jul 1972 and at Abbott's on 17 Aug 1980. Non-census records of adults were of two birds at the Bolinas sewer ponds on 20 Jul 1983 (JGE) and at Abbott's on 24 Jul 1988 (ABN: LJP). Fall records for coastal northern California extend from 8 Jul to 4 Dec, but birds occur irregularly before mid-Aug (primarily adults) and after early Nov (ABN). The earliest record of a juvenile is for 13 Aug (ABN: RAE). Our only spring census records were of single birds at Bolinas from 23 to 28 Apr 1973 (AB 27: 815) and on 21 Apr 1976 (BSo). The only other Point Reyes spring records are of one bird at Bolinas Lagoon on 9 Apr 1976 (GWP), another there from 17 to 24 May 1980 (AB 34: 812), one to two birds from 17 to 21 Apr 1976 (DS et al.) at the Bolinas sewer ponds, and one at Lawson's Landing, Dillon Beach, from 15 to 17 Apr 1986 (ABN: RHa). Pectoral Sandpipers occur irregularly in spring on the northern California coast from 4 Apr to 3 Jun (ABN). They are found in salt marshes, on tidal flats, at sewage ponds, and around freshwater pond and lagoon margins, especially where muddy or grassy.

Dunlin (*Calidris alpina*)

A very rare summer visitant and an abundant fall transient and winter resident (Fig. 30). A few birds occurred irregularly from early Jun to early Sep (Fig. 30). Dunlins reach California at least two months later than most other species of shorebirds and, atypically for this group, adult and first-year Dunlins arrive simultaneously. At Bolinas and Limantour, numbers rose rapidly to peak in Nov, then declined gradually to mid-Apr, before dropping off sharply in late Apr (Fig. 30); Holmes (1966) recorded a similar pattern on San Francisco Bay. Spring migration, evident from our data only by a decline in numbers (Fig. 30), extends chiefly from Apr to early May (Jurek 1973). At Abbott's, Dunlins occurred primarily as fall migrants (Fig. 30), presumably because in winter sand flats there were flooded by runoff.

Seasonal occurrence patterns varied annually depending on rainfall (Fig. 31). Winter numbers at Bolinas were highest during the drought years of 1975–76 and 1976–77, lowest in the wet years of 1972–73, 1973–74, and 1981–82 (Figs. 2

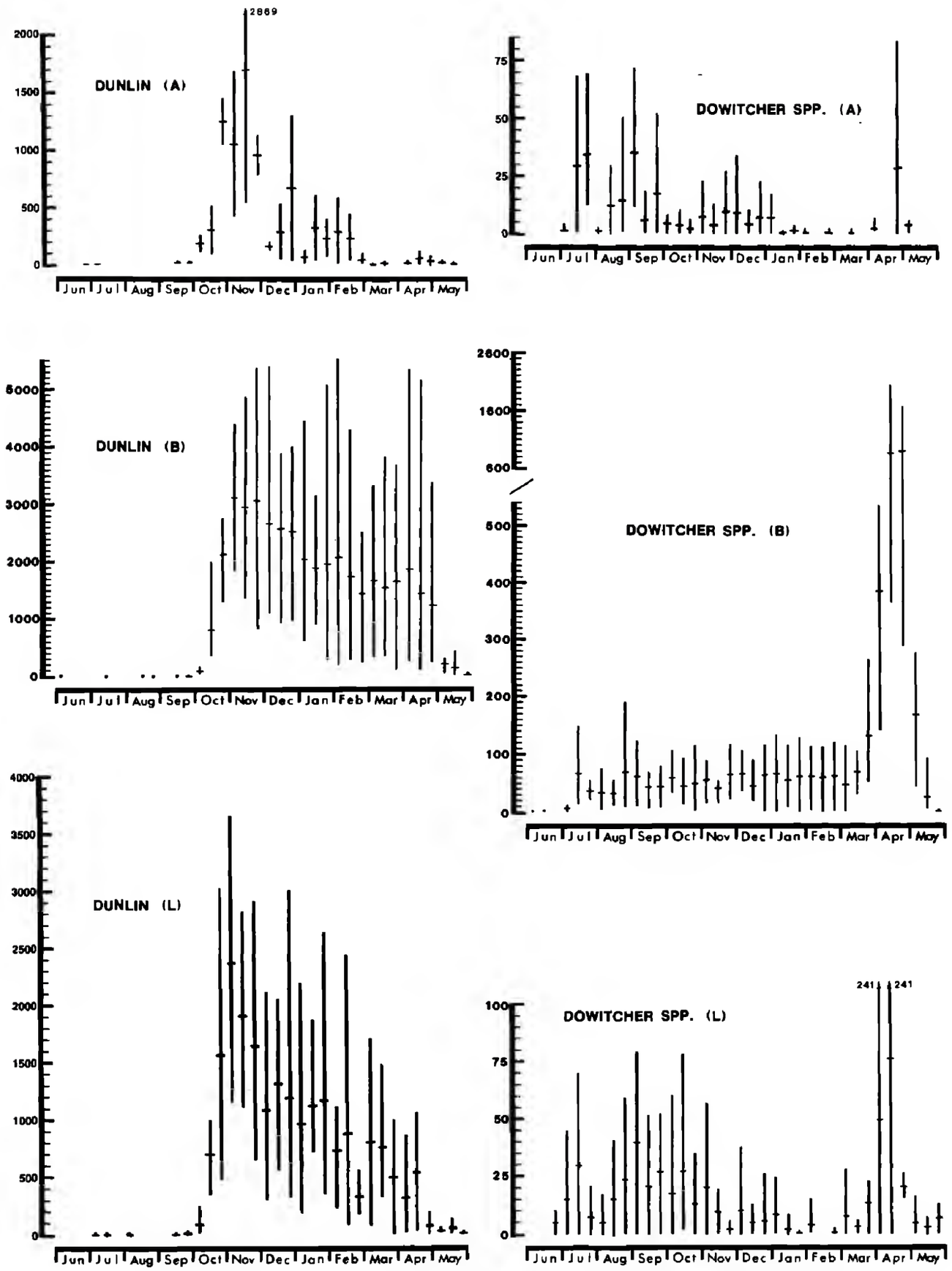


Figure 30. Seasonal abundance of the Dunlin and dowitchers in wetlands of Point Reyes. See Figure 4 for details.

and 14). In the drought years birds may have moved from freshwater habitats that dried up to tidal areas, and in wet years many may have remained in freshwater habitats. Part of the reason why numbers were high in the drought may have been that heavy rain in wet years, flooding mud flats, induced the birds to depart early, lowering the winter averages for wet winters. For example, in Jan 1973, when several days of heavy rains and very high tides inundated the tidal flats for most daylight hours, numbers at Bolinas fell sharply from about 1000 to 300 birds, and remained unusually low for the rest of the season (Fig. 31). The departure in Jan 1973 coincided with 29 cm of rain in 10 days, the highest total during our study for a 10-day period. Since this was also the only large drop in numbers during our study attributable to rainfall, it appears that Dunlins remain on the estuary except under extreme conditions. Dunlins feed on tidal flats, lagoon margins, freshwater and sewage pond margins, and, to a limited extent, on rocky reefs. At high tides they feed in rain-soaked pastures. At Bolinas, Dunlins, like Western Sandpipers, feed on somewhat sandier substrates than do Least Sandpipers (Page et al. 1979). Salt marshes are important nighttime roosts.

Curlew Sandpiper (*Calidris ferruginea*)

A very rare fall visitant from Asia with one census record of a juvenile at Bolinas Lagoon from 7 to 14 Sep 1974 (AB 29: 114, Luther et al. 1979). This is the only Point Reyes record and one of only 13 for California, 1971 to 1987: 12 in fall (adults and juveniles) from 4 Jul to 1 Nov and one in spring for 27 and 28 Apr 1974 (CBRC).

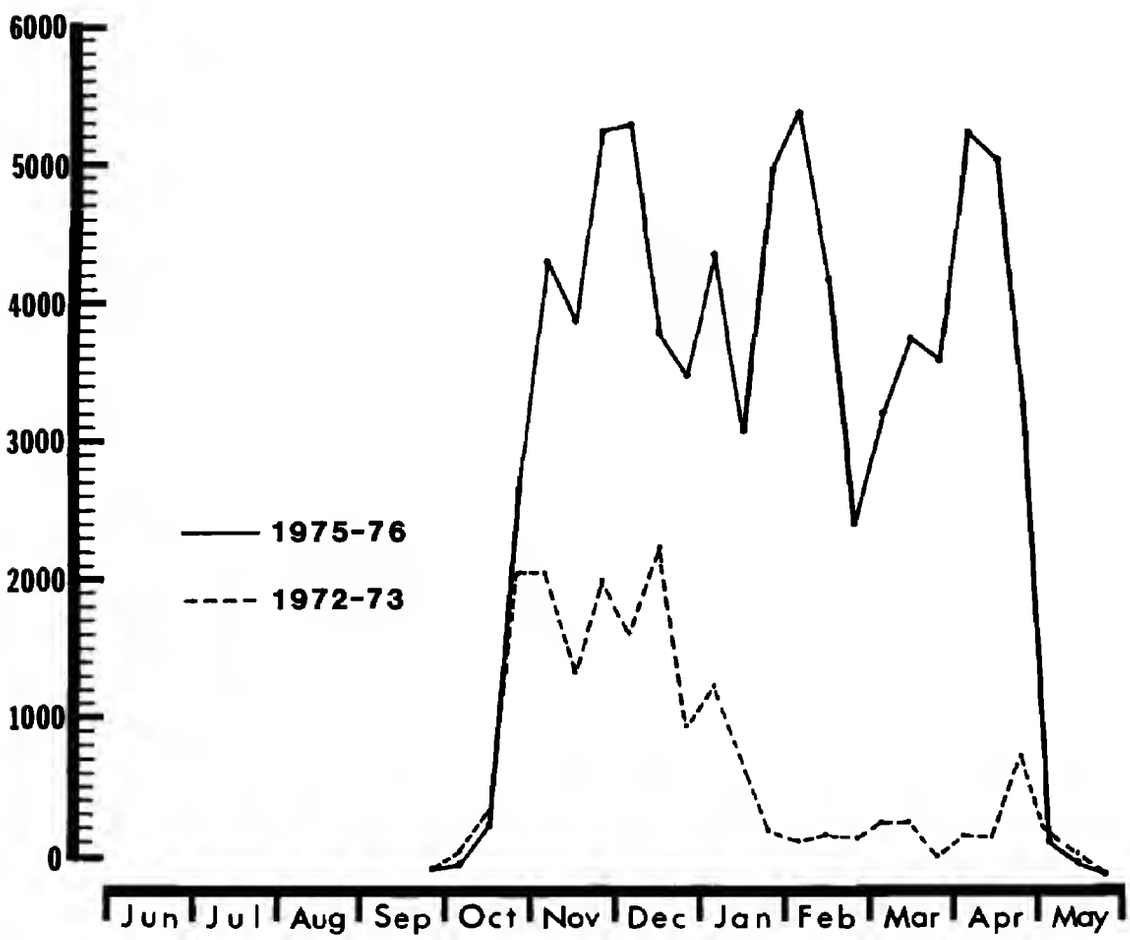


Figure 31. Mean number of Dunlins at Bolinas Lagoon in 1972–73 and 1975–76.

Stilt Sandpiper (*Calidris himantopus*)

A very rare fall visitant with one census record of an adult at Bolinas between 7 and 13 Jul 1971 (AB 25: 902, Page et al. 1979). Another adult was at Limantour from 19 to 20 Jul 1985 (ABN: SNGH). There are additional records for Point Reyes of about 10 individuals from 7 Aug to 22 Oct; birds identified to age were all juveniles (ABN). On the northern California coast, extreme dates for fall transients are 6 Jul and 8 Nov; most records are from mid-Aug to early Oct, the time of passage of juveniles, which begins at least by 17 Aug (ABN). In California, small numbers of Stilt Sandpipers winter and remain through the spring only at the south end of the Salton Sea (Garrett and Dunn 1981). Away from that locale there are only a handful of California records of spring migrants from mid-Apr to early Jun (Garrett and Dunn 1981, McCaskie et al. 1979). On Point Reyes Stilt Sandpipers use tidal flats, lagoon margins, freshwater ponds, and sewage ponds.

Ruff (*Philomachus pugnax*)

A very rare visitant with only one census record, of juvenile at Limantour from 14 to 22 Sep 1980 (AB 35: 221, Binford 1985). The three other substantiated Point Reyes records, all of single juveniles, are of one at Limantour from 30 Aug to Sep 1978 (AB: 33: 210, Luther et al. 1979); one at Abbott's from 25 to 30 Sep 1986 (ABN: DDK et al.), and another from 10 to 11 Oct 1986 (DAH, SP). Nothern California Ruff records, which have increased in frequency since 1974 (ABN), extend from 15 Jul to 6 May (four records for Jul one for May). Most occurrences are in Sep and Oct and represent migrating juveniles, which arrive as early as 23 Aug (ABN).

Dowitchers (*Limnodromus spp.*)

Since all Long-billed Dowitchers (*L. scolopaceus*) and Short-billed Dowitchers (*L. griseus*) were not identified to species on censuses, we have grouped them for analysis. As a whole, dowitchers were rare summer visitants, common fall transients and winter residents, and very common spring transients (Fig. 30). Non-census identifications provided a reasonably clear picture of seasonal occurrence for the two species. Dowitchers forage in estuaries, lagoons, and ponds. Long-billeds are found primarily in freshwater habitats, Short-billeds in more saline areas, although they occur also in fresh water during migration (Pitelka 1950). On Point Reyes, Long-billeds are most numerous at ponds and at freshwater inflows into estuaries. At Limantour and Bolinas, Long-billeds occur on muddier substrates than do Short-billeds (Lenna 1969, Page et al. 1979). Lenna (1969) reported that Long-billeds move to estuaries when muddy freshwater feeding areas are inundated by winter rains.

Short-billed Dowitchers were very rare visitants in the first two-thirds of Jun. Migration was apparent by late Jun with the movement of adults into the study area; Short-billeds outnumbered Long-billeds in fall. The earliest record of a juvenile Short-billed on Point Reyes is for 31 Jul (ABN: DAH), although juveniles may occur on the coast as early as 23 Jul (Pitelka 1950). On the central California coast, adults are greatly outnumbered by juveniles, whose peak passage is from mid-Aug to mid-Sep (Pitelka 1950, Lenna 1969, authors' unpubl. data). In contrast, on Humboldt Bay, Gerstenberg (1972) reported greatest movement and two peaks during the passage of adults and a smaller and later passage of juveniles. This corresponds with the sequence of fall passage in the East of adult females, then adult males, and finally juveniles (Jehl 1963). The peak of over 20,000 dowitchers, most adults, on Humboldt Bay suggests that adults largely by-pass the

Point Reyes area; in the East, Short-billeds appear to stage in certain areas and avoid others (Jehl 1963). Transients were seen regularly on Point Reyes through mid-Oct and sometimes lingered until late Nov, when winter population levels were reached.

Although Long-billeds generally outnumbered Short-billeds in winter in this area, the latter appear to be present annually, as indicated by the following records: Bolinas—five on 27 Dec 1975 and singles on 11 and 23 Jan 1976 (GWP,LES); Limantour—one or two on 2 Jan 1978 (DS); Bodega Harbor—up to eight throughout Jan and Feb 1978 (DS), and 6 and 13 on 19 and 21 Jan 1979 (DS), respectively; Drake's Estero—up to 10 during Jan and Feb 1981 (DS), and two on 25 Jan 1982 (DS); Tomales Bay—singles on 17 Dec 1977, 16 Dec 1978, and 21 Jan 1978 (DS). The low numbers and irregular occurrence in winter of Short-billeds at particular sites on Point Reyes may be a consequence of California's being at the north end of the species' winter range (Pitelka 1950). Spring migration began in mid-Mar (41 on 16 Mar 1976 at Bolinas), numbers peaked sharply from early to late Apr, and movement continued through May (Fig. 30). In contrast, others have reported two spring peaks, one in late Mar and another in late Apr (Lenna 1969, Gerstenberg 1972). Short-billeds vastly outnumber Long-billeds on the coast during spring migration.

Long-billed Dowitcher. The only Jun records were of single birds on Bolinas Lagoon on 9 Jun 1976 (PRBO), at the Bolinas sewer ponds on 12 Jun 1980 (DS), and on outer Point Reyes from 10 to 12 Jun 1988 (AB 42: 1337). Although adults normally appeared in mid-Jul (earliest 4 Jul), the main influx began with the arrival of numbers of juveniles in mid- to late Sep (Pitelka 1950, Lenna 1969, authors' unpubl. data). Our earliest date for a juvenile was 4 Sep (DS), which compares with 26 Aug in Oregon (Paulson 1983). The end of fall migration was ill defined, because of the substantial wintering population, but migration appeared to continue through mid-Oct, with stragglers trailing into Nov. Our highest winter census total was 158 birds at Bolinas on 6 Feb 1980. We suspect wintering birds in the Point Reyes area include both age classes but that immatures predominate, as Pitelka (1950) described for the coast in general; inland the opposite is true. In Jan 1973, numbers at Bolinas dropped dramatically from 100 to 0, when 29 cm of rain falling in a 10-day period and storm tides flooded foraging areas for extended periods, a pattern like that found by Gerstenberg (1972) at Humboldt Bay (see Dunlin account). No peak of spring migrants was detected in the Point Reyes area, but occasional sightings of small flocks of Long-billed Dowitchers in local non-wintering areas suggested that the spring migration period coincided with that of the Short-billed.

Common Snipe (*Gallinago gallinago*)

A fairly common winter resident with no obvious peaks of migration (Fig. 32). The span of dates of continuous occurrence in the Point Reyes area was 31 Aug to 11 May. Sightings of single birds at the Bolinas sewer ponds produced extreme dates of 28 Jul 1985 (AB 39: 958) and 24 May 1980 (AB 34: 812). For the northern California coast the early fall record on 16 Jul 1983 at Lake Earl, Del Norte Co. (ABN: RAE) is exceptional, as are Jul records in general. The delay until Oct in the arrival of snipes at Bolinas (Fig. 32) was due to the lack of freshwater habitat there before the winter rains. From 1972 to 1975, the four years with sufficiently frequent census data, snipes arrived in late Sep and their numbers built up by mid-Oct only in 1972 and 1973, when the rainy season began in Sep (Fig. 2). Arnold (1981) noted the importance of several heavy rains in fall before habitat becomes suitable for snipes. At Bolinas there was a sharp decline in winter numbers between the drought years of 1975–76 and 1976–77. Subsequently, snipes remained well below their pre-1975 abundance (Fig. 14).

At Bolinas snipes are restricted to a complex of vegetated brackish ponds in salt marsh, *Juncus*-covered swales, and water-soaked pastures on the Pine Gulch Creek delta. The paucity of similar habitat at the other censused wetlands explained why numbers were lower there than at Bolinas (Fig. 32). Snipes may concentrate locally elsewhere on Point Reyes, as 120 birds did near Olema Marsh

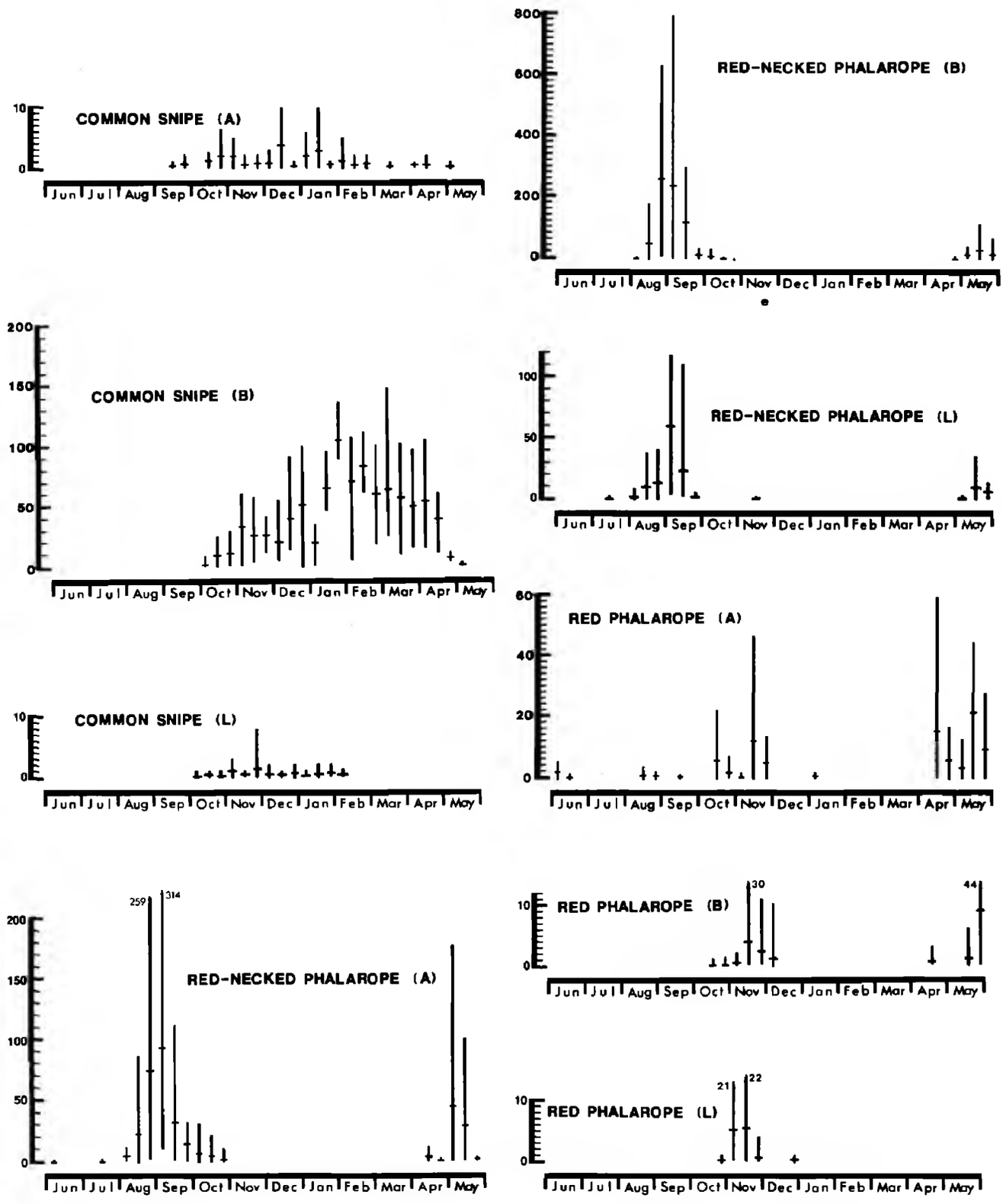


Figure 32. Seasonal abundance of the Common Snipe and phalaropes in wetlands of Point Reyes. See Figure 4 for details.

on 2 Dec 1983 (JGE). They were found roosting on dredge spoils when pastures nearby were flooded. Typically, snipes frequent the muddy edges of freshwater marshes and swales, wet fields with relatively tall vegetation, and, to a lesser extent, wet close-cropped pastures. Salt marshes are little used except in unusual circumstances, as described for Bolinas.

Wilson's Phalarope (*Phalaropus tricolor*)

A very rare fall transient with 26 birds on 15 censuses from 16 Jun to 15 Sep and a very rare spring transient with two birds on 22 May 1981 at Abbott's. There are four other Point Reyes records in spring from 3 May to 6 Jun (ABN); two records for 12 June, 1977 and 1988 (ABN), are hard to classify seasonally. The earliest record of a juvenile on Point Reyes is for 17 Jul 1988 at Abbott's (ABN: LJP). The greater adundance of fall migrants is consistent with the state-wide pattern (Jurek 1973, McCaskie et al. 1979, Garrett and Dunn 1981, Swarth et al. 1982). Fall passage in coastal California extends primarily from mid-Jun to mid-Sep (Fig. 12; Swarth et al. 1982, Jurek 1973, Garrett and Dunn 1981) with stragglers seen rarely through Oct; females precede adult males which are followed by juveniles (Jehl 1988). Since 1980 there have been two Jan to Feb coastal northern California records at salt ponds (AB 34: 303, Roberson 1985). Birds on spring migration pass primarily through the the Salton Sea and east of the Sierra Nevada and mostly avoid the coast. Spring passage extends primarily from mid-Apr to early Jun (Jurek 1973); the earliest northern California spring record is 3 Apr (AB 41: 484). In spring migration females apparently predominate early, males later (Oring and Davis 1966).

On Point Reyes, Wilson's Phalaropes frequent freshwater, sewage, and brackish ponds and occasionally tidal flats. They were formerly quite rare in the San Francisco Bay area (Grinnell and Wythe 1927) but, since the creation and expansion of salt-pond evaporators in south San Francisco Bay starting in the 1860s (Ver Planck 1951), their numbers in fall have increased dramatically. Now tens of thousands can be seen during the peak of migration in early Jul (Swarth et al. 1982, Jehl 1988). The species' status in the Point Reyes area appears to be similar to that in the Bay Area before the creation of salt ponds.

Red-necked Phalarope (*Phalaropus lobatus*)

A common fall and spring transient (Fig. 32). Although not recorded on our summer censuses, the species was an irregular visitant at that season; at the Horseshoe Pond 22 birds on 6 Jun 1981 dwindled to four or five birds that remained from mid-Jun through early Jul (DS). At Point Reyes wetlands, fall migration spanned early Aug to late Oct and peaked in late Aug and early Sep (Fig. 32); a similar pattern was recorded on Humboldt Bay (Gerstenberg 1972). Locally, stragglers have remained as late as 15 Dec 1979 at Tomales Bay (AB 34: 659). In contrast, the fall build-up in the interior at Mono Lake or at coastal salt ponds begins in late Jun or early Jul and peaks in late Aug (Winkler et al. 1977, Swarth et al. 1982, Roberson 1985, ABN). On neritic waters numbers build up at least by mid- to late Jul and peak in late Aug to mid-Sep (DeSante and Ainley 1980, Stallcup 1976, Briggs et al. 1987, ABN). From mid-Aug to mid-Sep 1971, 93% of all birds banded at Bolinas were juveniles (Page et al. 1979). In the same period in 1980 the percentage of juveniles in counts of 50–300 birds at Abbott's increased steadily from 69 to 98% (DS). At Mono Lake from Jul through Aug, adults outnumber juveniles, which have been banded as early as 3 Aug (Winkler et al. 1977); large numbers of Red-necked Phalaropes arriving in Jul on salt ponds in San Francisco Bay (Swarth et al. 1982) are presumably also adults. The pattern at favored sites reflects shorebirds' typical pattern in fall of adults preceding juveniles,

whereas the pattern on Point Reyes estuaries primarily reflects the passage of juveniles. Adult females precede males in fall migration (Orr et al. 1982). Fall numbers on coastal and neritic waters fluctuate markedly from year to year (Stallcup 1976, DeSante and Ainley 1980, Briggs et al. 1987, this study). Since 1974 healthy Red-neckeds have been found irregularly in Jan and Feb on salt ponds on the central California coast (ABN, Roberson 1985).

In spring, Red-necked Phalaropes migrate mainly over the inshore and offshore zones; only small numbers use estuaries, salt ponds, freshwater ponds, and sewage ponds (Fig. 32, Jurek 1973, Garrett and Dunn 1981, Swarth et al. 1982). Spring migrants occur primarily from mid-Apr to the end of May in all habitats; non-breeders may remain into Jun or Jul, when they blend with returning fall migrants. The spring peak in numbers is from late Apr to mid-May; Point Reyes' early date for a spring migrant is 3 Apr (GM); Monterey's is 24 Mar (Roberson 1985). Numbers of spring migrants over inshore waters of central California have peaked from 22 Apr to 19 May (ABN: BSa et al.). Red-neckeds on ocean waters generally occur closer to shore (within 50 km) than do Red Phalaropes (Wahl 1975, Briggs et al. 1984, 1987), and foraging birds of both species concentrate at surface convergences that concentrate zooplankton (Briggs et al. 1984). Migrants concentrate over the outermost shelf and upper continental slope (Briggs et al. 1987).

Red Phalarope (*Phalaropus fulicaria*)

A fairly common fall and spring transient (Fig. 32). In fall Red Phalaropes were found on the estuaries irregularly from mid-Aug to early Jan but mostly from mid-Oct to early Dec (Fig. 32); extreme (non-census) dates were 6 Aug and 31 Jan (ABN). This species' fall migration appears to be the most prolonged of any of our shorebirds. Offshore the Red Phalarope usually occurs from at least mid-Jul to early Jan and the timing of peak numbers in the Farallones–Point Reyes area varies annually between late Aug and late Nov (DeSante and Ainley 1980). Overall, peak numbers in northern California are from Jul through Oct and for central California are in Oct or Nov (Briggs et al. 1987). In some years the species remains numerous into Feb, with stragglers "wintering" from late Feb through Mar (Briggs et al. 1987). In fall, females precede males, which are followed by juveniles (Connors et al. 1979, Orr et al. 1982).

The species' occurrence on estuaries was irregular both within and between years because Red Phalaropes generally do not stray from their principal migration route over offshore or oceanic waters. During our censuses, influxes to the estuaries—up to 20–60 birds per day—occurred only in Nov in 1973, 1976, and 1979. On 21 Nov 1976 an estimated 10,000 individuals were on Tomales Bay following a severe storm (AB 31: 218). Not all fall influxes coincided with storms but all involved some emaciated adults and juveniles that were readily killed by raptors and scavengers (unpubl. data).

We had census records of spring migrants from mid-Apr to early Jun (Fig. 32) and non-census records from 16 Apr to 17 Jun (ABN). In northern California, Red Phalaropes sometimes arrive by early Apr, and stragglers may linger into Jul (ABN). We recorded true spring influxes of about 10–60 birds on censuses only in 1975, 1979, and 1982. A non-census estimate of 4000 to 8000 birds on Bodega Harbor on 25 May 1980 was by far the largest spring influx recorded (Connors and Smith 1982). In spring, influxes usually followed several days of strong onshore winds, and survival of birds appeared to be much better than during fall influxes. Strong onshore winds appear to be a necessary but not sufficient cause of onshore influxes of Red Phalaropes, as onshore winds typically blow for extended periods in spring. Perhaps when ocean food supplies are poor, birds

are weakened and more susceptible to wind drift, or they are forced to seek food away from the open ocean. Although small numbers of Red Phalaropes migrate over inshore waters of central California in spring (peak dates of migration range from 6 to 18 May, ABN: BSa et al.), most birds pass farther offshore than Red-necked Phalaropes (Wahl 1975, Briggs et al. 1984, 1987). Most Red Phalaropes concentrate over the central continental slope (10–75 km offshore, average 35 km), but some birds range to at least 195 km off Point Reyes (Briggs et al. 1984). In winter birds occupy waters mostly seaward of the continental shelf (Briggs et al. 1987). Ocean-foraging birds frequent zooplankton concentrations at surface water convergences where strong thermal gradients border upwelling waters (Briggs et al. 1984). Onshore they forage on the water's surface or along the shorelines of estuaries, lagoons, freshwater ponds, and sewage ponds, and occasionally on sandy beaches.

Parasitic Jaeger (*Stercorarius parasiticus*)

A very rare fall transient with about 20 birds on 17 censuses from 31 Aug to 14 Dec, mainly in Sep. Most sightings were at Bolinas, where the jaegers were frequently observed pirating food from Elegant Terns, which are numerous there. The occurrence of Parasitic Jaegers in the study area (Fig. 12) coincided with the fall passage in California, which extends from late Jul to late Dec and peaks in late Sep (Stallcup 1976, McCaskie et al. 1979, Garrett and Dunn 1981, Roberson 1985). Parasitic Jaegers are found in small numbers in ocean waters off California in winter, in greater numbers in spring, and irregularly in summer (McCaskie et al. 1979, Garrett and Dunn 1981). They are not recorded on the estuaries at these seasons. The species is found in neritic waters out to 75 km, but mostly within 15 km of land (Briggs et al. 1987), and in estuaries with concentrations of terns and gulls from which they pirate food.

Franklin's Gull (*Larus pipixcan*)

A very rare visitant with one census record of an adult at Abbott's on 23 Jun 1976 (AB 30: 399). Non-census records are of single birds at Abbott's from 18 to 25 Aug 1966 (AFN 21: 74, PRBO) and at Hog Island, Tomales Bay, on 13 Aug 1989 (DS, JPK). Franklin's Gulls occur irregularly on the northern California coast primarily in fall from mid-Aug to mid-Nov and secondarily in spring from mid-Apr to late Jun (ABN). They occur casually at other times of year.

Bonaparte's Gull (*Larus philadelphia*)

A rare summer visitant, an abundant fall migrant, an uncommon winter resident, and a very common spring migrant (Fig. 33). Small numbers occurred irregularly in summer and usually dwindled through the season. Fall migration extended primarily from mid-Oct through late Dec, peaking from mid- to late Nov. Over neritic waters numbers rise in Sep and Oct and peak in late Oct and Nov (Briggs et al. 1987). Our highest estuarine counts of migrants were after strong southwest winds from 22 to 28 Nov 1974 with 11,600 birds at Bolinas and 45,000 at Limantour. Bolinas was the only censused wetland where Bonaparte's Gulls remained through the winter. Spring migration extends from late Mar to early Jun and peaks from mid-Apr to mid-May (Fig. 33, ABN). Over inshore waters of central California, peak dates of migration usually range from 21 to 24 Apr, but strong movement exceptionally can start by 31 Mar (ABN: BSa et al.). Immatures predominate at the end of spring movement. Off California, Bonaparte's Gulls migrate over the continental shelf but mostly within 40 km of land (Briggs et al. 1987). Estuarine numbers were quite variable during migration

as birds veer from their over-ocean migration path at irregular intervals during inclement weather to seek refuge or feed in the estuaries. At any season Bonaparte's Gulls may be found in bays, estuaries, lagoons, and a variety of fresh-water habitats, especially sewage ponds.

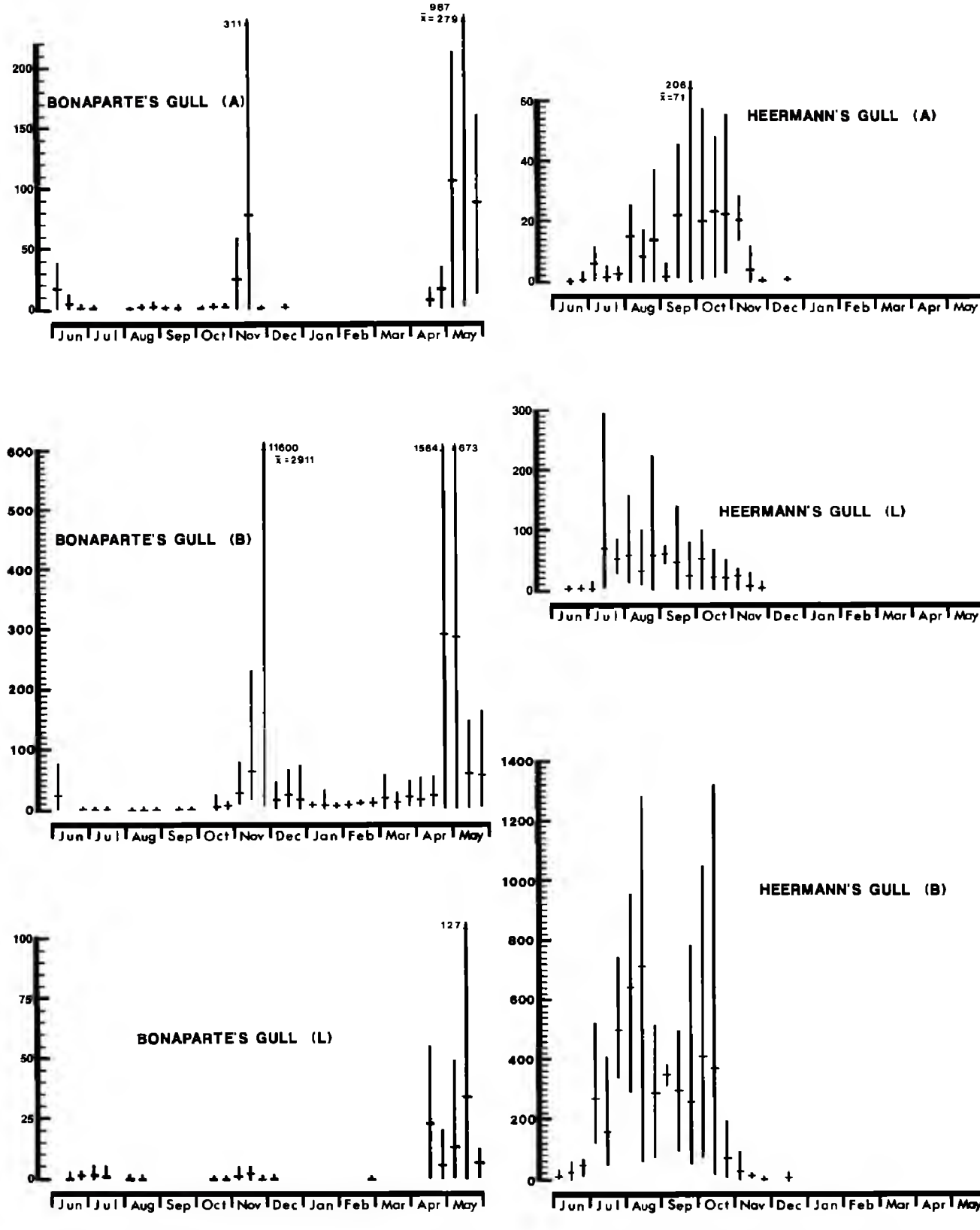


Figure 33. Seasonal abundance of Bonaparte's and Heermann's gulls in wetlands of Point Reyes. See Figure 4 for details.

Heermann's Gull (*Larus heermanni*)

A very common summer to early winter dispersant (Fig. 33). Although our earliest local non-census record was for 24 May, in central California northward spring movement may begin (very rarely) as early as late Apr (ABN); the increase in numbers occurs progressively later to the north (Briggs et al. 1987). Our earliest estuarine census record of 10 birds at Bolinas on 29 May 1973 coincided with a very early build-up of Heermann's Gulls and Brown Pelicans along the northern California coast (AB 27: 914) following a breeding failure in the Gulf of California attributed to anomalously warm water (Anderson and Anderson 1976, D. W. Anderson pers. comm.). In most years Heermann's Gulls did not begin arriving until mid-Jun, with the first major influx occurring in early Jul (Fig. 33). During anchovy runs in late Aug and Sep of 1984 and 1985 from 2000 to 6000 Heermann's Gulls concentrated in Bolinas Lagoon for short periods. Similar peaks were not apparent at Limantour and Abbott's, which are much less used by this species than Bolinas. Numbers remained high on the wetlands until late Oct, and only stragglers were left by Dec (Fig. 33). Although in some years a few birds remain throughout the winter along the Point Reyes–Bodega coast (ABN), the only ones recorded during our study were up to 10 immatures at Bodega Harbor throughout the late winter and spring of 1980 (DS et al.). Occurrence patterns vary along the California coast, with greater winter numbers and earlier spring influxes from Monterey south (Roberson 1985, Garrett and Dunn 1981).

The pattern and timing of post-"breeding" dispersal of Heermann's Gulls are linked to water temperatures as they affect food supply (D. W. Anderson pers. comm.; see also Brown Pelican). Since breeding Heermann's Gulls arrive at nesting islands in the Gulf of California in late Mar and begin laying in early Apr (Bent 1921), the Oct–Nov departure from northern California appears to be a response to a seasonal dwindling of food supplies and, perhaps more so, to stormy weather (D. W. Anderson pers. comm.), rather than migration directly to the breeding grounds.

Heermann's Gulls feed in inshore and offshore waters, estuaries, and lagoons and sometimes bathe in freshwater ponds along the coast. Because they are kleptoparasites on Brown Pelicans, the two species are very closely associated in the post-breeding season. Grinnell and Miller (1944) noted a decline in Heermann's Gulls' abundance between 1915 and 1930 with a recovery by 1943. Although Heermann's Gulls suffered the effects of DDT accumulation, disturbance, and egging in the late 1960s and early 1970s, their populations did not decline as did those of the Brown Pelican (D. W. Anderson pers. comm.).

Mew Gull (*Larus canus*)

An abundant winter resident (Fig. 34) with census records extending from 5 Oct to 5 May and non-census records extending from 3 Oct to 18 May. Although not recorded in summer on Point Reyes, the Mew Gull occurs casually along the northern California coast then (ABN). Fall migration over the inshore zone extends from early or mid-Oct until at least late Nov (DS pers. obs.). Our wetland data (Fig. 34) suggest that most Mew Gulls were transients in the area, a pattern similar to that of the California Gull (Fig. 34). The Mew Gull graphs for Bolinas and Limantour indicate a fall peak from Nov to mid-Jan, a mid-winter low between late Jan and early Feb, and a spring peak from mid-Feb to mid-Mar. In spring migration adults precede sub-adults, which predominate at the tail end of migration. Mew Gulls are found primarily on estuaries, lagoons, beaches, and inshore waters. Inshore they are often associated with windrows or tidal "rips" close to the shoreline (Briggs et al. 1987); they are casual offshore (Wahl 1975). They also forage in wet pastures after heavy rain and in freshly plowed fields within a few

kilometers of the coast. Mew Gulls are only rarely seen at refuse sites (Cogswell 1974).

Ring-billed Gull (*Larus delawarensis*)

A fairly common summer resident, a very common fall transient, and a common winter resident (Fig. 34). Summering birds were virtually all sub-adults. Our fall peak from Jul to Oct (Fig. 34) reflected the movement of inland breeders to the central California coast and their subsequent departure for wintering grounds in southern California and western Mexico (Vermeer 1970). Juveniles arrive on the northern California coast as early as 16 Jul (AB 37: 1024). The lack of a pronounced spring peak (Fig. 34) was consistent with the evidence that spring migration is primarily through the interior (Vermeer 1970). Conover (1983) reported an approximately 22-fold increase in the breeding population of the western U.S. in the last 50 years, which also implies a large increase in the West Coast's migrant and wintering populations. On the coast Ring-billed Gulls feed on protected estuaries, lagoons, bays, beaches, freshwater ponds, plowed fields, pastures, playgrounds, and dumps. They are casual offshore (Wahl 1975), rarely occurring more than 1 km from shore (Briggs et al. 1987).

California Gull (*Larus californicus*)

A fairly common summer resident, a very common fall dispersant, and a very common winter resident (Fig. 35). Virtually all birds summering on the Point Reyes wetlands were sub-adults. After breeding mostly at interior sites, California Gulls travel to the Pacific Coast and fan out to both the north and south (Woodbury and Knight 1951), though dispersal at this time is predominantly northward (V. M. Norris and D. W. Winkler unpubl. data). Adults and juveniles begin arriving on the northern California coast in mid-Jul, increasing numbers on the Point Reyes wetlands (Fig. 35). The earliest date for a juvenile, away from the recently established San Francisco Bay breeding colony (Jones 1986), is 9 Jul 1981 (ABN: RAE), though dates of 20–25 Jul are more typical (ABN). Numbers on the Point Reyes wetlands rose sharply in late Sep and peaked from Oct until mid-Jan, when they dropped to mid-winter lows (Fig. 35).

Cogswell (1974) and Johnston (1956) attributed a similar mid-Jan drop in numbers at San Francisco Bay trash dumps to competition for food between California Gulls and larger gulls, which arrive later at the dumps. However, surveys of coastal gulls by L. B. Spear (pers. comm.) show that in Oregon numbers peak in Oct then drop sharply to winter lows by Dec, that in northern California numbers peak in Oct but decline more gradually to winter lows by Jan, that in central California numbers peak in Nov then fall gradually to lows in Feb and Mar, and that in southern California numbers peak in Dec and fall to lows by May. These observations suggest that California Gulls drift south during late fall and early winter, a pattern also noted for gulls on ocean waters off California by Briggs et al. (1987). V. M. Norris and D. W. Winkler (unpubl. data) studied this phenomenon by analyzing band recoveries. Their data indicate an initial concentration of both adults and juveniles to the north off Washington and a progressive shift of the population south from Aug through Feb (peak movement in Oct and Nov), with sub-adults generally moving farthest south.

Since California Gulls initially shift north on the coast and later retreat south at roughly the same time that Brown Pelicans, Heermann's Gulls, and Elegant Terns do (see accounts), all these species appear to be responding to changes in ocean productivity stimulated by the upwelling that occurs progressively later to the north on the coast in spring and summer and declines in late summer and fall (see habitat preferences below and Results and Discussion). The southward shift to

exploit these seasonal changes in food supply may have kept California Gulls from competing with larger gulls as the former shift their range south of the latter's during a period of diminishing food supplies. Very large numbers of California Gulls "winter" in the Gulf of California and along the Baja California coast, and they may respond to southern oceanic conditions somewhat as Brown Pelicans and Heermann's Gulls do (D. W. Anderson pers. comm.).

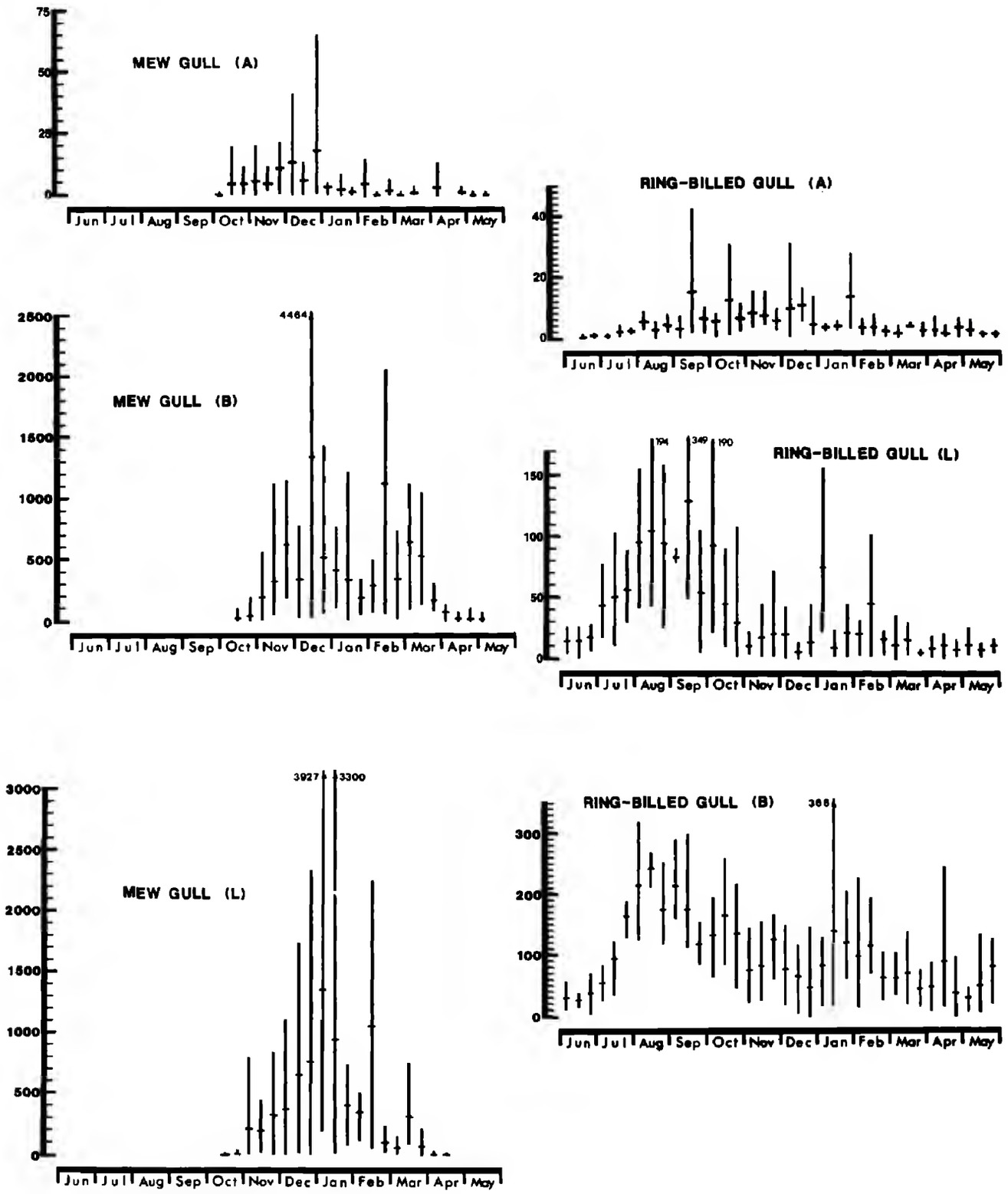


Figure 34. Seasonal abundance of the Mew and Ring-billed gulls in wetlands of Point Reyes. See Figure 4 for details.

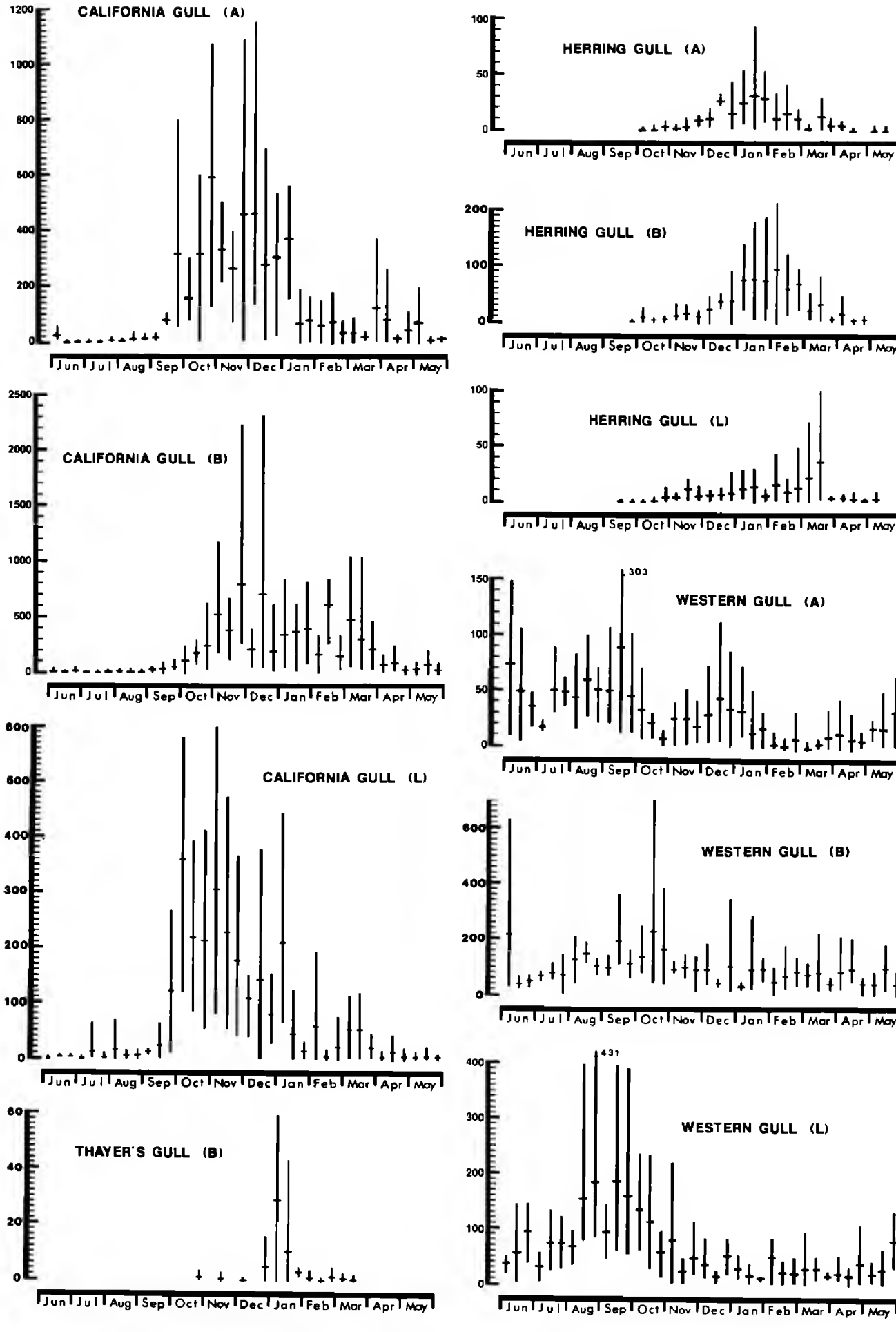


Figure 35. Seasonal abundance of some large gulls in wetlands of Point Reyes. See Figure 4 for details.

Since in spring there are only small peaks of migrants between Mar to May at coastal sites (Fig. 35, Cogswell 1974, L. B. Spear pers. comm.), most adults must migrate directly overland to interior breeding sites. Most sub-adults remain on the coast and shift progressively north (V. M. Norris and D. W. Winkler unpubl. data). On Point Reyes sub-adults make up the bulk of the California Gulls by early May and they can be seen moving north at least through late May (DS) when low summer numbers are reached. Sub-adults continue moving north throughout the summer (V. M. Norris and D. W. Winkler unpubl. data), but the low summer numbers on Point Reyes (Fig. 35) suggest that the magnitude of movement then is small. The northward shift of sub-adults in spring again puts them in a region with increasing food supplies.

Conover (1983) reported that the nesting population of the western U. S. has more than doubled in the last 50 years, implying also a large increase in the coastal population. California Gulls feed in estuaries, lagoons, and inshore and offshore waters. Off Point Reyes they range as far seaward as the central continental slope (Briggs et al. 1987). Offshore they may outnumber all other species of gulls in the fall, with immatures being particularly common in this zone (Wahl 1975). Non-marine foraging habitats include freshwater ponds and marshes, plowed fields, pastures, playing fields, parking lots, and dumps.

Herring Gull (*Larus argentatus*)

A common winter resident (Fig. 35). The only local (non-census) summer records were of one bird at Limantour on 4 Jul 1965 (RS), a third-year bird at Limantour on 5 Aug 1977 (AB 32: 353), and a first-year bird at Dillon Beach on 3 Jun 1982 (DS); the Herring Gull occurs casually on the northern California coast in summer (ABN, McCaskie et al. 1979). At Bolinas and Abbott's numbers increased from late Sep through Dec, peaked in Jan and Feb, and declined in Mar and Apr. High Mar numbers at Limantour may reflect a pulse of migrants (Fig. 35). On inshore waters off California numbers peak from Dec to Feb (Briggs et al. 1987). At the Farallones there appears to be a minor fall peak in late Oct, pronounced peaks in late Nov and late Dec, and a sharp spring peak in late Mar, and a minor peak late Apr (DeSante and Ainley 1980). Garrett and Dunn (1981) reported that Herring Gulls move north in Mar and Apr in coastal southern California. On the coast Herring Gulls frequent estuaries, lagoons, inshore and offshore waters, garbage dumps, and, less commonly, freshwater habitats. At sea Herring Gulls concentrate in neritic waters, but appreciable numbers also occupy waters over the continental slope (Briggs et al. 1987) and open ocean (Sanger 1970, 1973, Harrington 1975, Wahl 1975).

Thayer's Gull (*Larus thayeri*)

An uncommon winter resident (Fig. 35). Thayer's Gulls were seen on censuses from 24 Oct to 18 Mar with most birds occurring from late Dec to early Feb. Extreme non-census dates for the study area are 13 Oct (JGE) and 9 Apr (GWP), except for an immature at Bolinas from 5 to 11 Aug 1986 (AB 41: 139). On the northern California coast birds may occasionally arrive by late Sep (McCaskie et al. 1979), linger into May, and are casual in summer (ABN). Our highest census counts were at Bolinas, with 60 birds on 2 Jan 1975, 44 on 11 Jan 1977, and 54 on 8 Jan 1980. A large (non-census) count was of over 300 Thayer's Gulls in Tomales Bay from 10 to 13 Jan 1985 (AB 39: 206); birds there were apparently concentrated around spawning Pacific Herring. Thayer's Gulls frequent dumps, estuaries, beaches, and inshore and offshore waters. The highest concentrations in the San Francisco Bay area usually are at dumps, but, like Herring Gulls, Thayer's are abundant only in the absence of Western Gulls (Winter and Erickson

1977). Sources differ on whether Thayer's are common or only casual offshore (Sanger 1973, Wahl 1975, Winter and Erickson 1977).

Western Gull (*Larus occidentalis*)

A year-round resident, very common in fall and common in winter, spring, and summer (Fig. 35). Although Western Gulls are not long-distance migrants, their seasonal dispersals (Coulter 1975, Spear 1988) are reflected by changes in numbers in the estuaries. They breed regularly along the coast in the study area and on the nearby Farallon Islands, where about 60% of the total California breeding population is located (Sowls et al. 1980). Numbers on Point Reyes wetlands peaked from Aug to Oct (Fig. 35), when numbers are highest along all of the California coast, after post-breeding movement from the Farallones (Spear 1988). Spear (1988) found that in late summer and fall most immatures move north from the Farallones as far as Washington, then south of the Farallones for the winter. In years of poor upwelling and consequently poor ocean food supplies, many immatures go south without first going north. Each spring immatures go north again until their third year, when they move close to the Farallones. Individual adults disperse each year to the same location where they remain during the few months they do not occupy territories on the Farallones. Western Gull numbers on the wetlands were lowest from Nov to Apr (Fig. 35) when immatures had dispersed to the south and adults had reoccupied territories on the Farallones; numbers rose slightly in May and Jun (Fig. 35), perhaps because of a later northward movement of sub-adults when upwelling intensified, increasing ocean food supplies. The Western Gull is a marine species preferring estuaries, lagoons, tidal reefs, beaches, and neritic waters. Although most birds stay within 50 km of land, a few range up to 95 km from shore (Sanger 1973, Harrington 1975, Briggs et al. 1987). Western Gulls regularly travel a few kilometers inland to drink and bathe at lakes and reservoirs and feed at dumps. See Spear (1988) for age- and sex-related habitat preferences.

Western Gull numbers at the Farallones reached a plateau in 1959 after rebounding rapidly from low population levels early in the century caused by human disturbance (Ainley and Lewis 1974). Presently, the California population may be at an all-time high because garbage and fish offal produced by an expanding human population have increased the gulls' food resources and consequently their survival rate (especially of juveniles and sub-adults) in winter (Ainley and Lewis 1974, Sowls et al. 1980, Spear et al. 1987). The recent closing of many San Francisco Bay area dumps may reverse this trend.

Glaucous-winged Gull (*Larus glaucescens*)

An uncommon summer resident and a common winter resident (Fig. 36). Virtually all oversummering birds in the Point Reyes area were immatures. Although first-year birds may reach the northern California coast by 14 Sep (ABN: RAE, GSL), substantial influxes of birds to Point Reyes began in Oct (Fig. 36). At the Farallones, in fall there is a peak in late Nov and in spring in late Mar (DeSante and Ainley 1980), just before numbers at two census sites on Point Reyes declined (Fig. 36). Glaucous-winged Gulls prefer estuaries, lagoons, beaches, tidal reefs, neritic waters, and especially garbage dumps. They are also seen in moderate numbers in pelagic waters, with immatures tending to occur farther from shore than adults (Sanger 1973, Harrington 1975, Briggs et al. 1987). Interbreeding between this species and the Western Gull has been documented in the area of sympatry from southern British Columbia to Oregon (Scott 1971, Hoffman et al. 1978). Birds exhibiting characters intermediate between these two species were seen regularly in small numbers on our censuses.

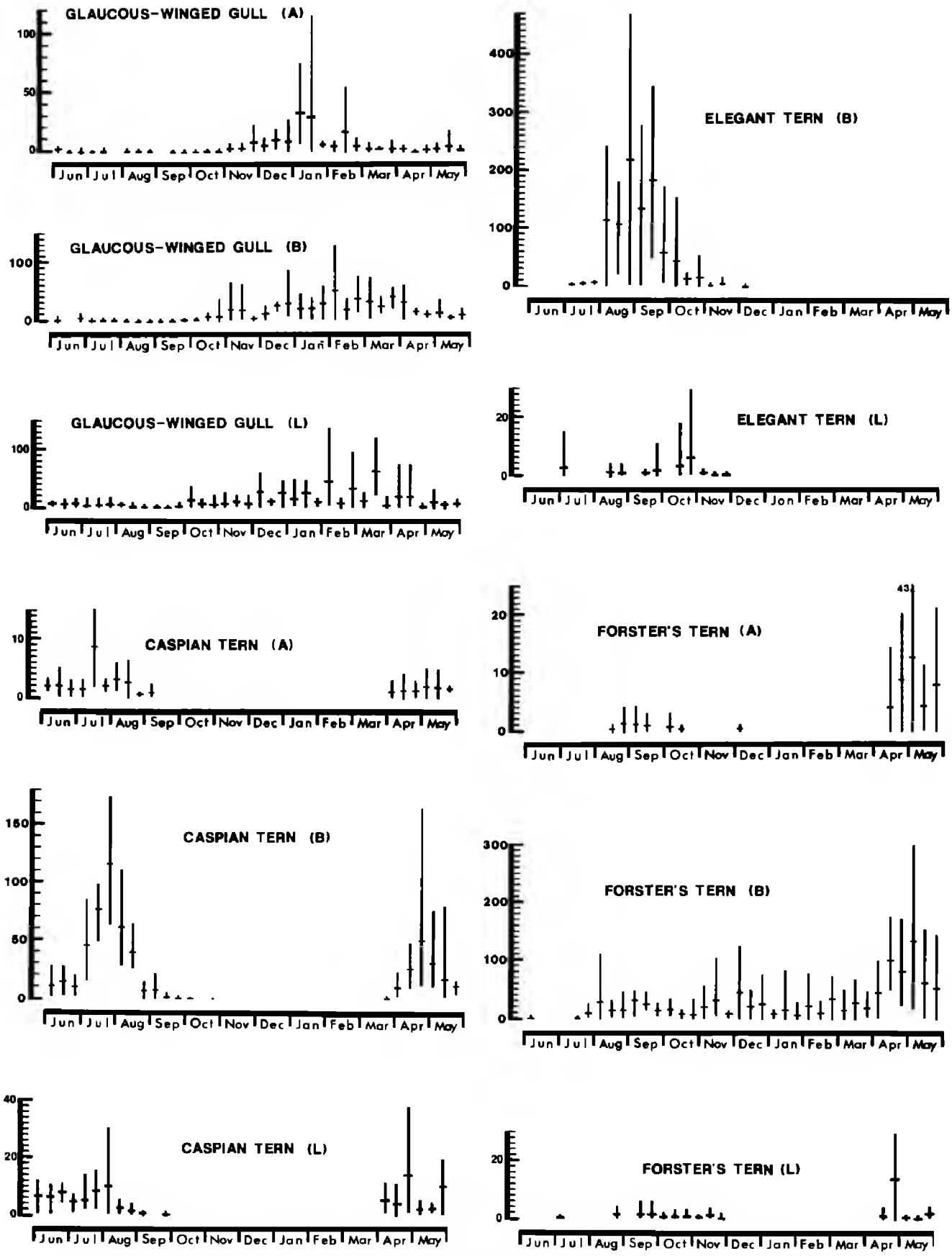


Figure 36. Seasonal abundance of the Glaucous-winged Gull and some terns in wetlands of Point Reyes. See Figure 4 for details.

Glaucous Gull (*Larus hyperboreus*)

A very rare visitant with one census record of one bird at Abbott's on 6 Dec 1975 (DS, JGE). Glaucous Gulls are now reported almost annually from Point Reyes waters on dates spanning 20 Oct to 21 May (ABN); the only adult was at Tomales Bay on 12 Dec 1976 (AB 31: 369). This species is rare the length of the California coast from late Nov to early Apr and is irregular from mid-Sep to late Nov and from early Apr to late May; stragglers have been recorded as late as 21 Jun (AB 39: 958). Almost all records are of immatures, and most of these are first-winter birds (Devillers et al. 1971, McCaskie et al. 1979, Garrett and Dunn 1981). Glaucous Gulls are found at dumps, estuaries, and occasionally well "offshore" (Harrington 1975, ABN).

Black-legged Kittiwake (*Rissa tridactyla*)

A very rare wetland winter visitant with census records of 26 birds on 14 dates from 17 Oct to 29 Jun and scattered non-census records in all months except Aug. Kittiwakes are pelagic birds that associate with the cold landward side of productive waters of the transition zone between warm subtropical and cold subarctic waters found well "offshore" of central California (Ainley 1976b); they may occur in similar densities over shelf, slope, or oceanic waters (Briggs et al. 1987). They typically show up in coastal wetlands only when unusually warm ocean surface temperatures cause them to move to shore (Ainley 1976b). Black-legged Kittiwakes inhabit the open ocean off California primarily from Sep to May and are most numerous from Dec to Mar (Ainley 1976a, Stallcup 1976, McCaskie et al. 1979, Garrett and Dunn 1981, Briggs et al. 1987). After flight years they also occur from Jun to Aug, although numbers dwindle through this period. Our only May to Jun records were for 1976 and followed an exceptional influx that left the highest numbers of kittiwakes to date in late spring and summer on the coast of northern (AB 30: 999, ABN) and southern California (Garrett and Dunn 1981).

Kittiwake numbers in California waters vary greatly from year to year and are highest in years with winter ocean surface temperatures at or below normal (Ainley 1976a); numbers are much lower in El Niño years (Briggs et al. 1987). The timing of peak winter abundance each year also varies greatly with seasonal variation in water temperature (Ainley 1976a,b). The timing of northward movement also varies markedly, as indicated by spring censuses of migrants over the inshore zone of central California, where from 1977 to 1979 numbers peaked from 5 to 24 Mar but in 1976 they peaked on 15 May (ABN: BSa et al.). In 1976 very large numbers of kittiwakes occurred far off California in mid-winter when ocean temperatures were below normal, but apparently unusually warm waters from mid-Feb to mid-Mar forced birds close to shore and precipitated a large die-off. This was followed by large numbers of kittiwakes lingering into spring and summer after water temperatures again fell below normal (Ainley 1976b). Kittiwakes undertake a leisurely long-distance dispersal from the breeding grounds rather than a true migration (Coulson 1966, Ainley 1976a). In 1976 and 1977, during spring movement over the inshore zone of central California, immatures were three times as common as adults (ABN: BSa et al.); although adults and immatures are equally represented in oceanic waters in winter, immatures predominate close to shore (Harrington 1975).

Caspian Tern (*Sterna caspia*)

A fairly common summer visitant, a common fall transient, and a fairly common spring transient (Fig. 36), with census records from 22 Mar to 26 Oct and non-census records from 16 Mar to 14 Nov (ABN). Before the 1980s

Caspian Terns were casual on the northern California coast between late Oct and mid-Mar (ABN). In 1981 arrival averaged about two weeks early at most locations, with the earliest bird noted on 19 Feb (AB 35: 332), and during the winters of 1985–86 through 1987–88 there were sightings of unprecedented numbers of birds (3–10 per year) from Dec to Feb (AB 40: 326, 41: 324, 42: 316).

The few birds oversummering in the study area may be prebreeders (Ludwig 1965, Gill and Mewaldt 1983) or perhaps breeders on long-distance feeding trips, since Bolinas is within the 60-km foraging range of adults (Gill 1976) from the nearest breeding colony on San Francisco Bay in Napa Co. (Gill 1977). Breeding there likely extends from early Apr to Sep, with the first young fledging in late Jun (Gill 1972b, 1977, Ludwig 1965). The early Jul increase in numbers on Point Reyes (Fig. 36) may have been the result of adults and young arriving from nearby breeding colonies, given the timing of breeding and our frequent observation of adults feeding fledged young; our earliest record of a juvenile was for 2 Jul 1980 (DS). After fledging, hatching-year birds disperse primarily to the north (Gill and Mewaldt 1983). Spring migrants pause on the estuaries mostly in Apr and May (Fig. 36). A high spring count was 250 at Bolinas on 26 Apr 1989 (KH). Peak dates of spring migration over inshore waters of the central California coast range from 12 to 29 Apr (ABN: BSa et al.).

Grinnell and Miller (1944) noted a slow recovery in numbers since the era of the feather trade prior to 1900. Since the beginning of this century the Pacific population has shifted from nesting in numerous small colonies in inland freshwater marshes to nesting primarily in large colonies in human-created habitats along the coast (Gill and Mewaldt 1983). Since 1960 the Pacific nesting population has increased by over 70%, and the San Francisco Bay population has increased by about 27% (Gill and Mewaldt 1983). However, our 1973 to 1982 censuses indicated no marked change in the spring population at Bolinas. Caspian Terns at San Diego Bay appear to be suffering from impaired reproductive success due to DDE accumulated from their prey (Ohlendorf et al. 1985). Caspian Terns use estuaries, lagoons, and the immediate inshore zone, as well as freshwater ponds, streams, reservoirs, and marshes. They forage in the shallow water over mudflats but more frequently in tidal channels (Baltz et al. 1979).

Elegant Tern (*Sterna elegans*)

A common summer and fall dispersant from 24 Jun to 4 Dec with highest numbers from Aug to early Oct (Fig. 36). Exceptional non-census records are of four birds at Bolinas on 26 Apr 1989 (ABN: KH) and one at Tomales Bay on 14 Dec 1983 (AB 38: 353). A count of 135 birds at Bolinas on 24 Jun 1986 (RMS) was high because only small numbers usually arrive before the main influx in early Aug (Fig. 36). Elegant Terns dispersing north typically reach southern California, north of the Gulf of California and San Diego breeding colonies, by late Jun and become common in Jul (Garrett and Dunn 1981). They generally arrive progressively later with increasing latitude (ABN). Birds have tended to arrive earlier in the season since about 1977 (Garrett and Dunn 1981, Roberson 1985), paralleling a northward expansion along the coast of the limits of regular post-breeding dispersal and an increase in late winter and early spring sightings since the late 1970s (Cogswell 1977, McCaskie et al. 1979, Morlan and Erickson 1988). Elegant Terns have now been seen on the northern California coast in every month of the year, and small numbers have been seen in Apr and May since 1985 (ABN). These spring birds may be prospecting for new nesting grounds, as they usually remain for short periods, Apr and May are too early for post-breeding dispersal, and the breeding range in southern California continues to expand (AB 41: 1488).

Elegant Terns breeding at San Diego are highly dependent on Northern Anchovies for feeding chicks (Schaffner 1986), and movements of Elegant Terns in California are probably closely related at all times to movements of Northern Anchovies (F. C. Schaffner pers. comm.). Although overall occurrence in northern California is similar to that at Point Reyes (Fig. 36), the timing of arrival in the region is variable and somewhat earlier to the south in the Monterey area (Roberson 1985, ABN). The Elegant Tern's progressively later movement to the north and variable timing of arrival are strikingly similar to those of the Brown Pelican (and Heermann's Gull), another anchovy-dependent species (see pelican account and Schaffner 1986). Timing of arrival may depend on patterns of anchovy abundance and oceanographic conditions, both at the breeding colonies and in the northern areas to which the terns disperse (F. C. Schaffner pers. comm.). The initial size of Brown Pelican breeding populations generally varies little from year to year, but that species' reproductive success is highly variable and positively correlated with anchovy abundance. In contrast to the pattern exhibited by pelicans, the breeding population size of Elegant Terns is variable and positively correlated with anchovy abundance, but the reproductive success of birds that do breed is generally high (Schaffner 1986). Hence, Brown Pelicans arriving early in central California may represent failed breeders (see account) while Elegant Terns arriving early may represent non-breeders (F. C. Schaffner pers. comm.).

In our study area large numbers of Elegant Terns were found consistently only at Bolinas (Fig. 36). Unusual numbers, such as 2500 on 7 Sep 1984, 2000–3000 from 26 to 28 Sep 1984, 3700 on 24 and 25 Aug 1985 (RMS), and over 6000 on 28 Aug 1985 (JGE), concentrated at Bolinas during the very rare anchovy runs inside the lagoon. Another high count was of over 2000 birds in Drake's Bay on 29 Sep 1985 (ABN: JW). Elegant Terns occurred irregularly at Limantour (Fig. 36). During our census period they were recorded at Abbott's only in 1981, a year of high anchovy abundance in southern and central California (Schaffner 1986), on six of seven censuses from 20 Jul to 16 Sep; the high count was 140 on 4 Sep.

Before 1950 Elegant Terns ventured rarely and irregularly north to San Francisco Bay (Grinnell and Miller 1944). Then a dramatic increase began (Cogswell 1977), including establishment of the San Diego colony in 1959 following the El Niño of 1957 and 1958 and coincident with increasing anchovy abundance (Schaffner 1986). Now large numbers of Elegant Terns are present regularly along the north-central California coast in fall (McCaskie et al. 1979, Garrett and Dunn 1981). For many years large numbers dispersed north regularly only as far as the Point Reyes area, but they now reach Humboldt Co. regularly (Morlan and Erickson 1988).

Royal Terns (*Sterna maxima*) formerly occurred as far north as Tomales Bay (Grinnell and Miller 1944). When Elegant Terns increased in California, Royals withdrew almost completely from central California and became less abundant in southern California (Cogswell 1977, McCaskie et al. 1979, Garrett and Dunn 1981). Simultaneously, Pacific Sardine numbers in central and southern California waters declined drastically, while Northern Anchovy numbers increased (Ainley and Lewis 1974, Schaffner 1986). Elegant Terns currently have seasonal movements roughly similar to the anchovy's (Schaffner 1985) and they have increased their numbers and range in California apparently by exploiting anchovy increases. In central California, Royal Terns likely depended heavily on sardines, which were abundant formerly inshore (along beaches, and in estuaries and lagoons) but also ranged to offshore and pelagic waters (Murphy 1966, Schaffner 1985). This dependence is suggested by the decline of the Royal Tern population at the time of the southward retraction of the sardine population (Schaffner 1985). See Appendix for former status of Royal Tern in the Point Reyes area.

Schaffner (1985) reported that in southern California the Elegant Tern feeds farther "offshore" than the Royal Tern, which he considered to be a warm-water species and primarily an "inshore" coastal forager, as it is throughout much of its range. In the Gulf of California, D. W. Anderson (pers. comm.) also notes that Elegant Terns are "pelagic" feeders and that Royal Terns are "inshore" or near-shore feeders. Briggs et al. (1987) reported that Elegant Terns are rare more than 4 km from shore along the California coast and Royal Terns are rare more than 1 km from shore. Our experience at Point Reyes is that Elegants forage in shallow water very close inshore and inside estuaries, harbors, and lagoons. Grinnell and Miller (1944) reported that Royal Terns forage "on the open ocean, mostly well offshore," areas that had been less intensively exploited by the sardine fishery (F. C. Schaffner pers. comm). Thus, these seemingly conflicting reports of habitat preference probably represent geographical differences in seasonal movements of anchovies, historical expansions and contractions of the anchovy populations, and possible seasonal observer biases.

Common Tern (*Sterna hirundo*)

A very rare fall transient, with 48 birds on 11 censuses from 7 Aug to 26 Sep, and a very rare spring transient, with 17 birds on 8 censuses from 21 Apr to 29 Jun. Most census records were for Abbott's, but Common Terns were also seen with regularity at Tomales Bay (DS). Marin Co. records extend from 9 Apr (JGE) to 19 Dec (AB 26: 651) with a fall peak of migrants from mid- to late Sep and a spring peak in mid-May (Fig. 12). Peak spring migration dates over inshore waters of the central California coast range from 25 Apr to 12 May (ABN: BSa et al.). Migration periods in northern California extend from early Apr through May in spring (with stragglers in Jun) and from early Jul to early Nov in fall (McCaskie et al. 1979, ABN). Common Terns are casual in northern California after mid-Nov (McCaskie et al. 1979), with the latest record being for 4 Jan (AB 38: 353).

Common Terns frequent estuaries, lagoons, and inshore and offshore waters. The general scarcity of the species along the shoreline of most of northern California, especially in spring (ABN), contrasts with the situation in the Monterey area, where the species is common, possibly because there the deep waters of the Monterey Submarine Canyon occur within a few miles of shore (Roberson 1985). This difference suggests Common Terns migrate over deep neritic waters at distances from shore influenced somehow by underwater topography. Briggs et al. (1987) reported that Common Terns are most numerous within 25 km of shore.

Forster's Tern (*Sterna forsteri*)

A very rare summer visitant, a fairly common fall transient, a fairly common winter resident, and a common spring transient (Fig. 36). Forster's Tern is primarily a transient in the Point Reyes area, although birds winter in moderate numbers at Bolinas (Fig. 36) and Tomales Bay (DS, JGE) and in small numbers at Bodega Harbor (DS). Spring migration extended from early Apr to late May and post-breeding dispersal and fall migration extended primarily from mid-Jul to mid-Oct, with stragglers to early Dec (Fig. 36). Migration over inshore waters of the central California coast begins in mid- to late Mar (ABN), and peak dates range from 24 Apr to 13 May (24 to 28 Apr in three of four years, ABN: BSa et al.). Breeding in San Francisco Bay extends from late Apr (Gill 1972b, 1977) probably until Sep, with the first young fledging in late Jun. In the Point Reyes area Forster's Terns were seen in only a few instances during the middle of the breeding season, although they occur regularly at that season as close as Tiburon in San Francisco Bay (BiL). Numbers at Bolinas began increasing by late Jul (Fig. 36), presumably as a consequence of post-breeding dispersal from nearby breeding

colonies since there are recoveries in Marin Co. of birds banded at San Francisco Bay. The limited evidence suggests most post-breeding dispersal is to the north (Gill and Mewaldt 1979). The first fall arrivals at Limantour and Abbott's in Aug (Fig. 36) may have been migrants from the north or dispersants from San Francisco Bay breeding colonies spilling over into less desirable habitat.

Since 1948 the San Francisco Bay nesting population has increased from about 100 pairs at one site (Sibley 1952) to about 2500 pairs at eight major sites (Gill 1977, Rigney and Rigney 1981). Although spring numbers at Bolinas have been relatively constant over the years, winter numbers have increased greatly (Fig. 14). This parallels the increase of winter numbers in Sonoma Co. (G. L. Bolander and Parmeter 1978) and the length of the northern California coast from the mid-1970s (AB 30: 762, AB 31: 369) to the present (AB 42: 316). A flock of 250 Forster's Terns off Bolinas on 31 Dec 1988 (ABN: PP) exemplifies this trend and approaches in size high counts during spring migration (Fig. 36). Forster's Terns inhabit estuaries, lagoons, inshore waters, freshwater ponds, and marshes. They feed primarily over mudflats in water 1 m or less deep (Baltz et al. 1979) but do not catch fish deeper than 30 cm (Salt and Willard 1971). Over the ocean they range to 15 km from shore (Briggs et al. 1987).

Black Tern (*Chlidonias niger*)

A very rare fall and spring visitant with census records of an immature at Abbott's on 27 Aug and 4 Sep 1980 (ABN) and a breeding-plumaged bird at Bolinas on 5 May 1982. Additional non-census records are of four single birds in fall, extending the date span to 15 Oct, and singles on 14 May 1965 and 30 May 1989 (ABN). In coastal northern California Black Terns are rare but regular transients from 23 Apr to 7 Nov, with most records in May, Aug, and Sep (ABN); there is also one record for 24 and 25 Jan (AFN 24: 536). The increasing abundance of migrant Black Terns from north to south along the coast of California (Garrett and Dunn 1981, McCaskie et al. 1979) indicates that virtually all birds move to and from interior breeding grounds via interior routes that intersect the coast in southern California or farther south. Since at least the 1940s, the Black Tern has decreased in California both as a migrant (Garrett and Dunn 1981) and as a breeder (McCaskie et al. 1979). Transients on the northern California coast have been found in estuaries, lagoons, marshes, freshwater ponds, and, occasionally, over the open ocean up to 16 km from shore (Willett 1933, ABN).

Common Murre (*Uria aalge*)

A very rare fall and winter visitant to the estuaries with eight single birds on eight dates from 28 Jul to 3 Oct at Limantour and Bolinas and single birds at Bolinas on 8 Feb 1973 and 21 Jan 1976. Common Murres breed regularly at three sites along our inshore study area, and 17% of California's population breeds nearby on the Farallon Islands (Sowls et al. 1980). Adults and flightless young disperse from these breeding sites between late Jun and mid-Aug (Boekelheide, Ainley, Morrell, Huber, and Lewis in press), shortly before most records of murres in the small estuaries. Most of our estuarine records were of immatures that were likely starved, sick, or injured, as juvenile mortality is very high at that season (Stenzel et al. 1988). Murres also occur regularly in the mouth of San Francisco Bay in "late summer" (Grinnell and Wythe 1927) and sometimes in outer Tomales Bay. Common Murres primarily inhabit inshore and offshore waters out to the edge of the continental shelf, with most birds concentrated on the inner shelf usually between depths of 55 and 150 m (Wahl 1975, Briggs et al. 1987). In the 1970s, the Farallon breeding population recovered dramatically from near extinction due to commercial egging, oil pollution, and disturbance

(Ainley and Lewis 1974), only to decline markedly again in the 1980s because of poor ocean productivity in El Niño years, oil pollution, and gill netting (Takekawa et al. in press). Recent declines of populations on the central California coast, including all three colonies along our inshore study area, have been even more dramatic than on the Farallones.

RESULTS AND DISCUSSION

Abundance

In all, 122 species, representing 16 families of aquatic birds, were recorded on the wetland censuses. Additional species that have been sighted at other times in the Point Reyes area (Appendix), but were not detected on censuses because of their extreme rarity or their use of non-estuarine habitats, are not included in the following analyses. Three families—the Anatidae (waterfowl), Scolopacidae (sandpipers and phalaropes), and Laridae (jaegers, gulls, and terns)—accounted for 68.0% of all species on censuses. Of the 122 species, 7.4% were abundant during at least one season, 11.5% were very common, 21.3% were common, 9.0% were fairly common, 8.2% were uncommon, and 42.6% were rare to very rare (Table 3). Of the 52 very rare or rare species, 34 are "very uncommon" or rarer in coastal northern California (McCaskie et al. 1979) or "uncommon" or rarer in coastal southern California in the comparable season (Garrett and Dunn 1981), 15 are more numerous on the coast in aquatic habitats poorly represented in the censused wetlands (Table 3), and 3, the Spotted Sandpiper, Clapper Rail, and Clark's Grebe, are difficult to compare for varying reasons. The Spotted Sandpiper's solitary behavior and patchy local distribution caused us to categorize it as rare whereas its overall widespread distribution renders it fairly common on a regional scale (McCaskie et al. 1979, Garrett and Dunn 1981). Likewise, Clapper Rails are more common at the regional level than at Point Reyes because of their restriction to a habitat lacking in our study area. Although Clark's and Western grebes were not differentiated in regional accounts (McCaskie et al. 1979, Garrett and Dunn 1981) or during our censuses, the available evidence (see accounts) suggests that these two species occur in the same relative abundance on Point Reyes as they do along the entire California coast.

Seasonal Use Patterns

The 70 most numerous species (categories abundant through uncommon), of course, dominate the seasonal use of the wetlands (Table 3). Although most of these species occur during more than one season, we have categorized each by one of six primary use patterns: *year-round resident* (4 species), *summer resident* (1 species), *winter resident* (46 species), *transient* (15 species), and *dispersant* (4 species).

A species-by-species analysis provides some insight into the importance of the estuaries to spring and fall migrants. Of the 15 transient species, six had roughly equivalent spring and fall peaks, two had almost exclusively spring peaks, three had peaks greater in spring than in fall, and four had peaks greater in fall than in spring. Of the 46 winter resi-

Table 3 Abundance Ranking for the Season of Peak Occurence of 122 Species of Aquatic Birds on Wetland Censuses at Point Reyes

Abundant
- Northern Pintail
- American Wigeon
- Ruddy Duck
- American Coot
- Western Sandpiper
- Least Sandpiper
- Dunlin
- Bonaparte's Gull
- Mew Gull

Very Common
- Brown Pelican
- Black Brant
- Green-winged Teal
- Surf Scoter
- Bufflehead
- Black-bellied Plover
- Willet
- Marbled Godwit
- Sanderling
- Short-billed Dowitcher
- Heermann's Gull
- Ring-billed Gull
- California Gull
- Western Gull

Common
- Horned Grebe
- Eared Grebe
- Western Grebe
- Double-crested Cormorant
- Great Egret
- Mallard
- Cinnamon Teal
- Northern Shovelar
- Gadwall
- Canvasback
- Greater Scaup
- Lesser Scaup
- White-winged Scoter
- Common Goldeneye
- Snowy Plover
- Semipalmated Plover
- Killdeer

Common (Continued)
- American Avocet
- Black Turnstone
- Long-billed Dowitcher
- Red-necked Phalarope
- Herring Gull
- Glaucous-winged Gull
- Caspian Tern
- Elegant Tern
- Forster's Tern

Fairly Common
- Common Loon
- Pied-billed Grebe
- American White Pelican
- Great Blue Heron
- Snowy Egret
- Black-crowned Night-Heron
- Red-breasted Merganser
- Whimbrel
- Long-billed Curlew
- Common Snipe
- Red Phalarope

Uncommon
- Red-throated Loon
- Ring-necked Duck
- Virginia Rail
- Sora
- Greater Yellowlegs
- Ruddy Turnstone
- Red Knot
- Baird's Sandpiper
- Pectoral Sandpiper
- Thayer's Gull

Rare[a]
- NW Pacific Loon
- Clark's Grebe
- •• Redhead
- Spotted Sandpiper

Table 3 (Continued)

Very Rare			
**	Red-necked Grebe	**FW	Hooded Merganser
OW	Ashy Storm-Petrel	FW	Common Merganser
NW	Brandt's Cormorant	**	Black Rail
NW	Pelagic Cormorant		Clapper Rail
* FW	American Bittern	**FW	Common Moorhen
**	Little Blue Heron	**UP/FW	Sandhill Crane
* UP/FW	Cattle Egret	**	Lesser Golden-Plover
**FW	Green-backed Heron	SP/FW	Black-necked Stilt
**	White Ibis	FW	Lesser Yellowlegs
* FW/UP	Tundra Swan	RC	Wandering Tattler
**FW/UP	Greater White-fronted Goose	**	Bar-tailed Godwit
		RC	Surfbird
**FW/UP	Snow Goose	**	Semipalmated Sandpiper
**FW/UP	Ross' Goose	**	Curlew Sandpiper
**	Emperor Goose	**	Stilt Sandpiper
* FW/UP	Canada Goose	**	Ruff
**FW	Wood Duck	SP/FW	Wilson's Phalarope
**FW	Blue-winged Teal	NW	Parasitic Jaeger
**	Eurasian Wigeon	**	Franklin's Gull
**	Tufted Duck	**	Glaucous Gull
**	King Eider	OW	Black-legged Kittiwake
**	Harlequin Duck	NW	Common Tern
**	Oldsquaw	**FW	Black Tern
**	Black Scoter	NW	Common Murre
**	Barrow's Goldeneye		

[a] A double asterisk indicates the species is "very uncommon" or rarer in coastal northern California (McCaskie et al. 1979), and "uncommon" or rarer in coastal southern California (Garrett and Dunn 1981); a single asterisk indicates the species is relatively rare in one region but not the other. Codes for habitat preferences that may explain rarity on estuaries or lagoons but not on the coast as a whole: FW, freshwater; NW, neritic waters; OW, oceanic waters; RC, rocky coasts; SP, salt ponds; UP, moist uplands.

dents, only 11 had pronounced peaks of migrants. Of these four had spring and fall peaks roughly equivalent, while seven had only pronounced fall peaks. Numbers of the four species of dispersants all peaked in late summer or fall. Because of the tendency of young birds to migrate over broader corridors or to wander out of range in fall, inclusion of rarer species in these breakdowns would bolster the total number of species with fall peaks, but these species represent relatively few individuals. Clarification of the importance of the wetlands as spring and fall staging areas awaits detailed analysis of numerical abundance rather than species totals for these seasons.

Because the dispersant category of seasonal use is not recognized in most avifaunal works, the five species so classified (including the rarer Cattle Egret) deserve further comment. Although these species generally move long distances between breeding and non-breeding areas they are

not true transients that proceed from point *A* to point *B* during annual migrations. Instead they generally disperse northward after breeding, and later retract southward, with the distance, timing, duration, and intensity of dispersal varying greatly (within certain bounds) with fluctuating food resources. Cattle Egrets disperse north into the Point Reyes area from more southerly breeding areas between late fall and early winter. The coincidence of their arrival with the initial part of the rainy season, rather than the end of their breeding season, suggests the dispersal is related to enhanced food resources rather than to post-breeding wanderings. Brown Pelicans, Heermann's Gulls, and Elegant Terns all disperse north along the California coast from their primary nesting grounds in the Gulf of California with the timing, duration, intensity, and distance of their movements apparently fluctuating with food (anchovy) availability in the California Current (see Species Accounts). In the fall, California Gulls migrate to the Pacific Coast from interior breeding sites. They then fan out along the coast, but initially concentrate to the north. A pattern of progressively later peaks of abundance of California Gulls with decreasing latitude along the coast coincides in timing with southward shifts in the abundance of Brown Pelicans, Heermann's Gulls, and Elegant Terns. This pattern suggests that, once on the coast, California Gulls also disperse as a result of a southward shift in food availability. Although exhibiting other primary seasonal use patterns, at least part of the Western Gull and Brandt's Cormorant populations also disperses north along the coast in summer and fall then returns south, presumably also in response to seasonal fluctuations in food supply. The category of dispersants separates out another group of species with common characteristics of seasonal occurrence, further highlighting the complexities of seasonal movements of waterbirds.

Most of the 122 species found on our wetland censuses do not breed locally. Only 10 species breed regularly in or within 1 km of the wetlands: Pied-billed Grebe, Great Blue Heron, Great Egret, Green-backed Heron, Mallard, Cinnamon Teal, Virginia Rail, American Coot, Snowy Plover, and Killdeer. Eight species breed irregularly in or within 1 km of the wetlands: American Bittern, Snowy Egret, Gadwall, Ruddy Duck, and Common Moorhen, definitively, and Blue-winged Teal, Black Rail, and Sora, probably. Of the 122 species an additional 19 breed regularly within 75 km, either in San Francisco Bay, on the Farallon Islands, on other coastal rocks and bluffs, or at inland lakes, streams, or marshes: Ashy Storm-Petrel, Double-crested Cormorant, Brandt's Cormorant, Pelagic Cormorant, Black-crowned Night-Heron, Canada Goose, Wood Duck, Northern Pintail, Northern Shoveler, Common Merganser, Clapper Rail, Black-necked Stilt, American Avocet, Spotted Sandpiper, California Gull, Western Gull, Caspian Tern, Forster's Tern, and Common Murre.

When we compared the primary seasonal use patterns of the most numerous species (abundant through uncommon) within and between taxonomic groups (Table 3), certain trends were evident. All loons (Gaviidae) and grebes (Podicipedidae) were winter residents. Of the 17 species of waterfowl (Anatidae), all were primarily winter residents except

for the Mallard, which is a year-round resident, and the Black Brant (formerly a winter resident), and Cinnamon Teal, which are primarily spring transients. All rails (Rallidae) were primarily winter residents. Of the 24 shorebird species (Charadriidae, Recurvirostridae, and Scolopacidae), 14 were winter residents and 10 were transients. The importance of the Point Reyes wetlands to migrant shorebirds is further indicated by the fact that five winter residents became even more numerous in migration. Snowy Plovers, Killdeers, and American Avocets might be classified as year-round residents but we considered them primarily winter residents because numbers on the coast of all three increased substantially in winter. Species of pelicans and cormorants (Pelecanidae and Phalacrocoracidae), herons and egrets (Ardeidae), and gulls and terns (Laridae) were rather widely distributed among the various seasonal use categories.

These comparisons stress that Point Reyes wetlands are used primarily by wintering species, secondarily by migrants, less by dispersants, and relatively little by year-round residents, summer residents, and local breeders. About three-quarters of the winter residents, which include loons, grebes, ducks, coots, shorebirds, and gulls, did not have migratory peaks on the estuaries, indicating that the wetlands served primarily as a final destination rather than a staging area for migrants. However, at least a few species in most taxonomic groups showed peaks of migrants. Although shorebirds were the predominant species using Point Reyes' wetlands during migration periods, the wetlands were a major staging area for only one species of shorebird, the Western Sandpiper in spring. But the importance of Point Reyes estuaries to migrant shorebirds should not be downplayed as Point Reyes is one of only 10 areas on the Pacific Coast known to support 20,000 or more shorebirds during the peak of migration (Senner and Howe 1984). The Black Brant, which concentrates in Drake's Estero and Tomales Bay during spring migration, is another species for which the Point Reyes estuaries serve as a major staging area. Large numbers of loons and scoters appear to use the inshore zone of Drake's Bay as a staging area in spring and fall. Also, Surf Scoters stage in large numbers in Tomales Bay, and further work there may document the importance of that bay to other migrant species. Most species that occurred primarily as transients had peaks in both spring and fall, indicating that their populations typically pass along the central California coast in both seasons. Although species richness is highest during the transition from autumn migration to the winter period we did not determine if overall aquatic bird abundance parallels this trend.

The change through the year in the species composition of the wetland community resulted from the combination of a large number of different species' seasonal use patterns. From late May to late June abundance and diversity were at the yearly low. Post-breeding influxes of birds in June and July consisted predominantly of shorebirds, terns, and dispersants from the Gulf of California; in August and September of dabbling ducks and shorebirds; and in October and November of diving and dabbling ducks, gulls, loons, and grebes. Many of the species that arrived

in October and November continued to increase into December. Most transient shorebirds and terns passed through by mid-October; some wintering species continued to increase through the fall. Gulf of California dispersants declined in October and November. Although spring migration began in late January with the arrival of Cinnamon Teal, in February and March the most abundant species of wintering waterfowl, shorebirds, and gulls were still at mid-winter peaks or, particularly in wet years, declining. Numbers of dabbling ducks and diving ducks that feed in shallow water declined rapidly in March, whereas most loons, grebes, and diving ducks declined in April. April was the peak month of spring shorebird migration, when the wintering numbers of some species were augmented by migrants and other purely transient species passed through the wetlands; terns were also migrating in April. Departure and migration continued though most of May until species diversity and population sizes reached summer lows late that month or in early June.

Inter-wetland Variation in Seasonal Occurrence

Most instances of the occurrence pattern of a single species varying among sites appeared to be explainable by habitat and resource differences. Occurrence patterns at Abbott's Lagoon frequently differed from those at the two estuaries, apparently because of different hydrographic regimes. Because Abbott's is a true lagoon with a barrier bar (see Methods), it becomes tidal infrequently and irregularly in winter. Water levels generally rise with the winter rains and decline during the summer dry period. In contrast to the situation at the estuaries, at Abbott's Lagoon Black-bellied Plovers, Semipalmated Plovers, Killdeer, Marbled Godwits, Sanderlings, Western Sandpipers, Least Sandpipers, and Dunlins (Figs. 23, 25, 27, 28, 29, and 30) remained numerous for an extended period in fall, were scarce and irregular in winter, and showed at most a limited peak in spring. The winter decline of shorebirds at Abbott's may have been due partly to the inundation of foraging flats by rising water levels during winter. However, censuses at Abbott's throughout the drought winter of 1975–76 did not reveal numbers of shorebirds consistently higher than in wet years. An alternative explanation may be that because of the lack of tidal influence and fluctuating winter salinities, Abbott's supports low numbers of prey which are depleted early in the season, forcing birds to move on. Shorebirds can deplete prey populations during migration (Schneider and Harrington 1981), but it is unknown if prey depletion itself ever causes shorebirds to migrate.

Numbers of Sanderlings at Abbott's appeared to be more closely linked to water levels than did those of other shorebirds. Sanderling numbers there increased rapidly when new feeding areas were exposed by dropping water levels when storms opened the lagoon mouth (see account). Funderburk and Springer (1989) also reported increased use by shorebirds of foraging flats exposed by dropping water levels at lakes Earl and Talawa.

Rising water levels that reduced food *availability* seemed to explain both declining winter numbers of American Wigeon, Ruddy Ducks, and American Coots at Abbott's (Figs. 17, 22, and 23) and a shift of these species and the Gadwall from freshwater ponds to the estuary at Limantour (Fig. 18). *Depletion* of food resources by the birds also may have caused these shifts.

Many differences in occurrence patterns appeared to be caused by strong preferences for one site over another, presumably because of gross differences in resources between sites. This probably explained why Brown Pelicans, Black-crowned Night-Herons, American Avocets, Common Snipes, and Elegant Terns occurred regularly at Bolinas Lagoon but irregularly at Limantour and Abbott's. Apparently for similar reasons a species that used two or three sites regularly differed in its seasonal use of those sites. For example, Forster's Terns occurred only as migrants at Abbott's and Limantour but also wintered at Bolinas (Fig. 36); Semipalmated Plovers occurred primarily as migrants at Abbott's and Bolinas but also wintered at Limantour (Fig. 25); Black Turnstones occurred only as migrants at Abbott's but also wintered at Bolinas and Limantour (Fig. 27); Western Sandpipers staged during spring migration primarily at Bolinas (Fig. 28). Although not documented by our census work, peak numbers of loons, grebes, cormorants, diving ducks, and gulls at Tomales Bay surely must have differed in timing from peaks at the other sites because Pacific Herring runs in Tomales draw thousands of birds there at irregular intervals in winter. That numbers of loons, grebes, and scoters in summer in inshore waters (Fig. 5) are higher than in wetlands (Figs. 4, 8, and 21) also suggests resource differences between the areas. In this case birds may move into less desirable areas as their numbers increase in fall and winter and then concentrate in preferred areas when numbers decline in summer.

The absence of Black-crowned Night-Herons at Limantour and Drake's may have been due to an absence of suitable daytime roosts. It is also possible that tradition, or proximity to the large San Francisco Bay population, may have played a role in the occurrence of a regular population of Long-billed Curlews at Bolinas since their main prey items (Stenzel et al. 1976) also occur in abundance at Limantour, where the curlew occurred only rarely. Certain species were numerous at only one site during the nesting season because the site offered requisites for breeding lacking at other sites. Examples were Great Egrets and Great Blue Herons at Bolinas (Fig. 10) and Mallards and Cinnamon Teal at Abbott's (Figs. 13 and 15). Particularly early arrival at one site, for example, of Northern Shovelers at Bolinas or Ruddy Ducks at Abbott's (Figs. 17 and 22), may have reflected the earlier settling of birds at preferred sites, as documented for other species elsewhere (Zwarts 1976, Goss-Custard 1977, van der Have et al. 1984).

We have no ready explanations for many differences in seasonal use patterns. For example, why was the spring peak of Semipalmated Plovers at Bolinas greater than the fall peak when the reverse was true at both Limantour and Abbott's (Fig.25)? Why did the occurrence pattern of Buffleheads differ at three sites (Fig. 22)? Conversely, did similar pat-

terns observed for the same species at different sites really reflect equivalent use? We suspect that the fall peak of Least Sandpipers at Bolinas may have represented fall staging or migration, while a similar peak at Abbott's (Fig. 29) may have reflected movement in relation to rising water levels or prey depletion.

Variation in Timing and Abundance

Although many facets of waterbird movements seem to be internally regulated, there is a certain amount of fine tuning influenced by external factors. In the Point Reyes area rainfall and winter storms appeared to be the most important immediate factors influencing waterbird movements locally and regionally. Changing water levels appeared to cause local shifts of dabbling ducks and coots from ponds to the estuary at Limantour, fall declines in shorebird numbers at Abbott's Lagoon, and dramatic influxes of Sanderlings to Abbott's. Annual variation in the timing of rainfall and storms also appeared to influence the timing of movements. The arrival of Common Snipe at Bolinas was influenced by the onset of winter rains. Rainfall also broadened the spectrum of winter habitat use of shorebirds, such as Black-bellied Plovers, Killdeer, Dunlins, Least Sandpipers, Long-billed Dowitchers, and Marbled Godwits (see accounts), that fed and roosted in rain-soaked pastures, especially at high tides.

Rainfall was also linked with rapid declines of the Northern Pintail, American Wigeon, Dunlin, and Long-billed Dowitcher at Bolinas Lagoon (see accounts). Pintail departure after intense mid- to late winter rain was a regular phenomenon except in very dry years, while wigeon departure after intense rainfall was less predictable. Wigeon may be able to remain at Bolinas longer than pintail because, unlike other dabbling ducks there, wigeon graze extensively in fields and marshes. The infrequent departure of the Dunlin and Long-billed Dowitcher suggests that these species usually adapt to local flooding and flee only under extreme circumstances. Rainfall and storm tides presumably may force departure by flooding favored feeding areas for extended periods. The effect of storms on high tides was more dramatic at Bolinas than at Limantour apparently because the former receives more stream inflow for its size and because the estuary mouth faces south toward storm winds and ocean swells. Siltation during heavy runoff covers feeding areas at creek deltas, possibly affecting the dabbling ducks that concentrate there. Lack of rainfall may have triggered slightly earlier arrival of some species in 1976–77, the second winter of a two-year drought. Although our censuses were infrequent that year, the Northern Pintail, American Wigeon, and American Avocet appeared to arrive slightly earlier, perhaps because of the shortage of shallow freshwater habitat inland.

Species that depend the most on irregularly fluctuating resources varied the most in timing of arrival, departure, and peak abundance. The schedules of Brown Pelicans (Fig. 9), Heermann's Gulls, and Elegant Terns (species breeding primarily in the Gulf of California) varied more than those of other regularly occurring estuarine species. The timing of

arrival of these species along the California coast is dependent mostly on when and whether birds initiate or fail in their breeding attempts, which is influenced by productivity in the Gulf of California (see Species Accounts). However, oceanic conditions along the California coast can affect the timing of regional peaks because dispersal northward along the coast generally follows the progression of upwelling in that direction (Anderson and Anderson 1976, Briggs et al. 1983, Bakun et al. 1974, Brinton 1976). In addition, local resource fluctuations such as anchovy runs also markedly affected seasonal or yearly variation in the period of peak abundance of these same species on the estuaries (see Species Accounts). As described in the previous section, Pacific Herring had a similar influence on the timing of peak numbers of loons, cormorants, scoters, and gulls in Tomales Bay. The irregular timing and abundance of Red Phalaropes, Bonaparte's Gulls, and Black-legged Kittiwakes on the estuaries also appeared to be related to fluctuating resources in the ocean (see Species Accounts). These species typically were numerous on the estuaries only when poor food supplies or storms caused them to look for alternative foraging habitats or shelter.

A few species increased or declined in abundance during the study (Fig. 14, Species Accounts). An increase was apparent in the number of wintering Marbled Godwits and Gadwalls at Limantour and Bolinas, in the latter species paralleling a continent-wide trend (Johnsgard 1978, Bellrose 1980). For the Red-breasted Merganser spring numbers increased at Limantour and Bolinas and winter numbers increased just at Limantour. Winter numbers of Buffleheads and Snowy Egrets increased at Bolinas, as did winter numbers of Black-bellied Plovers, Pied-billed Grebes, and Northern Shovelers at Limantour. Forster's Terns increased in winter and spring at Bolinas, the winter increase paralleling an overall increase in northern California (see Species Account). Range expansions accounted for increases in two species. American Avocets are continuing to expand their range and numbers in northern California. They have occurred regularly on Bolinas Lagoon since at least 1971, and their numbers increased through the 1975–77 drought. They have since stabilized at somewhat lower levels. Although rather rare in the area, the Cattle Egret was first recorded at the time of its initial range expansion into northern California and now occurs annually on Point Reyes. Populations of fewer species declined. Numbers of wintering Willets declined slightly at Bolinas. Winter numbers of American Coots declined at Bolinas and at Limantour; at Bolinas the precipitous decline occurred during the second year of the 1975–77 drought.

The abundances of some species appeared to vary in concert. The yearly variation in abundance of three fish-eaters, Western/Clark's Grebe, Red-breasted Merganser, and Forster's Tern, closely paralleled each other over a 7-year period (Fig. 37), suggesting similar resource use. During the two drought winters we recorded high numbers of most species of dabbling ducks, American Coots, American Avocets, and Dunlin, which were followed by much lower numbers in 1977–78 (Fig. 14), when rainfall returned to normal levels. Presumably these species concentrated on estuaries when freshwater habitats inland dried up.

Overview

In recent years intensive census studies (e.g., Prater 1981) and especially ecological studies of single species (e.g., Evans 1984, Pienkowski and Evans 1984) have expanded our understandings of the complexities of seasonal movements. Seasonal occurrence patterns respond to, and compromise with, constraints placed upon species in their efforts to breed, molt, migrate, and maintain themselves over winter. To meet different seasonal demands waterbirds frequently move great distances. Although generally these movements are between summering and wintering areas, there are also many within-season movements. Shorebirds may use a number of areas within a general wintering range. For example, some birds may migrate to one area in fall to molt

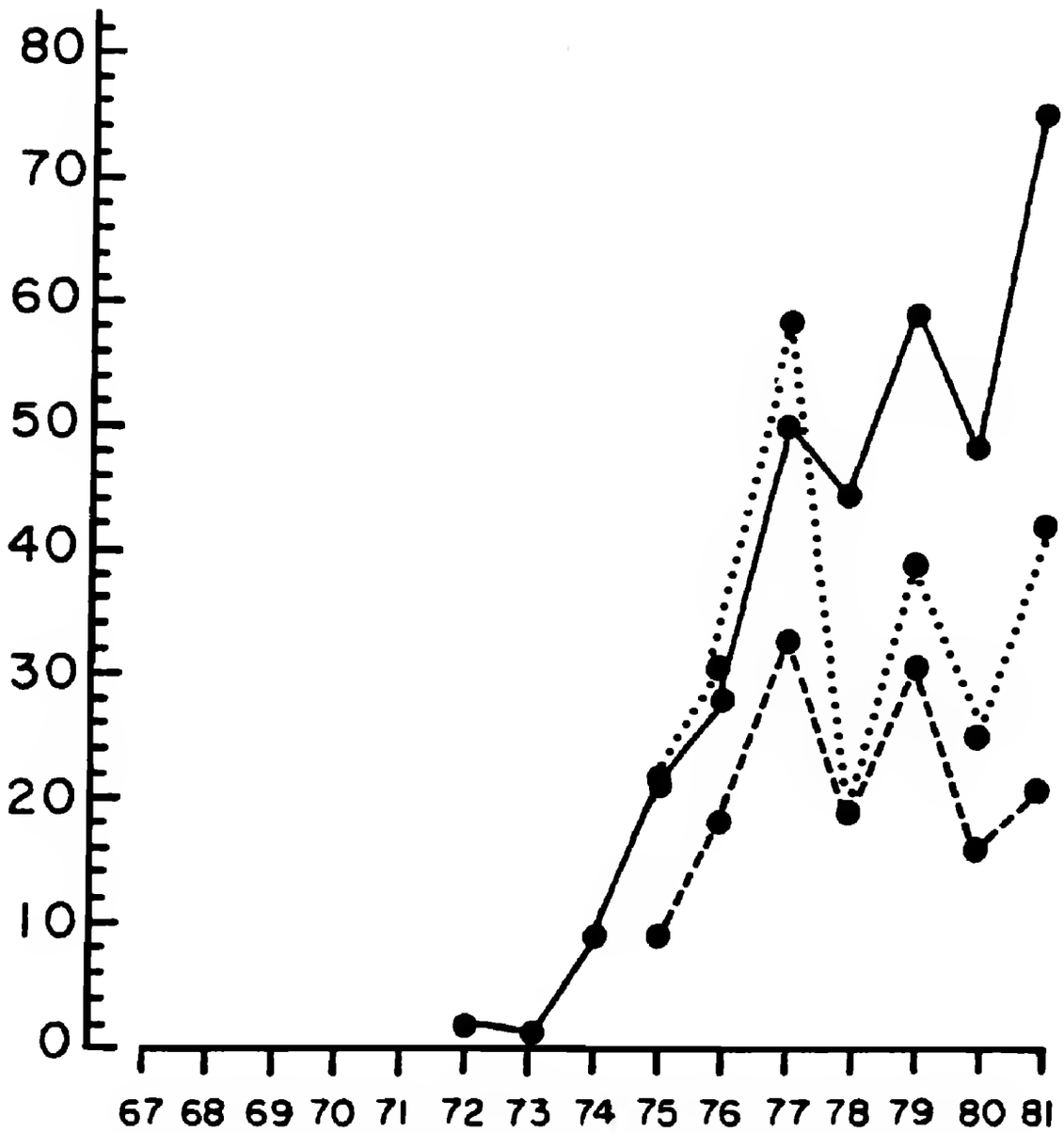


Figure 37. Winter numbers of three species of fish-eating birds at Bolinas Lagoon between 1972–73 and 1981–82. Dotted line, Western/Clark's Grebe; dashed line, Red-breasted Merganser; solid line, Forster's Tern.

("molt migration"), to another to "overwinter," and to yet another for spring molt before commencing long-distance migration to their breeding grounds (Pienkowski and Evans 1984). "Oversummering" shorebirds also move unknown directions for unknown durations (Loftin 1962). Waterfowl undertake short-distance molt migrations, post-breeding dispersal, and sometimes northward movements in fall during unseasonally mild weather (Hochbaum 1955). Strategies used in one season may have far-reaching effects in another. For example, in shorebirds the distance a species migrates or the degree of sexual segregation on the wintering grounds may be linked to the mating system (Myers 1981a,b).

Within species, layers of complexity in seasonal use patterns are (1) differences in migration routes and timing in different populations (e.g., see Harrington and Morrison 1979); (2) different schedules of migration by age and sex classes (see Page et al. 1979, Morrison 1984); (3) geographic or habitat segregation of sex or age classes on the wintering grounds (e.g., Bellrose et al. 1961, Page et al. 1972, Alexander 1983, Jorde et al. 1984); and (4) different seasonal use strategies of individuals (e.g., Evans and Pienkowski 1982, Townshend 1985). Many of these complexities follow predictable patterns within taxonomic groups. Although there are exceptions, in shorebirds the timing of migration of the sexes typically differs in spring (e.g., Myers 1981b) and fall (e.g., Morrison 1984). In fall adults migrate before juveniles (e.g., Page et al. 1979). Fall migration is slower than spring migration (e.g., Pienkowski and Evans 1984, Jehl 1979), and the fall migratory pathways of juveniles are broader than those of adults (e.g., Jehl 1979). Within a taxonomic group, there is, of course, some variation in seasonal use strategy such as the short- or long-hop migrations of shorebirds (e.g., Pienkowski and Evans 1984). Trends in seasonal use patterns may cross taxonomic boundaries. Both shorebirds and waterfowl "oversummering" on the wintering grounds are usually immature (Bellrose 1980, Johnsgard 1981).

Despite the vast improvement in knowledge of the details of seasonal movements, the reasons for concentrations of particular species on particular estuaries at particular times of year are poorly known (Evans 1984). Much of the recent work on winter ecology of waterbirds has focused on energetics and how birds stay alive. However, changes in species' use of an area have seldom been shown to relate to the density of available prey or changes in daylight or average winter temperatures, any of which might be expected to make a difference in a bird's ability to maintain itself. This lack of correlation suggests that many environmental factors may not be the proximate causes of movements within the nonbreeding range (Evans 1976, Evans and Dugan 1984). Although hard weather induces some movements in winter, apparently most estuarine shorebirds attempt to endure, not flee, periods of adverse weather (Evans 1976); hard-weather movements appear more frequent in inland species of shorebirds (Pienkowski et al. 1984). Some patterns of change in winter numbers may depend upon movements from outside the local system, some on the social behavior of birds on an estuary (see Townshend 1985). Most studies, however, have been conducted at lati-

tudes where freezing temperatures are thought to be the primary factor increasing energy demands while decreasing prey activity and availability (e.g., Evans and Dugan 1984, Pienkowski et al. 1984). In some climates rainfall acting via water levels can cause movements of waterbirds that rely on ephemeral freshwater habitats (e.g., Kushlan 1981). Our census studies on Point Reyes wetlands suggested that, in a seasonally wet environment, rainfall and storms also caused waterbirds to move.

Much remains to be learned about the patterns and causes of seasonal waterbird movements, which will be understood only through the coordination of census efforts with studies of individual species, particularly those involving marked birds. Census studies alone have many inherent limitations since our perceptions of seasonal abundance patterns obtained from graphs may not be correct. For example, a spring decline of Sanderlings at Bodega Bay easily might have been interpreted as the beginning of spring migration, but sightings of banded birds revealed that the decline reflected local movements to Point Reyes (Myers et al. 1985). Also, stable mid-winter peaks may suggest a lack of movement when in fact they conceal a dynamic stability in which departures and arrivals roughly cancel each other out (Evans and Pienkowski 1982, Myers et al. 1985). For species that occur year round, migration timing may be demonstrated only by intensive banding studies (e.g., Warriner et al. 1986). The importance of broad regional work is illustrated by both intra-estuarine (e.g., Bayer 1983) and inter-estuarine variation in seasonal abundance patterns (e.g., Jurek 1972, 1974; Prater 1979; this study).

California Perspective

The diversity of birds' seasonal use strategies in an estuary or a region is determined by climate, habitat and resource diversity, geographic setting, and perhaps tradition. The Mediterranean climate, which characterizes much of California, is found nowhere else in North America and only in a few places in the world (Major 1977). This climate is winter wet and summer dry, with the vast majority of precipitation falling as rain from October through April. We have discussed examples of the effects of seasonal rainfall on birds in the Point Reyes wetlands. We suspect that the amount of rainfall influences movement between estuarine and interior freshwater habitats, particularly in extremely wet and dry years. Such movements have been mentioned in the literature only infrequently (as for the Canvasback, Rienecker 1985), although we suspect they are an integral part of many species' strategies. Temperatures along the California coast vary little between summer and winter, with few days below freezing annually; generally temperatures decrease and rainfall increases with latitude along the coast. The mild winter climate allows a high diversity of waterbirds to overwinter on the coast. General avifaunal works (Grinnell and Miller 1944, McCaskie et al. 1979, Garrett and Dunn 1981) show that coastal California is primarily a wintering area for estuarine waterbirds, as demonstrated also by our study at Point Reyes. California is at the northern end of a broad geographical area (from 40°N to 40°S) with high numbers of shorebird species in the northern

winter (Pitelka 1979b). We know of no similar analysis for waterfowl or other waterbirds but suspect that California, and particularly Point Reyes, is at the high end of species diversity for estuarine waterbirds in winter on the Pacific Coast and perhaps for all of North America.

The productive current off the coast of California, Oregon, and Washington undergoes unique seasonal cycles not found elsewhere in North America. The influence of these cycles on seabirds breeding on the Farallon Islands and on the seasonal occurrence of offshore and pelagic species off the California coast has been well described (Ainley 1976a, Briggs et al. 1987, Ainley and Boekelheide in press). Research has also begun to focus on the effects of these cycles on estuarine and inshore species such as the Brown Pelican (Anderson and Anderson 1976, Briggs et al. 1981, 1983) and the Western Gull (Spear 1988). We surmise that several species that feed in late summer and fall in both inshore and estuarine waters have seasonal abundance patterns affected by the cycle of upwelling, which begins progressively later in the spring and summer from south to north along the California coast (Bakun et al. 1974, Brinton 1976). In addition to the Brown Pelican and Western Gull, these species are Brandt's Cormorant, Heermann's Gull, California Gull, and Elegant Tern (see Species Accounts).

The high diversity of species wintering in the Point Reyes area and California in general must reflect to some degree a high diversity of habitats. The extent, and presumably diversity, of coastal wetland habitats on the West Coast and their importance to waterfowl, however, are much less than on the Gulf and Atlantic coasts (Shaw and Fredine 1971, Sanderson 1980). On the basis of fragmentary information, the East Coast appears to be more important, overall, than the West Coast for staging of migratory shorebirds, but the latter area and the coastal southeastern United States are the only major wintering areas for shorebirds in North America (Senner and Howe 1984). Although the limited extent of West Coast estuaries probably is responsible for their secondary importance as staging grounds, geography must also play a part. California's position on the western edge of North America and the northwest-to-southeast orientation of the Americas places it out of a direct line for species migrating from the Arctic to tropical and south temperate areas, where most Western Hemisphere shorebirds winter (Senner and Howe 1984). On a regional scale, even when species are moving along a roughly straight corridor, migratory stops may by-pass seemingly suitable feeding areas because they are not strategically placed in relation to a direct route or the length of a particular migratory flight (e.g., Wilson 1981).

An underlying theme in recent research on waterbirds, because of many species' long-distance movements and elaborate life-history strategies, is the importance of advancing knowledge applicable to conservation on a broad geographic scale (e.g., Pitelka 1979a, Prater 1981, Senner and Howe 1984). Much of this work has focused on single species or specific taxonomic groups, particularly waterfowl and shorebirds, and only exceptionally have coordinated efforts been made to census all estuarine species in a large geographic area (e.g., Prater

1981). Advancement of knowledge has been uneven geographically, with Europe leading the way (e.g., Prater 1981, Evans et al. 1984), followed more recently by coordinated shorebird studies on the east and west coasts of North America and in Central and South America (Morrison and Harrington 1979, Myers 1983, Stenzel et al. 1989). Although some attention has been focused on the Pacific Coast (Pitelka 1979a), there has been no region-wide effort to census waterbirds except for federal and state waterfowl surveys and shorebird studies in California (Jurek 1974, Stenzel et al. 1989). Because of its unique climate, its role as a wintering area for aquatic birds, and the different sources of its waterbird populations, the Pacific Coast can provide a valuable perspective on waterbirds' seasonal occurrence patterns. Broad-scale census work is needed to provide information on the importance of various wetlands to waterbirds, while species-specific studies are needed for knowledge about local movements, habitat requirements, and foraging ecology. Intensive long-term local census studies such as ours are most useful in documenting long-term population trends, year-to-year variation in seasonal occurrence patterns, and, perhaps most importantly, in uncovering patterns that cry out for focused research.

SUMMARY

Long-term censuses at Point Reyes in coastal California provided information on the seasonal abundance of 122 species of aquatic birds. Two-thirds of the species were members of three families—the Anatidae (waterfowl), Scolopacidae (sandpipers and phalaropes), and Laridae (jaegers, gulls, and terns). The Point Reyes wetlands were used primarily by winter residents, secondarily by migrants, less by dispersants, and relatively little by year-round residents, summer residents, and breeders. The importance of Point Reyes as a wintering area was further emphasized by the fact that about 75% of the wintering species did not have migratory peaks on the wetlands. Shorebirds were the predominant group showing migratory peaks. Although most migrant species occurred in both spring and fall, the number of species of waterbirds was greatest in fall and early winter.

Inter-wetland variation in seasonal occurrence patterns was usually explainable by habitat and resource differences. The contrasts between a lagoon and two estuaries were due to different hydrographic regimes that may have caused changes in seasonal food availability or lowered prey densities, resulting in birds leaving after they depleted their prey. Rainfall and storms were probably the most important proximate factors influencing local and regional habitat shifts and the timing of these movements. The highest numbers of many species that use fresh water were found on the coastal wetlands during two years of a major drought. California's seasonal ocean cycles also affected some wetland species. These species varied the most in timing of arrival, departure, and peak abundance, and most dispersed north after breeding in the Gulf of California, with their movements timed to food availability and the progression of upwelling in spring and summer from south to north along

the coast. Population fluctuations and local movements of Northern Anchovies and Pacific Herring also strongly affected the timing and abundance of some fish- and egg-eaters.

On a continental scale, wetlands along the central California coast appear to be on the high end of wintering waterbird diversity, but overall they are of secondary importance as areas for wintering waterfowl and staging migrant shorebirds. Much work on the complexities of seasonal movements has been conducted in north temperate areas where freezing temperatures limit numbers of wintering species. Because of its seasonally wet climate, its importance as a wintering area, and the different sources of its waterbird populations, California can provide a valuable additional perspective on seasonal waterbird movements that may further help conservation efforts.

ACKNOWLEDGMENTS

Many volunteers and staff of Point Reyes Bird Observatory helped with the censuses that made this paper possible. We cannot list all their names here but express our deepest thanks to all who helped. Bill Clow, Bill Eastman, Phil Henderson, Phil Lenna, Mary Mayer, Libby Meyers, Bev McIntosh, Helen Pratt, John Smail, Bob Stewart, Alice Williams, and Pam Williams were regular censusers for extended periods during the study. Howard Cogswell took aerial photographs used for calculating habitat areas of the estuaries. Christmas Bird Count summaries were kindly provided for the Point Reyes Peninsula count by Gary Fellers, Bill Lenarz, and Irene Timossi, and for the Marin Co. (southern) count by Dianne Sierra. The California Department of Fish and Game kindly shared census data for Black Brant, J. P. Myers and associates for Sanderlings, and Larry B. Spear for California Gulls. David F. DeSante and Geoffrey R. Geupel gladly shared rainfall data collected at PRBO's Palomarin Field Station. Stephen F. Bailey, Alan D. Barron, Kurt F. Campbell, Richard A. Erickson, Ron LeValley, and David G. Yee kindly provided information from the notebooks of the Middle Pacific Coast Region of *American Birds*, as did Don Roberson from the data base of the California Bird Records Committee. We thank Chris Cutler, Julia Gennert, Karen Hamilton, and Susan Trivelpiece for drafting many of the figures, Gary Fellers for providing access to a lettering machine for preparing figures, and Susan Goldhaber, Meg Sanders, Meg Simonds, Liz Tuomi, and O'Brien Young for their efforts in preparation of the manuscript. Peter G. Connors and Joseph Morlan provided many helpful comments and criticisms of the manuscript, and Laurence C. Binford thoughtfully reviewed an earlier draft. Joseph Morlan also reviewed the Appendix drafted after the initial reviews. Several persons provided helpful insight on particular species: Daniel W. Anderson (Brown Pelican, Heermann's Gull, and Elegant Tern), Harry R. Carter (breeding seabirds), David B. Lewis (Brown Pelican), Helen M. Pratt (herons and egrets), Fred C. Schaffner (Elegant Tern), and Larry B. Spear (Western Gull). Financial support for some of the censusing came through Contract DE-AC03-79EV10254 from the U.S. Department of Energy. A grant from the Marin Sanctuary Program Office of NOAA helped fund the preparation of the report from which this paper evolved. Long-term projects such as this would not be possible without the support of the PRBO general membership. This is Contribution No. 344 of Point Reyes Bird Observatory.

LITERATURE CITED

Ainley, D. G. 1976a. The occurrence of seabirds in the coastal region of California. W. Birds 7: 33–68.

Ainley, D. G. 1976b. A spectacular seabird dieoff in 1976: A beach survey report. Point Reyes Bird Obs. Newsl. 39.

Ainley, D. G., Anderson, D. W., and Kelly, P. R. 1981. Feeding ecology of marine cormorants in southwestern North America. Condor 83: 120–131.

Ainley, D. G., and Boekelheide, R. J., eds. In press. Seabirds of the Farallon Islands: Ecology, Dynamics, and Structure of an Upwelling-System Community. Stanford Univ. Press, Stanford.

Ainley, D. G., and Lewis, T. J. 1974. The history of Farallon Island marine bird populations, 1854–1972. Condor 76: 432–446.

Ainley, D. G., and Sanger, G. A. 1979. Trophic relations of seabirds in the northeastern Pacific Ocean and Bering Sea, in Conservation of marine birds of northern North America (J. C. Bartonek and D. N. Nettleship, eds.), pp. 95–122. U.S. Fish Wildl. Serv. Wildl. Res. Rept. 11.

Alexander, W. C. 1983. Differential sex distributions of wintering diving ducks (Aythyini) in North America. Am. Birds 37: 26–29.

American Ornithologists' Union. 1957. Check-list of North American Birds. 5th ed. Am. Ornithol. Union, Baltimore.

American Ornithologists' Union. 1983. Check-list of North American Birds. 6th ed. Am. Ornithol. Union, Lawrence, KS.

Anderson, D. W., and Anderson, I. T. 1976. Distribution and status of Brown Pelicans in the California current. Am. Birds 30: 3–12.

Anderson, D. W., and Gress, F. 1983. Status of a northern population of California Brown Pelicans. Condor 85: 79–88.

Arnold, K. A. 1981. Fidelity of Common Snipe to winter grounds, with comments on local movements. Southwest. Nat. 26: 319–321.

Bakun, A., McClain, D. R., and Mayo, F. V. 1974. The mean annual upwelling off western North America as observed from surface measurements. Fish Bull., U. S. 72: 843–844.

Baltz, D. M., Morejohn, G. V., and Antrim, B. S. 1979. Size-selective predation and food habits of two California terns. W. Birds 10: 17–24.

Bayer, R. D. 1983. Seasonal occurrences of ten waterbird species at Yaquina Estuary, Oregon. Murrelet 64: 78–86.

Bellrose, F. C. 1980. Ducks, Geese, and Swans of North America. 3rd ed. Stackpole, Harrisburg, PA.

Bellrose, F. C., Scott, T. G., Hawkins, A. S., and Low, J. B. 1961. Sex ratios and age ratios in North American ducks. Ill. Nat. Hist. Surv. Bull. 27: 391–474.

Bent, A. C. 1921. Life histories of North American gulls and terns. U. S. Natl. Mus. Bull. 113.

Bent, A. C. 1926. Life histories of North American marsh birds. U. S. Natl. Mus. Bull. 135.

Bergquist, J. R. 1978. Depositional history and fault-related studies, Bolinas Lagoon, California. Open-File Rept. 78-802, U. S. Geol. Surv., Menlo Park.

Binford, L. C. 1983. Sixth report of the California Bird Records Committee. W. Birds 14: 127–145.

Binford, L. C. 1985. Seventh report of the California Bird Records Committee. W. Birds 16: 29–48

Blick, D. J., Jr. 1980. Advantages of flocking in some wintering shorebirds. Ph.D. thesis, Univ. of Michigan, Ann Arbor.

Boekelheide, R. J., Ainley, D. G., Huber, H. R., and Lewis, T. J. In press. Pelagic Cormorant and Double-crested Cormorant, in Seabirds of the Farallon Islands: Ecology, Dynamics, and Structure in an Upwelling-System Community (D. G. Ainley and R. J. Boekelheide, eds.). Stanford Univ. Press, Stanford.

Boekelheide, R. J., Ainley, D. G., Morrell, S. H., Huber, H. R., and Lewis, T. J. In press. Common Murre, in Seabirds of the Farallon Islands: Ecology, Dynamics, and Structure of an Upwelling-System Community (D. G. Ainley and R. J. Boekelheide, eds.). Stanford Univ. Press, Stanford.

Boekelheide, R. J., Ainley, D. G., Morrell, S. H., and Lewis, T. J. In press. Brandt's Cormorant, in Seabirds of the Farallon Islands: Ecology, Dynamics, and Structure in an Upwelling-System Community (D. G. Ainley and R. J. Boekelheide, eds.). Stanford Univ. Press, Stanford.

Bolander, G. L., and Parmeter, B. D. 1978. Birds of Sonoma County, California: An Annotated Checklist and Birding Gazetteer. B. D. Parmeter, 2500 Emerson St., Napa, CA 94558.

Bolander, L. P., Jr., and Bryant, C. A. 1930. Some notes on Point Reyes birds. Condor 32: 70–72.

Bollman, F. H., Thelin, P. K., and Forester, R. T. 1970. Bimonthly bird counts at selected observation points around San Francisco Bay, February, 1964, to January, 1966. Calif. Fish Game 56: 224–239.

Brewster, W. 1907. Notes on the Black Rail of California. Auk 24: 205–210.

Briggs, K. T., Dettman, K. T., Lewis, D. B., and Tyler, W. B. 1984. Phalarope feeding in relation to autumn upwelling off California, in Marine birds: Their feeding ecology and commercial fisheries relationships (D. N. Nettleship, G. A. Sanger, and P. F. Springer, eds.), pp. 51–62. Proc. Pac. Seabird Group Symp., Seattle, 6–8 Jan 1982.

Briggs, K. T., Lewis, D. B., Tyler, W. B., and Hunt, G. L., Jr. 1981. Brown Pelicans in southern California: Habitat use and environmental fluctuations. Condor 83: 1–15.

Briggs, K. T., Tyler, W. B., Lewis, D. B., and Carlson, D. R. 1987. Bird communities at sea off California: 1975 to 1983. Studies Avian Biol. 11.

Briggs, K. T., Tyler, W. B., Lewis, D. B., Kelly, P. R., and Croll, D. A. 1983. Brown Pelicans in central and northern California. J. Field Ornithol. 54: 353–373.

Brinton, E. 1976. Population biology of *Euphausia pacifica* off southern California. U.S. Fish Wild. Serv. Fish. Bull. 74: 733–762.

Carter, H. R., and Erickson, R. A. 1988. Population status and conservation problems of the Marbled Murrelet in California, 1897–1987. Final report to Calif. Dept. Fish Game, contract FG7569 (FY 1987–88).

Caspers, H. 1967. Estuaries: Analysis of definitions and biological considerations, in Estuaries (G. H. Lauff, ed.), pp. 6–8. Am. Assoc. Adv. Sci. Publ. 83.

Chaniot, G. E., Jr. 1966. Another California specimen of *Pluvialis dominica fulva*. Condor 68: 212.

Cogswell, H. L. 1974. Ecological factors in the hazard of gulls to aircraft in a bayside complex of airports and solid waste sites, in Proc. Conf. on Biol. Aspects of the Bird/Aircraft Collision Problem, pp. 27–108. Clemson Univ., Clemson, SC.

Cogswell, H. L. 1977. Waterbirds of California. Univ. Calif. Press, Berkeley.

Connelly, J., Jr. 1978. Trends in Blue-winged and Cinnamon Teal populations in eastern Washington. Murrelet 59: 2–6.

Connelly, J. W., and Ball, I. J. 1984. Comparisons of aspects of breeding Blue-winged and Cinnamon Teal in eastern Washington. Wilson Bull. 96: 626–633.

Connors, P. G. 1983. Taxonomy, distribution, and evolution of Golden Plovers (*Pluvialis dominica* and *Pluvialis fulva*). Auk 100: 607–620.

Connors, P. G., Myers, J. P., Connors, C. S. W., and Pitelka, F. A. 1981. Interhabitat movements by Sanderlings in relation to foraging profitability and the tidal cycle. Auk 98: 49–64.

Connors, P. G., Myers, J. P., and Pitelka, F. A. 1979. Seasonal habitat use by arctic Alaskan shorebirds, in Shorebirds in marine environments (F. A. Pitelka, ed.), pp. 101–111. Studies Avian Biol. 2.

Connors, P. G., and Smith, K. G. 1982. Ocean plastic particle pollution: Suspected effect on fat deposition in Red Phalaropes. Marine Pollution Bull. 13: 18–20.

Conover, M. R. 1983. Recent changes in Ring-billed and California Gull populations in the western United States. Wilson Bull. 95: 362–383.

Cottam, C., Lynch, J. J., and Nelson, A. L. 1944. Food habits and management of American sea brant. J. Wildl. Mgmt. 8: 36–56.

Coulson, J. C. 1966. The movements of the Kittiwake. Bird Study 13: 107–115.

Coulter, M. 1975. Post-breeding movements and mortality in the Western Gull, *Larus occidentalis*. Condor 77: 243–249.

Crosby, G. T. 1972. Spread of the Cattle Egret in the western hemisphere. Bird-Banding 43: 205–211.

DeSante, D. F., and Ainley, D. G. 1980. The avifauna of the South Farallon Islands, California. Studies Avian Biol. 4.

Devillers, P., McCaskie, G., and Jehl, J. R., Jr. 1971. The distribution of certain large gulls (*Larus*) in southern California and Baja California. Calif. Birds 2: 11–26.

Dunn, J. L. 1988. Tenth report of the California Bird Records Committee. W. Birds 19: 129–163.

Einarson, A. S. 1965. Black Brant, Sea Goose of the Pacific Coast. Univ. Wash. Press, Seattle.

Erskine, A. J. 1972. Buffleheads. Can. Wildl. Serv. Monogr. Ser. 4.

Evans, P. R. 1976. Energy balance and optimal foraging strategies in shorebirds: Some implications for their distribution and movement in the non-breeding season. Ardea 64: 117–139.

Evans, P. R. 1984. The significance of specific areas on the Palaearctic–African migration routes of waders: The British Isles, in Coastal Waders and Wildfowl in Winter (P. R. Evans, J. D. Goss-Custard, and W. G. Hale, eds.), pp. 261–275. Cambridge Univ. Press, Cambridge.

Evans, P. R., and Dugan, P. J. 1984. Coastal birds: Numbers in relation to food resources, in Coastal Waders and Wildfowl in Winter (P. R. Evans, J. D. Goss-Custard, and W. G. Hale, eds.), pp. 8–28. Cambridge Univ. Press, Cambridge.

Evans, P. R., Goss-Custard, J. D., and Hale, W. G., eds. 1984. Coastal Waders and Wildfowl in Winter. Cambridge Univ. Press, Cambridge.

Evans, P. R., and Pienkowski, M. W. 1982. Behavior of shelducks *Tadorna tadorna* in a winter flock: Does regulation occur? J. Anim. Ecol. 51: 241–262.

Evens, J., and Page, G. 1983. The ecology of rail populations at Corte Madera Ecological Reserve: With recommendations for management. Point Reyes Bird Obs./Marin Audubon Soc. Mgmt. Rept. P.R.B.O., 4990 Shoreline Hwy., Stinson Beach, CA 94970.

Evens, J., and Page, G. 1984. California Clapper Rail *Rallus longirostris obsoletus*. Endangered Species Information System. U. S. Fish Wildl. Serv., Portland, OR.

Evens, J., and Page, G. W. 1986. Predation on Black Rails during high tides in salt marshes. Condor 88: 107–109.

Evens, J. G., Page G. W., Stenzel, L. E., Stallcup, R. W., and Henderson, P. H. 1989. Distribution and relative abundance of the California Black Rail (*Laterallus jamaicensis coturniculus*) in the tidal marshes of the San Francisco Bay estuary. Report to Calif. Dept. Fish Game, Sacramento.

Evens, J., and Stallcup, R. 1986a. Monitoring avain communites at Olema and Livermore marshes, Tomales Bay, California: November 1985 to March 1986. Report to Audubon Canyon Ranch, 4900 Shoreline Hwy., Stinson Beach, CA 94970.

Evens, J., and Stallcup, R. 1986b. The 1986 breeding season at Olema and Livermore marshes, Tomales Bay, California: A monitoring project by Audubon Canyon Ranch, 4900 Shoreline Hwy., Stinson Beach, CA 94970.

Funderburk, S. L., and Springer, P. F. 1989. Wetland bird seasonal abundance and habitat use at Lake Earl and Lake Talawa, California. Calif. Fish Game 75: 85–101.

Gaines, D. 1988. Birds of Yosemite and the East Slope. Artemisia Press, Lee Vining, CA.

Garrett K., and Dunn, J. 1981. Birds of Southern California. Los Angeles Audubon Soc., Los Angeles.

Gerdes, G. L. 1970. Water bird counts at Morro Bay, 1966–67. Wildl. Mgmt. Branch Admin. Rept. 70-8. Calif. Dept. Fish Game, Sacramento.

Gerstenberg, R. H. 1972. A study of shorebirds (Charadrii) in Humboldt Bay, California—1968 to 1969. M.S. thesis, Humboldt State Univ., Arcata.

Gill, R., Jr. 1972a. Review of the bi-monthly bird counts of San Francisco Bay, February 1964–December 1965. Wildl. Mgmt. Branch Admin. Rept. 72-8. Calif. Dept. Fish Game, Sacramento.

Gill, R., Jr. 1972b. South San Francisco Bay breeding bird survey, 1971. Wildl. Mgmt. Branch Admin. Rept. 72-6. Calif. Dept. Fish Game, Sacramento.

Gill, R., Jr. 1976. On the foraging distance and prey selection of nesting Caspian Terns. Calif. Fish Game 62: 155.

Gill, R., Jr. 1977. Breeding avifauna of the south San Francisco Bay estuary. W. Birds 8: 1–12.

Gill, R., Jr. 1979. Status and distribution of the California Clapper Rail (*Rallus longirostris obsoletus*). Calif. Fish Game 65: 36–49.

Gill, R., Jr., and Mewaldt, L. R. 1979. Dispersal and migratory patterns of San Francisco Bay-produced herons, egrets, and terns. N. Am. Bird Bander 4: 4–13.

Gill, R. E., Jr., and Mewaldt, L. R. 1983. Pacific coast Caspian Terns: Dynamics of an expanding population. Auk 100: 369–381.

Goss-Custard, J. D. 1977. The ecology of the Wash. III. Density-related behavior and the possible effects of loss of feeding grounds on wading birds (Charadrii). J. Appl. Ecol. 14: 721–739.

Gress, F., Risebrough, R. W., Anderson, D. W., Kiff, L. F., and Jehl, J. R., Jr. 1973. Reproductive failure of Double-crested Cormorants in southern California and Baja California. Wilson Bull. 85: 197–208.

Grinnell, J., Bryant, H. C., and Storer, T. I. 1918. The Game Birds of California. Univ. Calif. Press, Berkeley.

Grinnell, J., and Miller, A. H. 1944. The distribution of the birds of California. Pac. Coast Avifauna 27.

Grinnell, J., and Wythe, M. W. 1927. Directory to the bird life of the San Francisco Bay region. Pac. Coast Avifauna 18.

The Gull. Golden Gate Audubon Society monthly bulletin. G.G.A.S., 1250 Addison St., #107B, Berkeley, CA 94702.

Harrington, B. A. 1975. Pelagic gulls in winter off southern California. Condor 77: 346–350.

Harrington, B. A. 1982. Untying the enigma of the Red Knot. Living Bird Quart. 1(2): 4–7.

Harrington, B. A., and Morrison, R. I. G. 1979. Semipalmated Sandpiper migration in North America, in Shorebirds in marine environments (F. A. Pitelka, ed.), pp. 83–100. Studies Avian Biol. 2.

Henderson, P. 1979. A Dotterel on Southeast Farallon Island, California. W. Birds 10: 92–94.

Henny, C., and Collins, J. 1980. Early concentrations of Brown Pelicans along southern Oregon coast. Murrelet 61: 99–100.

Hochbaum, H. A. 1955. Travels and Traditions of Waterfowl. Univ. Minn. Press, Minneapolis.

Hoffman, W., Wiens, J. A., and Scott, J. M. 1978. Hybridization between gulls (*Larus glaucescens* and *L. occidentalis*) in the Pacific northwest. Auk 95: 441–458.

Holmes, R. T. 1966. Breeding ecology and annual cycle adaptations of the Red-backed Sandpiper (*Calidris alpina*) in northern Alaska. Condor 68: 3–46.

Ives, J. H. 1972. Common Egret and Great Blue Heron nest study, Indian Island, Humboldt County, California 1971–72. Wildl. Mgmt. Branch Admin. Rept. No. 72-9. Calif. Dept. Fish Game, Sacramento.

Ivey, G. L., Stern, M. A., and Carey, C. G. 1988. An increasing White-faced Ibis population in Oregon. W. Birds 19: 105–108.

Jehl, J. R., Jr. 1963. An investigation of fall-migrating dowitchers in New Jersey. Wilson Bull. 75: 250–261.

Jehl, J. R., Jr. 1979. The autumn migration of Baird's Sandpiper, in Shorebirds in marine environments (F. A. Pitelka, ed.), pp. 55–68. Studies Avian Biol. 2.

Jehl, J. R., Jr. 1988. Biology of the Eared Grebe and Wilson's Phalarope in the nonbreeding season: A study of adaptations to saline lakes. Studies Avian Biol. 12.

Jehl, J. R., Jr., and Craig, A. M. 1970. San Diego shorebird study. Spec. Wildl. Invest. Rept., Project W-54-R. Calif. Dept. Fish Game, Sacramento.

Jeter, H. H., and Paxton, R. O. 1964. Little Blue Heron collected in California. Condor 66: 447.

Johnsgard, P. A. 1978. Ducks, Geese, and Swans of the World. Univ. Nebr. Press, Lincoln.

Johnsgard, P. A. 1981. The Plovers, Sandpipers, and Snipes of the World. Univ. Nebr. Press, Lincoln.

Johnston, D. W. 1956. The annual reproductive cycle of the California Gull. I. Criteria of age and the testis cycle. Condor 58: 134–162.

Jones, P. A. 1986. Aspects of the reproductive biology of the California Gull in Alviso, California. M.A. thesis, San Francisco State Univ.

Jorde, D. G., Krapu, G. L., Crawford, R. D., and Hay, M. A. 1984. Effects of weather on habitat selection and behavior of Mallards in Nebraska. Condor 86: 258–265.

Josselyn, M. 1983. The ecology of the San Francisco Bay tidal marshes: A community profile. U. S. Fish Wildl. Serv. FWS/OBS-83/23.

Jurek, R. M. 1972. California shorebird survey, 1970–71. Spec. Wildl. Invest. Proj. Rept. Calif. Dept. Fish Game, Sacramento.

Jurek, R. M. 1973. California shorebird survey, 1969–74. Spec. Wildl. Invest. Proj. Final Rept. Calif. Dept. Fish Game, Sacramento.

Jurek, R. M. 1974. California shorebird survey 1969–74. Spec. Wild. Invest. Rept. Proj. W-54-R, Job III-1. Calif. Dept. Fish Game, Sacramento.

Kelly, P. R., and Cogswell, H. L. 1979. Movements and habitat use by wintering populations of Willets and Marbled Godwits, in Shorebirds in marine environments (F. A. Pitelka, ed.), pp. 15–32. Studies Avian Biol. 2.

King, D. B., Baumgartel, M., DeBeer, J., and Meyer, T. 1987. The birds of San Elijo Lagoon, San Diego County, California. W. Birds 18: 177–208.

Kushlan, J. A. 1981. Resource use strategies of wading birds. Wilson Bull. 93: 145–163.

Lenna, P. 1969. Short-billed and Long-billed Dowitchers in the Point Reyes, California, area. Point Reyes Bird Obs. Newsl. 13.

Leopold, A. S., and Smith, R. S. 1953. Numbers and winter distribution of Pacific Black Brant in North America. Calif. Fish Game 39: 95–101.

Lidicker, W. Z., Jr., and McCollum, F. C. 1979. Canada Goose established as a breeding species in San Francisco Bay. W. Birds 10: 159–162.

Loftin, H. 1962. A study of boreal shorebirds summering on Apalachee Bay, Florida. Bird-Banding 33: 21–42.

Lowe-McConnell, R. H. 1967. Biology of the immigrant Cattle Egret *Ardeola ibis* in Guyana, South America. Ibis 109: 168–179.

Ludwig, J. P. 1965. Biology and structure of the Caspian Tern (*Hydroprogne caspia*) population of the Great Lakes from 1896–1964. Bird-Banding 36: 217–233.

Luther, J. S. 1980. Fourth report of the California Bird Records Committee. W. Birds 11: 161–173.

Luther, J. S., McCaskie, G., and Dunn, J. 1979. Third report of the California Bird Records Committee. W. Birds 10: 169–187.

Luther, J. S., McCaskie, G., and Dunn, J. 1983. Fifth report of the California Bird Records Committee. W. Birds 14: 1–16.

Maillard, J. 1904. A few records supplementary to Grinnell's check-list of California birds. Condor 6: 14–16.

Mais, K. F. 1974. Pelagic fish surveys in the California Current. Calif. Dept. Fish Game Fish. Bull. 162: 1–79.

Major, J. 1977. California climate in relation to vegetation, in Terrestrial Vegetation of California (M. G. Barbour and J. Major, eds.), pp. 11–74. Wiley, New York.

Manolis, T. 1978. Status of the Black Rail in central California. W. Birds 9: 151–158.

McCaskie, R. G. 1965. The Cattle Egret reaches the west coast of the United States. Condor 67: 89.

McCaskie, G., DeBenedictis, P., Erickson, R., and Morlan, J. 1979. Birds of Northern California: An Annotated Field List. 2nd ed. Golden Gate Audubon Soc., Berkeley.

Moffitt, J. 1932. Second annual Black Brant census in California. Calif. Fish Game 18: 298–310.

Moffitt, J. 1939. Notes on the distribution of Whistling Swan and Canada Goose in California. Condor 41: 93–97.

Moffitt, J. 1940. Third record of the King Eider in California. Condor 42: 305.

Moffitt, J. 1941. Eleventh annual Black Brant census in California. Calif. Fish Game 27: 216–233.

Moffitt, J. 1943. Twelfth annual Black Brant census in California. Calif. Fish Game 29: 19–28.

Moffitt, J., and Cottam, C. 1941. Eelgrass depletion on the Pacific coast and its effect upon Black Brant. U.S. Fish Wildl. Serv. Wildl. Leaflet 204.

Morlan, J. 1985. Eighth report of the California Bird Records Committee. W. Birds 16: 105–122.

Morlan, J., and Erickson, R. 1988. Supplement to the Birds of Northern California, in McCaskie, G., DeBenedictis, P., Erickson, R., and Morlan, J. 1979. Birds of Northern California: An Annotated Field List. 2nd ed. Golden Gate Audubon Soc., Berkeley. Reprinted with supplement, April 1988.

Morrison, R. I. G. 1984. Migration systems of some New World shorebirds, in Shorebirds: Migration and Foraging Behavior (J. Burger and B. L. Olla, eds.), pp. 125–202. Behavior of Marine Animals. Vol 6. Plenum, New York.

Morrison, R. I. G., and Harrington, B. A. 1979. Critical shorebird resources in James Bay and eastern North America. Trans. N. Am. Wildl. Nat. Resource Conf. 44: 498–507.

Morrison, R. I. G., Harrington, B. A., and Leddy, L. E. 1980. Migration routes and stopover areas of North American Red Knots *Calidris canutus* wintering in South America. Wader Study Group Bull. 28: 35–39.

Murphy, G. I. 1966. Population biology of the Pacific sardine (*Sardinops caerulea*). Proc. Calif. Acad. Sci. 34: 1–84.

Myers, J. P. 1980. Sanderlings *Calidris alba* at Bodega Bay: Facts, inferences, and shameless speculations. Wader Study Group Bull. 30: 26–32.

Myers, J. P. 1981a. Cross-seasonal interactions in the evolution of sandpiper social systems. Behav. Ecol. Sociobiol. 8: 195–202.

Myers, J. P. 1981b. A test of three hypotheses for latitudinal segregation of the sexes in wintering birds. Can. J. Zool. 59: 1527–1534.

Myers, J. P. 1983. Conservation of migrating shorebirds: Staging areas, geographic bottlenecks, and regional movements. Am. Birds 37: 23–25.

Myers, J. P., Maron, J. L., and Sallaberry, M. 1985. Going to extremes: Why do Sanderlings migrate to the Neotropics?, in Neotropical Ornithology (P. A. Buckley, M. S. Foster, E. S. Morton, R. S. Ridgely, and F. G. Buckley, eds.), pp. 520–535. Ornithol. Monogr. 36.

Myers, J. P., Schick, C. T., and Hohenberger, C. J. 1984. Notes on the 1983 distribution of Sanderlings along the United States' Pacific Coast. Wader Study Group Bull. 40: 22–26.

Naylor, A. E. 1960. The Wood Duck in California with special reference to the use of nest boxes. Calif. Fish Game 46: 241–269.

Nichols, D. R., and Wright, N. A. 1971. Preliminary map of the historic marshlands, San Francisco Bay, California. Open File Rept. Basic Data Contrib. 9, U. S. Geol. Surv., Menlo Park.

Ohlendorf, H. M., Schaffner, F. C., Custer, T. W., and Stafford, C. J. 1985. Reproduction and organochlorine contaminants in terns at San Diego Bay. Colonial Waterbirds 8: 42–53.

Oring, L. W., and Davis, W. M. 1966. Shorebird migration at Norman, Oklahoma: 1961–63. Wilson Bull. 78: 166–174.

Orr, E. D., Ward, R. M. P, Williams, N. A., and Brown, R. G. 1982. Migration patterns of Red and Northern phalaropes in the southwest Davis Strait and in the northern Labrador Sea. Wilson Bull. 94: 303–312.

Orr, R. T. 1944. A coastal record of the Emperor Goose in California. Condor 46: 90.

Orr, R. T. 1950. A new North American record for the Tufted Duck. Condor 52: 140.

Orr, R. T. 1962. The Tufted Duck in California. Auk 79: 482–483.

Page, G. W., Bidstrup, F. C., Ramer, R. J, and Stenzel, L. E. 1986. Distribution of wintering Snowy Plovers in California and adjacent states. W. Birds 17: 145–170.

Page, G., Fearis, B., and Jurek, R. M. 1972. Age and sex composition of Western Sandpipers on Bolinas Lagoon. Calif. Birds 3: 79–86.

Page, G. W., Shuford, W. D., Evens, J. G., and Stenzel, L. E. 1983. The distribution and abundance of aquatic birds in wetlands of the Point Reyes to Bodega area. A report for the Point Reyes–Farallones Marine Sanctuary. P.R.B.O., 4990 Shoreline Hwy., Stinson Beach, CA 94970.

Page, G. W., and Stenzel, L. E., eds. 1981. The breeding status of the Snowy Plover in California. W. Birds 12: 1–40.

Page, G., Stenzel, L. E., and Wolfe, C. M. 1979. Aspects of the occurrence of shorebirds on a central California estuary, in Shorebirds in marine environments (F. A. Pitelka, ed.), pp. 15–32. Studies Avian Biol. 2.

Palmer, R. S., ed. 1962. Handbook of North American Birds. Vol. 1. Loons through Flamingos. Yale Univ. Press, New Haven.

Palmer, R. S. 1967. Species accounts, in The Shorebirds of North America (G. D. Stout, ed.), pp. 143–267. Viking Press, New York.

Palmer, R. S., ed. 1976a. Handbook of North American Birds. Vol. 2, Waterfowl (Part 1). Yale Univ. Press, New Haven.

Palmer, R. S., ed. 1976b. Handbook of North American Birds. Vol. 3, Waterfowl (Part 2). Yale Univ. Press, New Haven.

Parrish, R. H., Nelson, C. S., and Bakun, A. 1981. Transport mechanisms and reproductive success of fishes in the California Current. Biol. Oceanogr. 1: 175–203.

Paulson, D. R. 1983. Fledgling dates and southward migration of juveniles of some *Calidris* sandpipers. Condor 85: 99–101.

Phillips, A. R. 1975. Why neglect the difficult? W. Birds 6: 69–86.

Pienkowski, M. W., and Evans, P. R. 1984. Migratory behavior of shorebirds in the Western Palearctic, in Shorebirds: Migration and Foraging Behavior (J. Burger and B. L. Olla, eds.), pp. 73–123. Behavior of Marine Animals. Vol. 6. Plenum, New York.

Pienkowski, M. W., Fearns, P. N., Davidson, N. C., and Worrall, D. H. 1984. Balancing the budget: Measuring the energy intake and requirements of shorebirds in the field, in Coastal Waders and Wildfowl in Winter (P. R. Evans, J. D. Goss-Custard, and W. G. Hale, eds.), pp. 29–56. Cambridge Univ. Press, Cambridge.

Pitelka, F. A. 1950. Geographic variation and the species problem in the shore-bird genus *Limnodromus*. Univ. Calif. Publ. Zool. 50.

Pitelka, F. A., ed. 1979a. Shorebirds in marine environments. Studies Avian Biol. 2.

Pitelka, F. A. 1979b. Introduction: The Pacific Coast shorebird scene, in Shorebirds in marine environments (F. A. Pitelka, ed.), pp. 1–11. Studies Avian Biol. 2.

Prater, A. J. 1979. Shorebird census studies in Britain, in Shorebirds in marine environments (F. A. Pitelka, ed.), pp. 157–166. Studies in Avian Biol. 2.

Prater, A. J. 1981. Estuary Birds of Britain and Ireland. Poyser, Calton, England.

Pratt, H. M. 1970. Breeding biology of Great Blue Herons and Common Egrets in central California. Condor 72: 407–416.

Pratt, H. M. 1972a. Nesting success of Common Egrets and Great Blue Herons in the San Francisco Bay region. Condor 74: 447–453.

Pratt, H. M. 1972b. Nesting success of Great Blue Herons and Common Egrets at Audubon Canyon Ranch in 1971. Am. Birds 26: 699–702.

Pratt, H. M. 1974. Breeding of Great Blue Herons and Great Egrets at Audubon Canyon Ranch, California, 1972–73. W. Birds 5: 127–136.

Pratt, H. M. 1980. Directions and timing of Great Blue Heron foraging flights from a California colony: Implications for social facilitation of food finding. Wilson Bull. 92: 489–496.

Pratt, H. M. 1983. Marin County California heron colonies: 1967–1981. W. Birds 14: 169–184.

Pritchard, D. W. 1967. What is an estuary: Physical viewpoint, in Estuaries (G. H. Lauff, ed.), pp. 3–5. Am. Assoc. Adv. Sci. Publ. 83.

Ralph, C. J. 1969. An analysis of offshore migration. Point Reyes Bird Obs. Newsl. 12.

Ralph, C. J., and Ralph, C. R. 1958. Notes on the nesting of egrets near San Rafael, California. Condor 60: 70–71.

Ratti, J. T. 1981. Identification and distribution of Clark's Grebe. W. Birds 12: 41–46.

Recher, H. R. 1966. Some aspects of the ecology of migrant shorebirds. Ecology 47: 393–407.

Remsen, J. V., Jr. 1978. Bird species of special concern in California. Wildl. Mgmt. Branch Admin. Rept. 78-1. Calif. Dept. Fish Game, Sacramento.

Remsen, J. V., Jr., and Binford, L. C. 1975. Status of the Yellow-billed Loon (*Gavia adamsii*) in the western United States. W. Birds 6: 7–20.

Richardson, S. L. 1980. Spawning biomass and early life of northern anchovy, *Engraulis mordax*, in the northern subpopulation off Oregon and Washington. Fish. Bull. 78: 855–876.

Rienecker, W. C. 1985. An analysis of Canvasbacks banded in California. Calif. Fish Game 71: 141–149.

Rigney, M., and Rigney, T. 1981. A breeding bird survey of the south San Francisco salt pond levee system. A report to the San Francisco Bay Natl. Wildl. Refuge, P.O. Box 524, Newark, CA 94560.

Ritter, J. R. 1969. Preliminary studies of sedimentation and hydrology in Bolinas Lagoon, Marin County, California, May 1967–June 1968. U.S. Dept. Int., Geol. Surv., Water Resources Div., Menlo Park, CA.

Ritter, J. R., and Brown, W. M, III. 1973. Bolinas Lagoon, Marin County, California. Summary of sedimentation and hydrology, 1967–69. U.S. Dept. Int., Geol. Surv., Water Resources Div., Menlo Park, CA.

Roberson, D. 1980. Rare Birds of the West Coast of North America. Woodcock Publ., Pacific Grove, CA.

Roberson, D. 1985. Monterey Birds. Monterey Peninsula Audubon Soc., Carmel, CA.

Roberson, D. 1986. Ninth report of the California Bird Records Committee. W. Birds 17: 49–77.

Salt, G. W., and Willard, D. E. 1971. The hunting behavior and success of Forster's Tern. Ecology 52: 989–998.

Sanderson, G. C. 1980. Conservation of waterfowl, in Ducks, Geese, and Swans of North America (F. C. Bellrose, ed.), pp. 43–58. 3rd ed. Stackpole, Harrisburg, PA.

Sanger, G. A. 1970. The seasonal distribution of some seabirds off Washington and Oregon, with notes on their ecology and behavior. Condor 72: 339–357.

Sanger, G. A. 1973. Pelagic records of Glaucous-winged and Herring Gulls in the North Pacific Ocean. Auk 90: 384–393.

Schaffner, F. C. 1985. Royal Tern nesting attempts in California: Isolated or significant incidents? W. Birds 16: 71–80.

Schaffner, F. C. 1986. Trends in Elegant Tern and Northern Anchovy populations in California. Condor 88: 347–354.

Schneider, D. C., and Harrington, B. A. 1981. Timing of shorebird migration in relation to prey depletion. Auk 98: 801–811.

Scott, J. M. 1971. Interbreeding of the Glaucous-winged Gull and Western Gull in the Pacific Northwest. Calif. Birds 2: 129–133.

Senner, S. E., and Howe, M. A. 1984. Conservation of nearctic shorebirds, in Shorebirds: Breeding Behavior and Populations (J. Burger and B. L. Olla, eds.), pp. 379–421. Behavior of Marine Animals. Vol. 5. Plenum, New York.

Shaw, S. P., and Fredine, C. G. 1971. Wetlands in the United States: Their extent and their value to waterfowl and other wildlife. U. S. Fish Wildl. Serv. Circ. 39.

Shuford, W. D. 1982. Field checklist of the birds of Marin County, Alta California. P.R.B.O., 4990 Shoreline Hwy., Stinson Beach, CA 94970.

Sibley, C. G. 1952. Birds of the south San Francisco Bay region. San Jose State College, mimeo. 44 pp. Available at P.R.B.O. Library, 4990 Shoreline Hwy., Stinson Beach, CA 94970.

Sidle, J. G., Koonz, W. H., and Roney, K. 1985. Status of the American White Pelican: An update. Am. Birds 39: 859–864.

Siegfried, W. R., 1970. Mortality and dispersal of ringed Cattle Egrets. Ostrich 41: 122–135.

Siegfried, W. R. 1978. Habitat and the modern range expansion of the Cattle Egret, in Wading birds (A. Sprunt IV, J. C. Ogden, and S. Winckler, eds.), pp. 315–324. Natl. Audubon Soc., Res. Rept. 7.

Sloan, N. F. 1982. Status of breeding colonies of White Pelicans in the United States through 1979. Am. Birds 36: 250–254.

Smith, M., Steinbach, T., and Pampush, G. 1984. Distribution, foraging relationships and colony dynamics of the American White Pelican, *Pelecanus erythrorhynchos*, in southern Oregon and northeastern California. Unpubl. ms. The Nature Conservancy, 785 Market St., San Francisco, CA 94103.

Sowls, A. L., DeGange, A. R., Nelson, J. W., and Lester, G. S. 1980. Catalog of California seabird colonies. U.S. Fish Wildl. Serv., Biol. Serv. Prog. FWS/OBS 37/80.

Spear, L. B. 1988. Dispersal patterns of Western Gulls from Southeast Farallon Island. Auk 105: 128–141.

Spear, L. B., Penniman, T. M., Penniman, J. F., Carter, H. R., and Ainley, D. G. 1987. Survivorship and mortality factors in a population of Western Gulls, in Ecology and behavior of Gulls (J. L. Hand, W. E. Southern, and K. Vermeer, eds.), pp. 44–56. Studies Avian Biol. 10.

Spratt, J. D. 1981. Status of the Pacific herring (*Clupea harengus pallasii*) resource in California 1972 to 1980. Calif. Dept. Fish Game Fish Bull. 171.

Stallcup, R. W. 1976. Pelagic birds of Monterey Bay, California. W. Birds 7: 113–136.

Stenzel, L. E., Huber, H. R., and Page, G. W. 1976. Feeding behavior and diet of the Long-billed Curlew and Willet. Wilson Bull. 88: 314–332.

Stenzel, L. E., Kjelmyr, J. E., Page, G. W., and Shuford, W. D. 1989. Results of the first comprehensive shorebird census of northern and central California coastal wetlands, 8–12 September 1988. A report of Point Reyes Bird Observatory, 4990 Shoreline Hwy., Stinson Beach, CA 94970.

Stenzel, L. E., Page, G. W., Carter, H. R., and Ainley, D. G. 1988. Seabird mortality in California as witnessed through 14 years of beached bird censuses. Final Report to the Gulf of the Farallones National Marine Sanctuary, Fort Mason #201, San Francisco, CA 94123.

Stenzel, L. E., Peaslee, S. C., and Page, G. W. 1981. Part II. Mainland Coast, in The breeding status of the Snowy Plover in California (G. W. Page and L. E. Stenzel, eds.), pp. 6–16. W. Birds 12: 1–40.

Stephens, A. B. 1931. Audubon notes. Gull 13(7).

Stephens, L. A., and Pringle, C. C. 1933. Birds of Marin County. Audubon Association of the Pacific, San Francisco. Avialable at P.R.B.O. Library, 4990 Shoreline Hwy., Stinson Beach, CA 94970.

Stone, K., and Rigney, M. 1978. The reproductive success of three species of herons nesting on Bair Island, San Mateo County, 1978. Report to San Francisco Bay Natl. Wildl. Refuge, P. O. Box 524, Newark, CA 94560.

Stoner, E. A. 1934. Recent occurrence of the American Egret in the San Francisco Bay region. Condor 36: 57–59.

Storer, R. W. 1951. The seasonal occurrence of shorebirds on Bay Farm Island, Alameda County, California. Condor 53: 186–193.

Storer, T. I. 1915. Additional records of the California Clapper Rail and Red Phalarope in California. Condor 17: 98.

Swarth, C. W., Akagi, C., and Metropulos, P. 1982. The distribution patterns and ecology of waterbirds using the Coyote Hills salt ponds. Report to San Francisco Bay Natl. Wildl. Refuge, P. O. Box 524, Newark, CA 94560.

Takekawa, J. E., Carter, H. R., and Harvey, T. E. In press. Decline of the Common Murre *Uria aalge*) in central California. Studies Avain Biol.

Townshend, D. J. 1985. Decisions of a lifetime: Establishment of spatial defence and movement patterns by juvenile Grey Plovers (*Pluvialis squatarola*). J. Anim. Ecol. 54: 267–274.

Unitt, P. 1977. The Little Blue Heron in California. W. Birds 8: 151–154.

Van der Have, T. M., Nieboer, E., and Boere, G. C. 1984. Age-related distribution of Dunlin in the Dutch Wadden Sea, in Coastal Waders and Wildfowl in Winter (P. R. Evans, J. D. Goss-Custard, and W. G. Hale, eds.), pp. 160–176. Cambridge Univ. Press, Cambridge.

Vermeer, K. 1970. Breeding biology of California and Ring-billed Gulls. Can. Wildl. Serv. Rept. Ser. 12.

Vermeer, K., and Bourne, N. 1984. The White-winged Scoter diet in British Columbia waters: Resource partitioning with other scoters, in Marine birds: Their feeding ecology and commercial fisheries relationships (D. N. Nettleship, G. A. Sanger, and P. F. Springer, eds.), pp. 30–38. Proc. Pac. Seabird Group Symp., Seattle, 6–8 Jan 1982.

Ver Planck, W. E. 1951. Salines in the Bay Area, in Geologic guidebook of the San Francisco Bay counties, pp. 219–222. Calif. Div. Mines. Bull. 154.

Wahl, J. R. 1975. Seabirds in Washington's offshore zone. W. Birds 6: 117–134.

Warriner, J. S., Warriner, J. C., Page, G. W., and Stenzel, L. E. 1986. Mating system and reproductive success of a small population of polygamous Snowy Plovers. Wilson Bull. 98: 15–37.

Wheeler, R. J. 1965. Pioneering Blue-winged Teal in California, Oregon, Washington and British Columbia. Murrelet 46: 40–42.

Williams, A., and Miller, G. W. 1963. A Trumpeter Swan in Marin County, California. Condor 65: 69.

Willett, G. 1933. A revised list of the birds of southwestern California. Pac. Coast Avifauna 21.

Wilson, J. R. 1981. The migration of High Arctic shorebirds through Iceland. Bird Study 28: 21–32.

Winkler, D. W., Weigen, C. P., Engstrom, F. B., and Burch, S. E. 1977. Ornithology, in An ecological study of Mono Lake, California (D. W. Winkler, ed.), pp. 88–113. Inst. Ecol. Publ. 12. Univ. of Calif., Davis.

Winter, J. 1973. The California Field Ornithologists Records Committee report 1970–1972. W. Birds 4: 101–106.

Winter, J., and Erickson, D. 1977. The winter season. Middle Pacific Coast region. Am. Birds 31: 367–372.

Winter, J., and McCaskie, G. 1975. 1973 report of the California Field Ornithologists Records Committee. W. Birds 6: 135–144.

Woodbury, A. M., and Knight, H. 1951. Results of the Pacific gull color-banding project. Condor 53: 57–77.

Yocum, C. F., and Harris, S. W. 1975. Status, habitats, and distribution of birds of northwestern California. Humboldt State Univ. Bookstore, Arcata, CA.

Yocum, C. F., and Wooten, W. A. 1956. Blue-winged Teal in Del Norte County, California. Calif. Fish Game 42: 81.

Zwarts, L. 1976. Density-related processes in feeding dispersion and feeding activity of Teal *Anas crecca*. Ardea 64: 192–209.

Accepted 1 September 1989

APPENDIX

The following accounts are of waterbird species from Point Reyes not detected on censuses because of their extreme rarity or their preference for non-estuarine habitats. We have included many species with strong affinities for offshore and oceanic waters when they have been recorded alive onshore or when seen with some regularity from shore. Because they are generally associated with the open ocean we have excluded all Procellariiformes, although species such as the Sooty Shearwater can be abundant in inshore waters here. Additional species that have been seen at sea off Point Reyes or have been recorded from beach-cast specimens are the Short-tailed Albatross, Black-footed Albatross, Laysan Albatross, Northern Fulmar, Mottled Petrel, Murphy's Petrel, Cook's Petrel, Pink-footed Shearwater, Flesh-footed Shearwater, Buller's Shearwater, Short-tailed Shearwater, Black-vented Shearwater, Wilson's Storm-Petrel, Fork-tailed Storm-Petrel, Leach's Storm-Petrel, Black Storm-Petrel, Long-tailed Jaeger, South Polar Skua, Arctic Tern, Craveri's Murrelet, Parakeet Auklet, Crested Auklet, and Horned Puffin.

Their status in waters off Point Reyes is covered by references on pelagic species in California (Ainley 1976a, Stallcup 1976, Sowls et al. 1980, Roberson 1985, Briggs et al. 1987) or more general avifaunal works discussing northern California (Grinnell and Miller 1944, McCaskie et al. 1979, Morlan and Erickson 1988).

Yellow-billed Loon (*Gavia adamsii*)

Six Point Reyes records, all of single birds: five for Tomales Bay from 13 Nov to 1 Jan, 1967 to 1983, and one for Drake's Estero on 13 Apr 1983 (CBRC). Details of a Tomales Bay report for 25 Jan 1971 (AB 25: 620) have not been submitted to the CBRC; an additional 4 Point Reyes reports have been rejected by the CBRC. First recorded in California in 1967, now occurs annually in the state with 42 accepted records of single birds (CBRC). Yellow-billed Loons have been found in California waters every month of the year, but most birds occur from from Dec through Apr (Remsen and Binford 1975, CBRC). They usually prefer large bays, estuaries, inshore ocean waters, or, occasionally, freshwater lakes.

Red-footed Booby (*Sula sula*)

An immature was seen from the mouth of San Francisco Bay north to Bolinas (14 Oct) from 13 to 18 Oct 1987 until picked up sick and brought to a wildlife rehabilitation center on 18 Oct (CBRC, AB 42: 128, ABN). This was 1 of 4 (possibly 5) Red-footed Boobies sighted off California in fall 1987, and 1 of a total of 7 accepted records for California (since 1975), all in fall from 26 Aug to 15 Nov, except for one for 22 May 1985 (CBRC).

Magnificent Frigatebird (*Fregata magnificens*)

There are at least 5 inshore or estuarine records for Point Reyes involving at least 7 birds (mostly immatures) from 12 Jul to 26 Aug (ABN, PRBO). Magnificant Frigatebirds occur in coastal waters of northern California primarily as post-breeding dispersants from Mexico and mostly from mid-Jul to early Sep (ABN). Extreme dates are 20 Jun and 20 Oct (Grinnell and Miller 1944, ABN), except for 3 winter records (McCaskie et al. 1979, AB 34: 302, AB 40: 519).

Least Bittern (*Ixobrychus exilis*)

Three records for Point Reyes: 1 adult at Drake's Beach pond on 18 Sep 1980 (AB 35: 220), 1 at Olema Marsh on 27 Dec 1967 (ABN: RS), and 1 at Olema Marsh on 29 Jan 1969 (AB 23: 515). Occurs irregularly on the northern California coast with records for every month (ABN, Grinnell and Wythe 1927, Roberson 1985). Interior breeding populations have declined, owing to habitat loss (Remsen 1978).

White-faced Ibis (*Plegadis chihi*)

Two fall records: singles at Drake's Estero on 12 Oct 1978 (AB 33: 210) and on "Point Reyes" on 6 Oct 1985 (ABN: RMS). Local spring records, all in 1988 and perhaps involving the same birds: 15 birds flying south by Cypress Grove, near Marshall, Tomales Bay, on 20 May (ABN: JPK), up to 12 at Bolinas sewer ponds on 25 and 26 May (DDeS et al.), and 4 on outer Point Reyes on 26 May (ABN: RS). The birds were observed at freshwater ponds and marshes and in flight.

On the northern California coast White-faced Ibises occur almost annually in fall from 9 Aug to 19 Nov, except for 1 bird that lingered from 11 Oct to 28 Dec; there are 5 additional winter records, 25 Dec–20 Mar (ABN, Roberson 1985).

Fall records are usually of 1–3 birds, rarely up to 15; maximum for winter is 31. Spring records, of flocks up to 57 birds, extend from 3 May to 20 Jun with most from mid- to late May (ABN, Roberson 1985). Formerly accidental on the northern California coast in spring until seen in 5 of 7 years from 1981 to 1987 (ABN). A major coastal influx in spring 1988 involved about 15 widespread records of about 300 birds total (ABN). Until recently, White-faced Ibis had declined markedly in California (Grinnell and Miller 1944, Remsen 1978). Breeding ibises expanded their range and increased their population in the interior of California (ABN) and Oregon (Ivey et al. 1988) during a wet period from 1982 to 1985, when flooding may have displaced breeding ibises from Great Salt Lake (Ivey et al. 1988). The 1988 influx to coastal California may have been prompted by recent colonizers abandoning marshes in the interior of the state that dried up during the drought in 1987 and 1988.

Trumpeter Swan (*Cygnus buccinator*)

The only Point Reyes record, of a single bird at Abbott's Lagoon from 1 Jan to 9 Mar 1962 (Williams and Miller 1963, Dunn 1988), is one of a total of 11 accepted records for California involving 19 birds on dates spanning 8 Nov to 15 Mar, 1935 to 1987 (CBRC).

Yellow Rail (*Coturnicops noveboracensis*)

There are 7 old specimen records for Point Reyes from marshes at the south end of Tomales Bay, 27 Oct–22 Feb, 1898 to 1936, 4 in 1905 alone (CAS and MVZ, fide CBRC). Not yet reviewed by the CBRC, an additional 5 specimens for "Point Reyes," 27 Oct–27 Dec 1905, are at the American Museum of Natural History, New York (numbers 354496, 354497, 354499, 354500, 354502, fide SNGH). Likely there are further specimens from the area at other eastern museums. The few recent local records have all been of single birds from the south end of Tomales Bay during winter flood tides: 1 on 3 Dec 1986 (AB 41: 323, CBRC); 1 on 2 Dec 1987 (AB 42: 316) and 1 dropped by a Great Egret and retrieved on 21 Dec 1987 (AB 42: 316, CAS 84063) (both under review by CBRC as one record); details of a report on 13 Feb 1961 (AFN 15: 354–355) have not been submitted to the CBRC. The accepted Point Reyes records are among 52 (all but 5 prior to 1937) of birds wintering at tidal or freshwater marshes on the coast or in the interior from 2 Oct to 10 Apr (CBRC). Although this rail was formerly considered rare in California (Grinnell and Miller 1944), the number of old records and its secretive habits suggest a substantial population once wintered on the coast. The probable extirpation of breeding populations in the interior of California (Remsen 1978) and declines elsewhere may explain the apparent decline of the coastal wintering population. Recent coastal wintering records and the discovery of breeding populations in southern Oregon (AB 36: 999, 38: 1042), however, may presage a limited resurgence of California's population.

Mountain Plover (*Charadrius montanus*)

One estuarine record from Limantour Estero on 10 Feb 1967 (AFN 21: 454). Additionally, at least 26 birds have been found in pastures and plowed fields from 2 Oct to 1 Jan in 5 years from 1978 to 1988 (ABN). All local records involve 1–3 birds, except for a flock of 21 at the RCA Station, Point Reyes on 21 Oct 1983 (AB 38: 242, ABN). Transient and wintering birds occur irregularly on the coastal slope of northern California from 22 Sep to 10 Feb (ABN). Has decreased historically in California (Grinnell and Miller 1944).

Eurasian Dotterel (*Charadrius morinellus*)

Two records of single juveniles in pastureland on outer Point Reyes: 6–9 Sep 1986 (AB 41: 138–139, CBRC) and 10–13 Sep 1988 (AB 43: 27 and 163; under review by CBRC). The only other record for California is of a juvenile on SE Farallon Is. from 12 to 20 Sep 1974 (Henderson 1979, Luther et al. 1979).

Black Oystercatcher (*Haematopus bachmani*)

A year-round resident of rocky reefs, seastacks, and offshore islets on the outer coast of Point Reyes. Fairly evenly distributed along rocky shoreline during the breeding season, when a minimum of 8 pairs inhabit Point Reyes (Sowls et al. 1980). Breeding has been confirmed at Tomales Point, Chimney Rock, Double Point, and between Point Resistance and Miller's Point (Stephens and Pringle 1933, ABN, DS). Distribution more clumped in winter, especially when the rocky shoreline is extensively wave-washed during storm tides, concentrating roosting birds. Flocks of up to 20 birds have been recorded in winter at Tomales Point (ABN). Birds occasionally stray for brief periods to sandy beaches and estuarine shorelines, usually those near their rocky shoreline haunts.

Solitary Sandpiper (*Tringa solitaria*)

Occurs on Point Reyes almost annually in fall from 4 Aug to 29 Sep (ABN), with an outlying date of 19 Oct 1984 (RMS). Most fall birds are juveniles, of which the earliest reported date is 6 Aug 1988 (ABN: LJP). Two local spring records: 2 birds on Bolinas Mesa on 2 May 1974 (AB 28: 847) and 1 at the Bolinas sewer ponds from 5 to 6 May 1980 (DS et al.). One at a freshwater pond near Inverness from 22 Jan to 14 Mar 1984 (AB 38: 353, 954) is the only winter record for northern California (McCaskie et al. 1979, Morlan and Erickson 1988) and one of few for the state as a whole (Garrett and Dunn 1981). On the northern California coast dates of transient Solitary Sandpipers in fall extend from 19 Jul to 19 Oct with a peak from late Aug to mid-Sep (ABN). Spring dates range from 9 Apr to 24 May with a peak in late Apr and early May (ABN). Solitary Sandpipers are generally less numerous on the coast in spring than in fall, but since the mid-1980s they have been seen on the north coast with regularity and in increasing numbers in spring (Morlan and Erickson 1988, ABN). They frequent the margins of freshwater ponds, sewer ponds, reservoirs, stock ponds, or slow-moving streams.

Little Stint (*Calidris minuta*)

The only Point Reyes record, of a juvenile at the Bolinas sewer ponds from 14 to 22 Sep 1983 (Roberson 1986), is 1 of 2 currently accepted records of the species for California (CBRC).

White-rumped Sandpiper (*Calidris fuscicollis*)

One Point Reyes record of a single bird at Kehoe Beach on 11 Jun 1978 (Luther et al. 1983). This is among a total of 9 accepted records for California, 1969 to 1986: 7 in spring from 17 May to 16 Jun; 2 in fall from 15 Aug to 18 Sep (CBRC).

Sharp-tailed Sandpiper (*Calidris acuminata*)

One old Point Reyes record from Olema on 27 Nov 1870 (Grinnell and Miller 1944); 16 later records of 18 birds (all juveniles) on Point Reyes from 21 Sep to 22 Nov, 1966 to 1988. Now recorded annually in coastal northern California (all

juveniles) from 2 Sep to 27 Nov (most from late Sep to early Nov), except for 1 bird remaining on a salt pond in south San Francisco Bay from 17 Nov 1985 to 5 Jan 1986 (AB 40: 326).

Rock Sandpiper (*Calidris ptilocnemis*)

Four records for Point Reyes, all of single birds: 25 Oct 1966 at Abalone Point (AB 21: 74), 27 Feb 1975 at Duxbury Reef (AB 29: 737), 29 Nov 1980 at RCA Beach, Bolinas (ABN: CSw), and 20 Dec 1986 at Walker Creek mouth, Tomales Bay (AB 41: 324). All were on rocky substrate on the outer coast except the Tomales Bay bird, which, atypically, was on tidal mudflats. Dates of occurrence on the northern California coast span 15 Oct to 9 May with most records from Nov to mid-Apr (ABN).

Buff-breasted Sandpiper (*Tryngites subruficollis*)

Seven accepted records for Point Reyes of 21 birds from 24 Aug to 29 Sep, 1977 to 1987 (CBRC), with a high count of 11 birds at Tomales Point from 26 to 31 Aug 1978 (Luther et al. 1983). Additionally a record of 5–10 birds on Point Reyes from 9 to 11+ Sep 1988 is under review by the CBRC. All birds frequented pastures, or low marsh vegetation on the sandy shores of Abbott's Lagoon. Except for the first state record, 14 Sep 1923 (Grinnell and Miller 1944, CBRC), and the lone spring record, 3–4 May 1980, dates of all accepted California records range from 23 Aug to 22 Oct, 1964 to 1987 (CBRC). Buff-breasted Sandpipers have been recorded annually and in increasing numbers in California since 1975.

Pomarine Jaeger (*Stercorarius pomarinus*)

Pomarine Jaegers occur primarily at sea off central California, where they favor waters seaward of the continental shelf during migration (Briggs et al. 1987). They occur mostly as fall migrants from mid-Jul to early Nov (peak late Aug to early Oct), secondarily as spring migrants from mid-Apr to late May, and sparingly as winter residents; they are irregular in summer (Stallcup 1976, Roberson 1985, Briggs et al. 1987). Although outnumbered by Parasitic Jaegers close to land, Pomarines are seen from shore over the inshore zone and sparingly in large bays and estuaries, on Point Reyes primarily in Sep and Oct (ABN). Nearshore sightings in fall coincide with greatest offshore abundance of this jaeger, peak numbers of Elegant Terns near shore, and greatest observer coverage. Pomarines have been seen on 9 of 19 Point Reyes CBCs from 1970 to 1988, with a high count of 4 in 1985.

Little Gull (*Larus minutus*)

A Point Reyes record of 1 bird at Tomales Bay on 21 Nov 1984 is among 32 accepted records for California falling in every month, but mostly Oct to May, 1968 to 1987 (CBRC). Annual sightings in California since 1977 parallel increases elsewhere, including recent breeding in North America (AOU 1957, 1983).

Common Black-headed Gull (*Larus ridibundus*)

The only Point Reyes record is of a single bird at Tomales Bay from 5 to 8 Apr 1976 (Luther et al. 1979). This is 1 of 13 accepted California records, 1954 to 1986, all falling between Sep and Apr except for single Jun and Jul records (CBRC).

Sabine's Gull (*Xema sabini*)

The Sabine's Gull typically inhabits offshore and oceanic waters off California during migration. It occurs primarily in fall from Aug through Oct (peak Sep and early Oct) and in spring in Apr and May (peak mid-May), exceptionally in mid-winter or mid-summer (Ainley 1976a, Stallcup 1976, Roberson 1985, Briggs et al. 1987). Seen irregularly from shore at Point Reyes, mostly in fall (ABN). Two winter records from inshore at Point Reyes: 1 immature at Limantour on 15 Dec 1968 (AFN 23: 516); 2 immatures off Point Reyes Beach during a storm on 4 Jan 1978 (AB 32: 396).

Royal Tern (*Sterna maxima*)

A northward dispersant from Mexico to estuarine and inshore waters in California. Although variable in timing and abundance, Royal Terns formerly were "fairly common" off California from Sep to Mar, though recorded in every month (Grinnell and Miller 1944). A 23 Nov 1918 specimen for Humboldt Bay (Yocum and Harris 1975) is the only evidence of former occurrence north of Tomales Bay (Grinnell and Miller 1944). Specimen records for Point Reyes are of 1 bird at Bolinas on 17 Oct 1893 (CAS 43313) and 4 from Bolinas Bay: 3 on 9 Jan 1926 (MVZ 1922, 1923, 1932) and 1 on 20 Jan 1927 (MVZ 2783). There are no valid recent records for Point Reyes. See Elegant Tern for discussion of a major decline of Royal Terns at the time of a great increase of Elegant Terns beginning in the 1950s. Royal Terns now occur casually in northern California north to San Francisco Bay from Mar through Oct (Morlan and Erickson 1988, ABN).

Least Tern (*Sterna antillarum*)

Two Point Reyes records, both from Bolinas Lagoon: 1 on 27 Apr 1980 (LES) and 1 in "fall" 1987 (KH). These likely represent birds from San Francisco Bay, which currently supports the only breeding colonies of Least Terns in northern California (McCaskie et al. 1979, Morlan and Erickson 1988). Dates of occurrence in northern California span 27 Mar to 16 Oct, but Least Terns are scarce in this region before mid-Apr and after early Sep (ABN). Least Terns found irregularly in spring or fall north of the Golden Gate from 23 Apr to 13 Sep (ABN) likely represent overshooting migrants or post-breeding dispersants. Least Terns have declined dramatically as breeders on the California coast and are currently listed as endangered by both state and federal governments.

Pigeon Guillemot (*Cepphus columba*)

About 140 pairs breeds on cliffs, sea stacks, and offshore islets along the Point Reyes shoreline (Sowls et al. 1980). They forage inshore almost exclusively within 5 km, and mostly 1–2 km, of land (Briggs et al. 1987). Breeders begin to arrive in numbers by mid-Mar, remain common through Aug, and thereafter dwindle to winter lows by mid-Oct, when most that remain are young (ABN). A count of 19 juveniles in Drake's Bay on 10 Oct 1980 (DS) is high for late fall, and a count of 26 at Tomales Point at the mouth of Tomales Bay, the only locale on Point Reyes where guillemots winter regularly, on 6 Jan 1979 (DS) is high for mid-winter. Guillemots were recorded on 10 of 19 Point Reyes CBCs from 1970 to 1988 with 1–3 guillemots in 6 years, 10–13 in 3 years, and 42 in 1 year. Guillemot populations on the Farallones have recovered from declines caused probably by oil pollution (Ainley and Lewis 1974)

Marbled Murrelet (*Brachyramphus marmoratus*)

A year-round resident along the northern California coast with birds nesting in old-growth forests up to 40 km inland and foraging in nearshore waters mostly within 1–2 km of land (Carter and Erickson 1988). Occurs in nearshore waters of Point Reyes mostly from Aug to Mar (ABN). Although birds have been seen off Point Reyes in the breeding season (1 Apr–1 Sep; Carter and Erickson 1988), a lack of nearshore records from 2 May to 30 Jun and a total lack of inland records suggests that Marbled Murrelets do not breed regularly in the Point Reyes area despite the availability of seemingly suitable nesting habitat. Local Jul and Aug records probably pertain to post-breeding dispersants from elsewhere. The California population of Marbled Murrelets has probably declined because of the destruction of old-growth forests, although the species is also susceptible to mortality from gill netting and oil pollution (Carter and Erickson 1988).

Xantus' Murrelet (*Synthliboramphus hypoleucus*)

A bird hit by a car about 2 km north of Bolinas on 28 Aug 1973 (PRBO specimen 736) and another in Drake's Bay seen from shore on 9 Oct 1987 (ABN: RS) constitute the only Point Reyes nearshore records. Xantus' Murrelets typically occupy waters 20 to 100 km off the northern California coast, primarily from Jul to Oct (Roberson 1985, Briggs et al. 1987) and irregularly during the remainder of the year (McCaskie et al. 1979). With an increase in boat trips since the 1970s, Xantus' Murrelets are now seen with regularity in waters west of the Farallones and near the Cordell Banks off Point Reyes (ABN). Recent late May and Jun sightings there indicate rapid northward post-breeding dispersal (Briggs et al. 1987, D. G. Ainley pers. comm.).

Ancient Murrelet (*Synthliboramphus antiquus*)

These murrelets occupy inshore and offshore waters off Point Reyes from mid-Sep through Apr, but mostly Nov to Mar; there are only 4 May–Aug records (ABN). Numbers fluctuate greatly from year to year apparently because of varying ocean conditions and the species' preference for cold waters (Ainley 1976a). Ancient Murrelets have been recorded on 14 of 19 Point Reyes CBCs from 1970 to 1988; the outlying high count of 155 excluded, the median number for 13 years was 15 (range 2–49). Of the 155 birds on 17 Dec 1988, 150 were seen from a boat plying inshore waters from Tomales Point to the Point Reyes headlands (KH).

Cassin's Auklet (*Ptychoramphus aleuticus*)

Year round this auklet occupies California waters mostly from the mid-continental shelf to about 150 km from land (Briggs et al. 1987). In late spring and summer birds concentrate around colonies (Briggs et al. 1987), particularly the Farallones which support 80% of the California population (Sowls et al. 1980). They range more widely during post-breeding dispersal from Aug to Oct, and the state's population at least doubles in winter with immigrants from the north (Briggs et al. 1987). Cassin's Auklets are rarely seen close to shore at Point Reyes, usually during or after winter storms; they were recorded on only 6 of 19 Point Reyes CBCs from 1970 to 1988 (range 0–15).

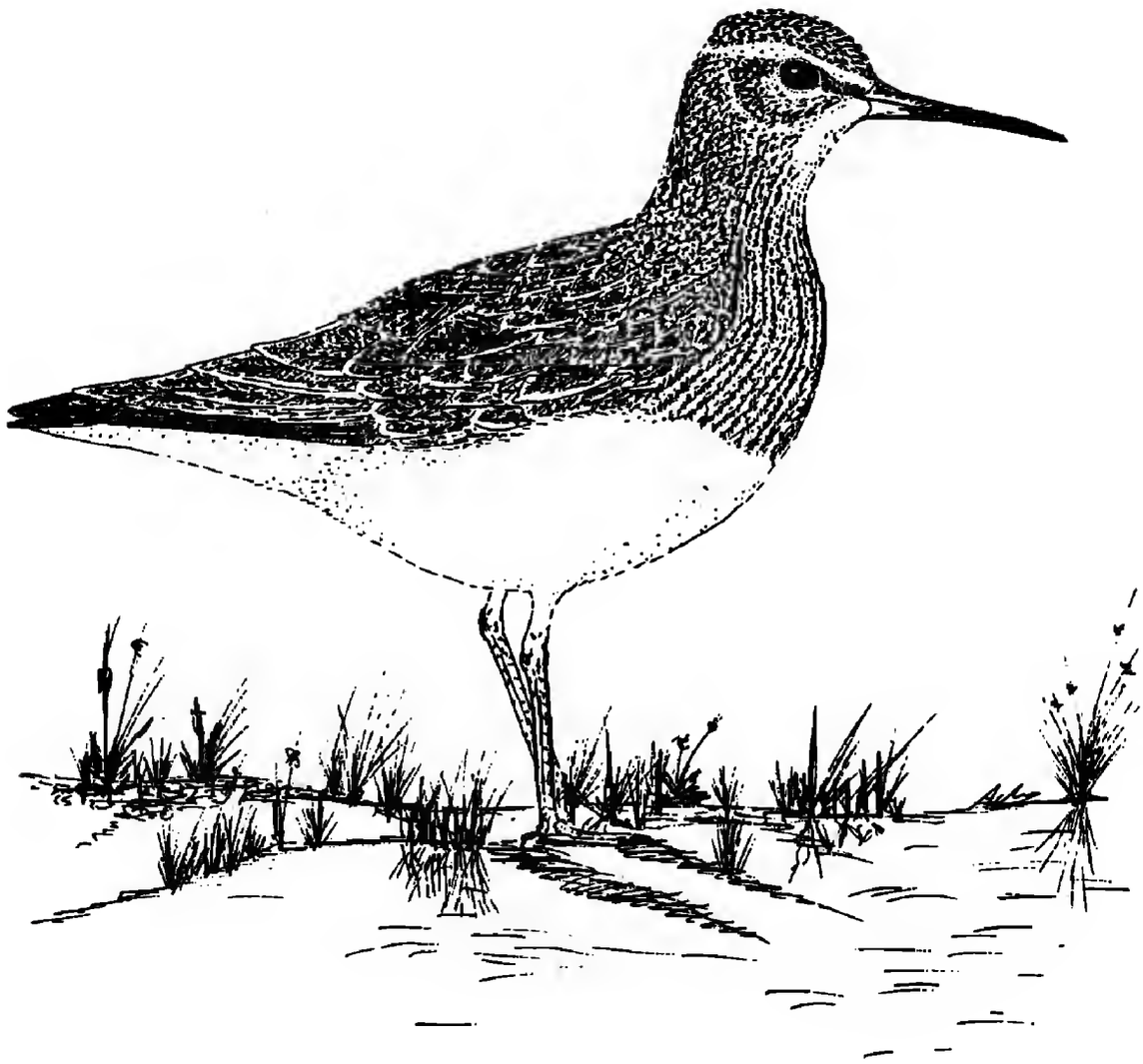
Rhinoceros Auklet (*Cerorhinca monocerata*)

Rhinoceros Auklets inhabit neritic and oceanic waters of central California year round, particularly seaward of the continental shelf break (Briggs et al. 1987). The

small nesting population of this region is swelled greatly in winter by influxes from the north. Off Point Reyes greatest numbers occur from mid-Oct to mid-Apr (ABN). Breeding populations are now increasing in California and elsewhere on the West Coast (Sowls et al. 1980, Briggs et al. 1987). Since 1977, up to 11 birds at a time have been observed on the water below the Point Reyes headlands in May and Jun (ABN). These birds have been observed "billing" and in passing flights that suggest local breeding.

Tufted Puffin (*Fratercula cirrhata*)

Tufted Puffins occur in neritic and oceanic waters off California year round, though numbers are much greater in winter than during summer (Briggs et al. 1987). At sea in any season birds are most numerous seaward of the continental slope, with a few birds as far from shore as 180 km. Breeding populations of Tufted Puffins are now expanding or becoming re-established in California after declining early in this century, perhaps because of oil pollution (Ainley and Lewis 1974, Sowls et al. 1980). Formerly they were suspected of breeding on "Point Reyes" and at Bird Rock, Tomales Point (Stephens and Pringle 1933, Grinnell and Miller 1944), but a subsequent lack of reports may have been due to limited observer coverage or actual decline. Since 1976 up to 6 birds at a time have been seen in the vicinty of the Point Reyes headlands each year from mid-Apr through Jul (ABN). These birds have been seen in passing flights, gathering algae, and carrying food up to cliffs, but no nests have been found because the sites are inaccessible. Many birds in oceanic waters off Point Reyes during the nesting season probably come from the important Farallon colony.



Pectoral Sandpiper *Sketch by Sven Achtermann*

PRESIDENT'S MESSAGE

Greetings!

WFO's 14th Annual Meeting was held jointly with the Western Bird Banding Association in Reno, Nevada, during the crisp days of mid-October, as Evening Grosbeaks arrived in the foothills of the eastern Sierra. Activities ranged from excellent, informative paper presentations to demonstrations of banding, raptor trapping, radio telemetry, and tree-climbing techniques. An enthusiastic, overflow audience joined WFO's panel of experts in debating identification problems. Ron LeValley's excellent banquet program on "The Sea of Cortez" culminated the proceedings. Field trips to Pyramid Lake, Mt. Rose, Stillwater National Wildlife Refuge, and Honey Lake focused on the birds of the eastern Sierra Nevada and the Great Basin desert.

WFO thanks Alan Gubanich, who so ably organized the meeting for both organizations, and his helpers for their gracious hosting of a superb gathering.

Our next annual meeting will be in San Diego, 7-9 September 1990—watch for details!

THANKING WFO'S VITAL VOLUNTEERS

WFO's sincere thanks go to retiring President Tim Manolis, whose thoughtful expertise and tact have guided WFO well indeed for the past 3 years, and to retiring Director Ginger Johnson, whose quiet, behind-the-scenes work with *Western Birds*, boat trips, T-shirts, and numerous other nitty-gritty jobs has enabled WFO to function much more smoothly. Ginger, who has aided WFO since its inception, will continue to serve as graphics manager and layout artist for *Western Birds* and to handle T-shirts and spring boat trips; Tim will continue to contribute to *Western Birds* as Associate Editor and Chairman of the identification papers committee.

Taking over the fall boat trips is Marjorie Hastings, who has also worked on the Membership Committee for several years, and whose generous help we welcome.

Three truly key figures who enable WFO to be a vigorous, purposeful organization are our Editor, Phil Unitt; our Treasurer, Howard Cogswell; and our Circulation Manager, Jerry Oldenettel. All three contribute valuable birding time to do essential chores for WFO, and we appreciate your high professionalism and conscientious work!

Among the many who help WFO in ways small and large, I'd also like to highlight our membership committee: in Alaska, Dan Gibson and Thede Tobish; in Arizona, Carol deWaard and Janet Witzeman; in British Columbia, Wayne Weber; in California, Sarah Brooks, Elizabeth Copper, Marjorie Hastings, Ginger Johnson, and Jean-Marie Spoelman; in Colorado, Peter Gent; in Hawaii, Sheila Conant; in Montana, Jon Swenson; in Nevada, Vincent Mowbray; in New Mexico, Dustin Huntington; in Oregon, Steve Summers; in Texas, Mike Austin; in Utah, Martha Balph; and in Washington, Gene Hunn. To all of you, and to former members Doug Inkley and Terrell Rich (who both moved east), thank you!

Discerning readers will have noticed that we need membership committee help in Idaho and Wyoming—and we always welcome more help in any state! If you have time to hand out a few WFO brochures at meetings of local bird clubs and Audubon chapters, please contact me.

NEW OFFICERS

Your officers for 1989-90 are President, Narca Moore-Craig; Vice President, Peter Gent; Past-President, Tim Manolis; Membership Secretary/Treasurer, Howard Cogswell; Recording Secretary, Jean-Marie Spoelman; and Directors, Ron LeValley, John Luther, Joe Morlan, Robert McKernan, Guy McCaskie, and Janet Witzeman.

NEWSLETTER

WFO plans to publish a pilot issue of a newsletter, edited by Bruce Webb, with Tim Manolis helping. This newsletter will tell you about boat trips and other special field trips in our focal area, notify you of meetings of state ornithological groups, and report other news of the western birding world.

Bruce welcomes your input and ideas; you can send submissions to him at 8204 Cantershire Way, Granite Bay, CA 95661.

RENEWAL POLICY

WFO will be mailing renewal notices separately from *Western Birds,* instead of including notices with the journal, where they may be inadvertently thrown away. (As before, a year's membership corresponds to a year's four issues of *Western Birds*, and not *necessarily* to a calendar year.) We are hoping that this change will prompt everyone to renew quickly, before memberships expire, and thus save WFO the extra mailing costs and save our volunteer staff from extra work!

One option that allows you to avoid completely the nuisance of renewing each year is to become a Life Member for only $250. Life Member contributions go into a special endowment fund to build WFO's long-term financial foundation.

SUBMISSIONS TO *WESTERN BIRDS*

Finally, I'd like to appeal to all of you who are doing field work and who make interesting, unusual, and scientifically valuable observations to submit your findings for publication in *Western Birds*. Our journal's high quality begins with *your* fieldwork and manuscripts! This is *your* organization, and we welcome your involvement at any level.

Good birding to you—

Narca Moore-Craig

NEWS FROM THE CALIFORNIA BIRD RECORDS COMMITTEE

DON ROBERSON, Secretary, 282 Grove Acre, Pacific Grove, California 93950

The California Bird Records Committee (CBRC) has published to date ten reports, the latest being that by Dunn (1988). It has been the intent of the Committee to publish these reports annually, to apprise birders and field ornithologists of our decisions, changes to the state list, revisions of our Review List or our Bylaws, and changes in CBRC membership. These have been features of all recent CBRC reports. The Committee agreed at the January 1990 annual meeting that a regular CBRC news and update article such as this would provide a more timely service to our readers and would report changes in the state list, our membership or rules, and in our Review List.

Since the mid-1980s, the Committee has attempted to obtain for review and permanent archiving not only details of all recent rarities, but documentation for all of the published records of species on our Review List, no matter how long ago the record had been published. We considered a record "published" for these purposes if it appears in any major ornithological journal (e.g., *The Auk, The Condor, Western Birds, Murrelet*), other significant ornithological publications (e.g. Grinnell and Miller 1944, Garrett and Dunn 1981, DeSante and Ainley 1980), or in the seasonal summaries of *American Birds* and its predecessor *Audubon Field Notes*. We do not consider reports in local Audubon Society or bird-club newsletters "published" in the ornithological literature and have not attempted to obtain information on them. The Committee also considers, of course, any documentation it receives of Review List species, including unpublished records. These, too, are included in our statistics. In 1983, the Committee had received documentation on only 49% of all published records. During the last six years, substantial progress has been made towards the goal of reviewing all records. We especially appreciate the effort of Peter Pyle for Point Reyes Bird Observatory, along with David DeSante and Phil Henderson, in submitting documentation on virtually every record from Southeast Farallon Island, and that of Gary S. Lester in obtaining details from reports from northwestern California. We have also had excellent cooperation with the regional editors for *American Birds* in recent years, as they have routinely forwarded all relevant documentation they receive. Through the spring season of 1989, we had received details on 2651 of 2908 published records, for a review rate of 91.2%.

This project, though, has delayed the annual publication of CBRC reports as our workload has doubled and even tripled in some recent years. We continue to review all reports thoroughly, and continue to obtain comments from experts outside our area when that seems prudent. We have also had an unusual number of interesting and controversial records to evaluate in the late 1980s, including some of several species of *Pterodroma* petrels, various Siberian ducks, Crested Caracara, difficult *Calidris* sandpipers, several gulls (e.g., Iceland, Band-tailed, and Swallow-tailed), Ruddy Ground-Dove, Alder Flycatcher, and Oriental Greenfinch. All of these have added to the time it has taken to produce timely reports. Currently, authors of the eleventh, twelfth, thirteenth, and fourteenth reports are at work writing reports that not only list our decisions but synthesize our reasoning (one report will also deal with the numerous old records recently reviewed).

State list. Dunn (1988) reported the state list at 563 species. The taxonomic decisions by the A.O.U. (1988) add two more, with the split of the Western Flycatcher into Pacific-slope *Empidonax difficilis* and Cordilleran *E. occidentalis* flycatchers and the separation of the California Gnatcatcher *Polioptila californica* from the Black-tailed Gnatcatcher *P. melanura*. As of January 1990, seven additional species have been added to the Califor-

nia state list, bringing the total to 572 species: Wedge-tailed Shearwater *Puffinus pacificus*, Terek Sandpiper *Xenus cinereus*, Long-toed Stint *Calidris subminuta*, Ruddy Ground-Dove (*Columbina talpacoti*, Chuck-will's-widow *Caprimulgus carolinensis*, Xantus' Hummingbird *Hylocharis xantusii*), and Three-toed Woodpecker *Picoides tridactylus*. Details of some of these records have been published already; others will appear in upcoming CBRC reports.

Committee membership. I am currently the Secretary and all documentation and correspondence should be sent to me at the address above. The other current members of the CBRC are Stephen F. Bailey, Louis R. Bevier, Jon L. Dunn, Richard A. Erickson, Kimball L. Garrett, Paul E. Lehman, Michael J. Lippsmeyer, Guy McCaskie, and Joseph Morlan. Committee procedures have remained fairly consistent over our history, though refinements in the Bylaws continue to be adopted. One adopted in 1990 specifically identified our geographic coverage offshore as concurrent with the United States Fisheries Conservation Zone, which extends 200 nautical miles from the nearest point of land, including offshore islands (and south of the Oregon border at 42° N). Current copies of our Bylaws, our Review List, and a report form (whose use is not necessary) are available free for the asking from the Secretary (a self-addressed stamped envelope is appreciated).

Review list. In 1989, the Committee voted to remove Cook's Petrel from the Review List, along with *Pterodroma* petrels of the subgenus *Cookilaria*. The latter category had been added only in 1988 (see Dunn 1988) but was dropped once it became evident that the Cook's Petrel is a regular part of the avifauna far offshore. In 1990, the Committee voted to remove the Wilson's Storm-Petrel, Barred Owl, and Prothonotary Warbler from the Review List. These species no longer meet our general criterion of averaging four records or less over the most recent ten-year period, or, in the case of the Barred Owl, now appear to have a small resident population within the state. The Committee voted to add the Tricolored Heron to the Review List as of 1 January 1990. We will not attempt to review old records of this species, which at one time occurred more regularly but has become increasingly scarce during the past decade.

We thus solicit reports of species not yet accepted on the state list and the following species: Yellow-billed Loon, Least Grebe, Wandering Albatross, Short-tailed Albatross (1900 and later only), Mottled and Stejneger's petrels, Streaked, Greater, and Wedge-tailed shearwaters, Band-rumped and Wedge-rumped storm-petrels, White-tailed and Red-tailed tropicbirds, Masked, Blue-footed (1972 and later only), Brown, and Red-footed boobies, Olivaceous Cormorant, Anhinga, Tricolored Heron (1990 and later only), Reddish Egret, Yellow-crowned Night-Heron, White Ibis, Roseate Spoonbill (1977 and later only), Black-bellied Whistling-Duck, Whooper and Trumpeter swans, Emperor Goose, Baikal Teal, American Black Duck, Garganey, Tufted Duck, King and Steller's eiders, Smew, Mississippi Kite, Common Black-Hawk, Zone-tailed Hawk, Gyrfalcon, Yellow Rail (1940 and later only), Purple Gallinule, Mongolian, Wilson's, and Piping plovers, Eurasian Dotterel, American Oystercatcher, Spotted Redshank, Gray-tailed Tattler, Terek and Upland sandpipers, Little Curlew, Hudsonian and Bar-tailed godwits, Rufous-necked, Little, and Long-toed stints, White-rumped, Curlew, and Buff-breasted sandpipers, Jack Snipe, Little, Common Black-headed, and Lesser Black-backed gulls, Sandwich and Sooty terns, Thick-billed Murre, Kittlitz's Murrelet, Parakeet, Least, and Crested auklets, Ruddy Ground-Dove, Black-billed Cuckoo, Groove-billed Ani, Snowy Owl (1900 and later only), Chuck-will's-widow, White-collared Swift, Broad-billed, Xantus', Violet-crowned, Blue-throated, and Ruby-throated hummingbirds, Red-headed and Three-toed woodpeckers, Greater Pewee, Eastern Wood-Pewee, Yellow-bellied, Dusky-capped, Great Crested, and Sulphur-bellied flycatchers, Thick-billed Kingbird, Scissor-tailed Flycatcher, Eurasian Skylark, Blue Jay, Sedge Wren, Dusky Warbler, Northern Wheatear, Veery, Gray-cheeked and Wood thrushes, Rufous-backed Robin, Gray Catbird, Curve-billed Thrasher, Yellow, White, White/Black-backed, and Black-backed wagtails, Red-throated and Sprague's pipits, Brown Shrike, White-eyed, Yellow-

throated, Philadelphia, and Yellow-green vireos, Blue-winged, Golden-winged, Blue-winged × Golden-winged, Golden-cheeked, Yellow-throated, Grace's, Pine, Cerulean, and Worm-eating warblers, Louisiana Waterthrush, Kentucky, Connecticut, Mourning, and Red-faced warblers, Scarlet Tanager, Pyrrhuloxia, Varied and Painted buntings, Cassin's, Field, Baird's and Le Conte's sparrows, Rustic and Snow buntings, Common Grackle, Streak-backed Oriole, Brambling, White-winged Crossbill, and Common Redpoll.

LITERATURE CITED

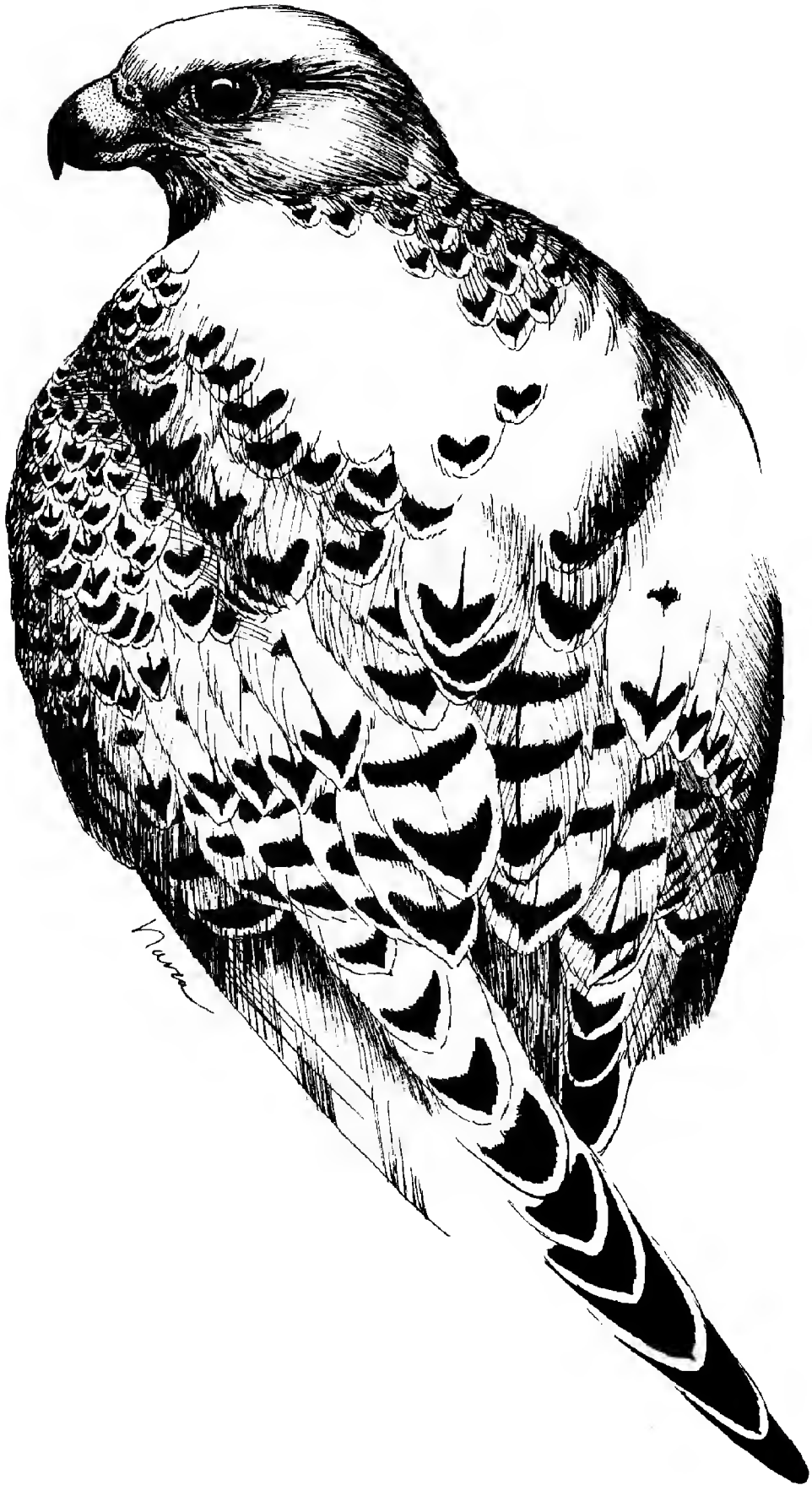
American Ornithologists' Union. 1989. Thirty-seventh supplement to the A.O.U. Check-list of Northern American birds. Auk 106: 532-538.

DeSante, D.F., and Ainley, D.G. 1980. The avifauna of the South Farallon Islands, California. Studies Avian Biol. 4.

Dunn. J.L. 1988. Tenth report of the California Bird Records Committee. W. Birds 19: 129-163.

Garrett, K.L., and Dunn, J.L. 1981. Birds of Southern California. Los Angeles Audubon Soc., Los Angeles.

Grinnell, J., and Miller, A.H. 1944. Distribution of the birds of California. Pac. Coast Avifauna 27.



Gyrfalcon *Sketch by Narca Moore-Craig*

WESTERN BIRDS, INDEX, VOLUME 20, 1989

Compiled by Mildred Comar

Volume 20, Number 4, 1989

Cover photo by © Ian C. Tait of Mill Valley, California: Shorebirds in flight (*Calidris sp.*), Bolinas, California, January 1989.

Western Birds solicits papers that are both useful to and understandable by amateur field ornithologists and also contribute significantly to scientific literature. The journal welcomes contributions from both professionals and amateurs. Appropriate topics include distribution, migration, status, identification, geographic variation, conservation, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, and techniques for censusing, sound recording, and photographing birds in the field. Papers of general interest will be considered regardless of their geographic origin, but particularly desired are reports of studies done in or bearing on the Rocky Mountain and Pacific states and provinces, including Alaska and Hawaii, western Texas, northwestern Mexico, and the northeastern Pacific Ocean.

Send manuscripts to Philip Unitt, 3411 Felton Street, San Diego, CA 92104. For matter of style consult the *Suggestions to Contributors to Western Birds* (8 pages available at no cost from the editor) and the *Council of Biology Editors Style Manual* (available for $24 from the Council of Biology Editors, Inc., 9650 Rockville Pike, Bethesda, MD 20814.

Reprints can be ordered at author's expense from the Editor when proof is returned or earlier.

Good photographs of rare and unusual birds, unaccompanied by an article but with caption including species, date, locality and other pertinent information, are wanted for publication in *Western Birds*. Submit photos and captions to Photo Editor.