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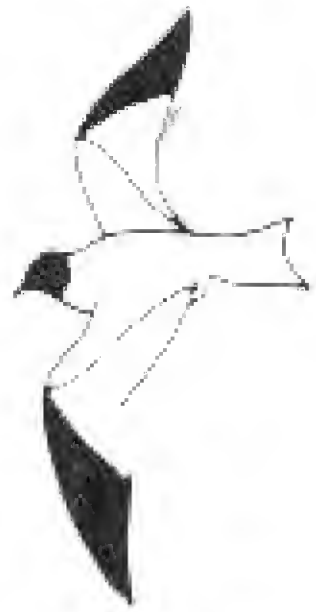

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WESTERN BIRDS

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SURVEY OF MARINE BIRDS IN PUGET SOUND, HOOD CANAL AND WATERS EAST OF WHIDBEY ISLAND, WASHINGTON, IN SUMMER 1982

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This report presents results of the first complete survey of marine birds of Puget Sound and adjacent waters. Observations of marine birds in the area date back to 1792 when breeding Pigeon Guillemots were found by Menzies (Newcombe 1923). Since that time there have been observations and studies at localized sites, with results of these appearing in theses and dissertations, ornithological jounals, Jewett et al. (1953), and Dawson and Bowles (1909). However, no complete surveys have been conducted.

The remainder of the inland marine areas of Washington were surveyed year-round in 1978 and 1979. Wahl et al. (1981) describe studies of populations, including nesting birds and sites, in the area of the Strait of Juan de Fuca, Strait of Georgia and adjacent waters.

METHODS

We surveyed all waters of "Puget Sound" (Figure 1) from 27 May through 20 June 1982 in an attempt to locate all non-breeding and breeding birds. Four census types were employed. Small boat was the most frequently used platform, followed in decreasing order by censuses from small aircraft, on foot, and from ferries. Boat censuses covered a strip transect 300 m wide along open shorelines, in bays and harbors, around islands and rocks, and across offshore open waters. In most cases we could obtain "total" counts of bays, harbors and some larger passages by observing beyond the 300 m zone. Aircraft censuses were used in areas of low human populations or boat traffic, using 120 m strip transects, along straight, open shorelines and across open waters. Observations from shore were limited to a few areas difficult to reach or unsuitable for boat or aircraft censuses; these usually resulted in total area counts. While traveling between study areas by ferry, 500 m strip transect censuses were used. These same methods were used in other surveys in 1978 and 1979 (Wahl et al. 1981). We recorded all observations as they occurred either directly on census forms or, in the case of aircraft censuses, on tape cassettes for later transcription.

Actual time censusing amounted to about 52 hours from small boat and 8½ hours from the aircraft. The time spent censusing from shore amounted to about 10 hours and from ferries less than 2 hours. All areas were thoroughly surveyed once, and a few were surveyed several times during transits to new areas. Due to time and budget considerations we censused during available hours and at whatever tide stages we encountered at each site or subregion.

We attempted to count and identify all individuals and species in the study area. When possible, age determination was made also. Because of generally low numbers of birds present in the study area, nearly all sightings resulted in specific identification. Except during flights, where they were not needed, binoculars were frequently used to aid identification.

The study area included all the marine waters of Hood Canal, Puget Sound, and those east of Whidbey Island. During the survey, all of the near-shore waters and almost all waters of bays and harbors were checked for birds. Open waters of the larger passages were also sampled. Surveys along river deltas (e.g. Skagit, Nisqually deltas) consisted of transects along exposed shorelines but did not include river channels, marshes and other inland habitats of these areas.

We divided the study area into 56 geographic subregions (Figure 1), each essentially a roughly definable body of water, corresponding, in most cases, to designations used on navigation charts. The data acquired, sometimes from a variety of census types, within each subregion were then summed. The results are presented in Table 1 (breeding species) and in species accounts below. We recorded nest site locations where possible, especially for Glaucous-winged Gull, Pigeon Guillemot and Pelagic Cormorant. Photographs were obtained of most important nest sites. To minimize disturbance to nesting birds, only one colony was entered.

RESULTS

Fourteen species associated with the marine waters were found to be or were presumed to be breeding in the study area (Table 1). One additional species breeds outside the study area, with a significant portion of its population feeding within the study area (see Wahl et al. 1981). We found 26 other species as non-breeding summer residents or early fall migrants.

BREEDING SPECIES

PELAGIC CORMORANT *Phalacrocorax pelagicus*. Although this is a common bird on Washington's outer coast and in the Strait of Juan de Fuca and San Juan Islands areas with nearly 4900 birds nesting at over 60 sites (Wahl et al. 1981, Speich and Wahl in press), only one nest site was found: a colony of about 60 pairs nesting on a high wooden tower off the north end of Indian Island, Port Townsend (Figure 2). South of here, in Puget Sound there may be very small numbers (a pair or two) nesting. During our survey we observed only one adult in breeding plumage south of the above colony site. We saw 160 birds away from that site, with 95 of these in the Port Townsend subregion and small numbers of non-breeders scattered elsewhere in the study area.

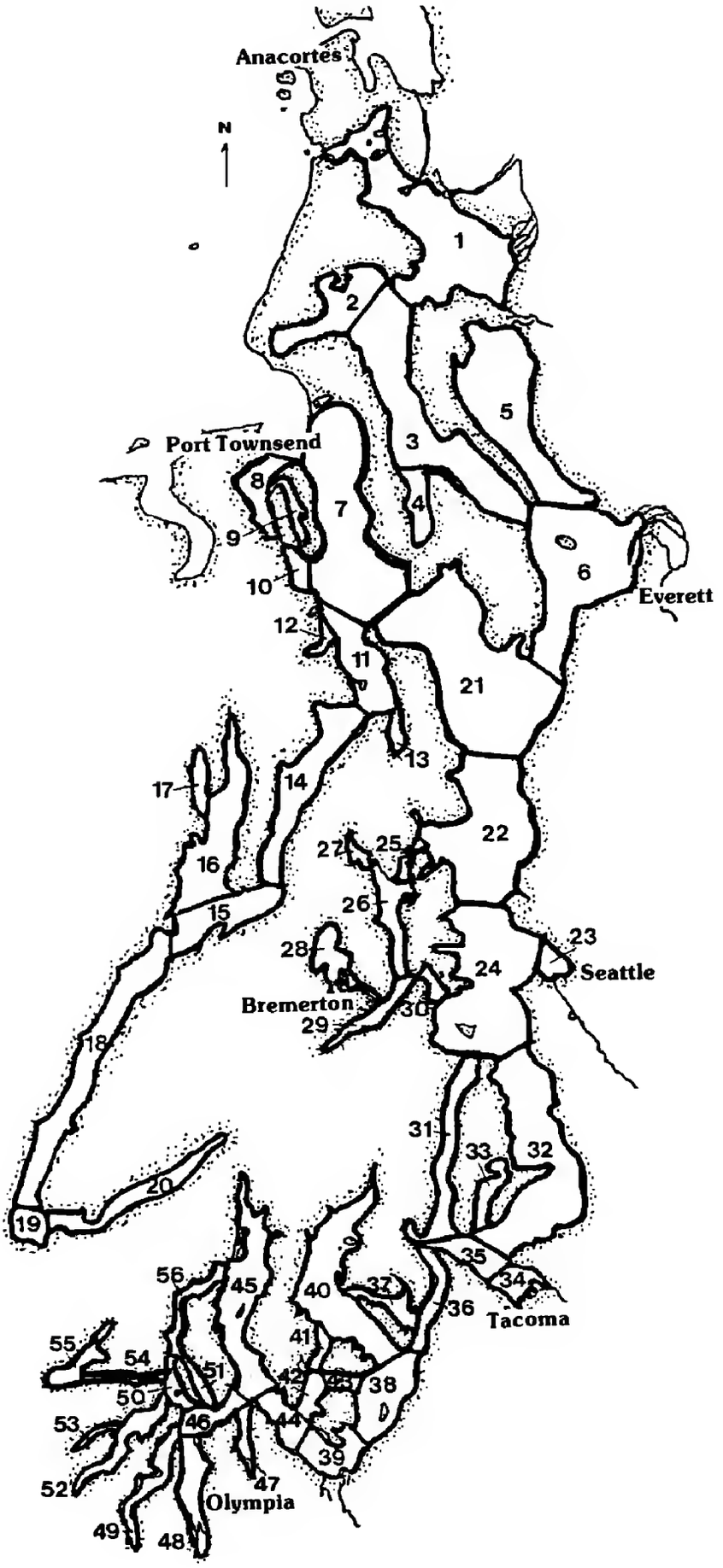

Figure 1. Study area showing subregion boundaries, in Puget Sound and adjacent waters, Washington, summer 1982.

Table 1. Numbers of breeding marine birds by subregion in Puget Sound and adjacent waters, Washington, 1982.

SUBREGION		NUMBERS OF INDIVIDUALS[1]						
Number	Name	Great Blue Heron	Mallard	Glaucous-winged Gull[2]	Pigeon Guillemot	Marbled Murrelet	Belted Kingfisher	Northwestern Crow
1	Skagit Bay	77	98		4		1	35
2	Penn Cove/Crescent Harbor	10	12		88		2	126
3	Saratoga Passage	5			9	21		15
4	Holmes Harbor	7			1	4		4
5	Port Susan	61	40		6	2	1	4
6	Possession Sound	16		300	8	24	1	4
7	Southern Admiralty Inlet	3			44	20		4
8	Port Townsend	2		100	71	159		16
9	Killisut Harbor	6			118			5
10	Oak Bay	1			21	49		13
11	Hood Canal Entrance	6		44[3]	28	26	1	8
12	Port Ludlow	1			3	1		9
13	Port Gamble	4						
14	Northern Hood Canal	1			3	10		7
15	Central Hood Canal	2				2		3
16	Dabob Bay				6	17		
17	Quilcene Bay				2			
18	Southcentral Hood Canal	11			2	8	1	2
19	Anna's Bay		3		18		3	
20	Great Bend	1	92		3	3	3	38
21	Northern Puget Sound	28			12	1		4
22	Northcentral Puget Sound	9	10	2	32	4	1	37
23	Elliott Bay	11	30	628[4]	1			7
24	Central Puget Sound	5	4		15	12	1	18
25	Agate Passage				27		1	42
26	Port Orchard	14	4		46	4		77
27	Liberty Bay				20			62
28	Dyes Inlet	8	36		18		1	98
29	Sinclair Inlet	14	16		8			28
30	Rich Passage		16		1	1		18
31	Colvos Passage		4		1			44
32	East Passage	9				1		8
33	Quartermaster Harbor	1	2		3	1	2	86
34	Commencement Bay			530	2			4
35	Dalco Passage	29	45		6		8	1
36	The Narrows	1			3	2	1	18
37	Hale Passage		32		11			
38	Steilacoom				6	3		7
39	Nisqually Reach	32			28	12		
40	Carr Inlet	34	41		105	4	4	363

Table 1 (Cont.)

SUBREGION		NUMBERS OF INDIVIDUALS[1]						
Number	Name	Great Blue Heron	Mallard	Glaucous-winged Gull[2]	Pigeon Guillemot	Marbled Murrelet	Belted Kingfisher	Northwestern Crow
41	Pitt Passage	1	1		18			
42	Drayton Passage	8			9	4		16
43	Balch Passage				8			5
44	Treble Point/Johnson Point	1			35	2		23
45	Case Inlet	51		2?	93	5	1	288
46	Dana Passage	1			9	2		
47	Henderson Inlet	6			12		3	6
48	Budd Inlet	4	9	30+	36		4	5
49	Eld Inlet		2		21			3
50	Squaxin	10	2		19			
51	Peale Passage	2			11		1	13
52	Totten Inlet	35	7		44		7	26
53	Skookum Inlet	2			8		1	3
54	Hammersley Inlet	10	13		49		5	6
55	Oakland Bay	7	5	40	1			25
56	Pickering Passage	14	8		8			45
	Totals	561	532	1676	1159	406	54	1679

[1]For Pelagic Cormorant, Canada Goose, domestic goose, Bald Eagle, Osprey, American Black Oystercatcher and Killdeer, see breeding species accounts for subregion and numbers observed.

[2]Numbers are of individuals on or associated with active nests.

[3]Derived from count of active nests.

[4]We observed 28 nests along Elliott Bay; this total includes estimates from Eddy (1982 and pers. comm.).

GREAT BLUE HERON *Ardea herodias*. This widespread species was found in 44 of the 56 subregions surveyed. Apparently a number of small to medium-sized heronries are located throughout the study area. Undoubtedly nearly all birds observed, all of which were adults, were breeding birds foraging near their nest sites. The observed birds represent perhaps only 50% of the actual number of nesting birds: it is very likely some adults were at nests and others were missed during censusing.

The methods of survey we employed to detect birds on the water or nearby shoreline are not suitable for locating heronries, which are often a considerable distance from the water in upland habitats. Even when close to the water, nests are

often partially concealed in tree-top foliage. To date there has not been a statewide effort to locate and identify all nesting sites, though a one-year survey of heronries in the King County portion of the study area (greater Seattle area) was conducted by Shipe and Scott (1981).

CANADA GOOSE *Branta canadensis*. We saw only 34 birds, including family groups, in six subregions (Numbers 8, 22, 27, 56 on Figure 1), particularly in the Kellogg Island area of the Duwamish Waterway, Seattle (20 birds), and in the Puyallup River delta at Tacoma (6 birds). It is likely many additional birds were missed. A number of domestic-type geese (*Anser sp.*) were also observed.

MALLARD *Anas platyrhynchos*. We observed 532 individuals, including many family groups in 25 subregions. In most cases the birds appeared to be tame or at least partially so, nesting and feeding in close proximity to human habitations and activity.

Many urban "Mallards" are fed by humans in the study area, though some, especially those residing in industrial areas, may be self-sufficient. Many birds were of mixed plumage, revealing interbreeding with domestic stock. We believe we missed a high proportion of the Mallards that are present in the study area during the summer. Mallards are rarely found nesting in the Strait of Juan de Fuca/San Juan Islands/Strait of Georgia area (pers. obs.).

BALD EAGLE *Haliaeetus leucocephalus*. During this survey we observed 15 adult Bald Eagles in 10 subregions (Subregion-No. obs.: 2-1; 5-4; 7-1; 8-1; 39-1; 40-2; 42-1; 44-1; 47-2; 55-1). This is clearly a low count for this area, a product of our census techniques.

During summer, 1982, personnel from the state's Nongame Wildlife Program conducted eagle nesting surveys in Washington. In our present study area they found several active nests. Along Hood Canal 6 nests were located; 2 were unoccupied and the other 4 were unsuccessful. In the area of Admiralty Inlet from Port Townsend south to Port Madison, 10 nests were located, and 4 of these produced 7 young. Seventeen nests were located in the area east of Whidbey Island. Twelve of these were occupied, 11 of which produced 17 young. In the Puget Sound area south of Port Madison, only 4 of 12 nests were successful and these produced 5 young.

OSPREY *Pandion haliaetus*. We observed two adults at two possible nest sites (Subregion-No. obs.: 2-1; 54-1). Our census techniques were not well-suited to locating Osprey nests and we probably missed seeing a number of breeding birds present in the study area.

AMERICAN BLACK OYSTERCATCHER *Haematopus bachmani*. We observed only three individuals of this species during the survey, all on a gravel/sand spit island at the north end of Indian Island in Port Townsend (Figure 2). We did not find proof that these birds were breeding there, though the situation was suitable. These individuals may have been non-breeders or perhaps foraging breeders from Protection Island, about 17 km away, though our experience indicates this latter possibility is unlikely. There is no reason to believe that additional birds occur within the study area, and there are no historical breeding records for this area (Speich and Wahl in press). During sureys of breeding birds in the Strait of Juan de Fuca, San Juan Islands, Strait of Georgia and adjacent waters in 1978 and 1979, 46 pairs were found nesting on 25 islands and other sites north of the present study area. About 330 birds are known to occur at about 100 nesting locations in western Washington marine areas (Speich and Wahl in press).

KILLDEER *Charadrius vociferus*. We saw only 22 individuals during the survey. Undoubtedly, many others were overlooked in uplands adjacent to marine waters. However, total numbers are probably not large for the entire study area.

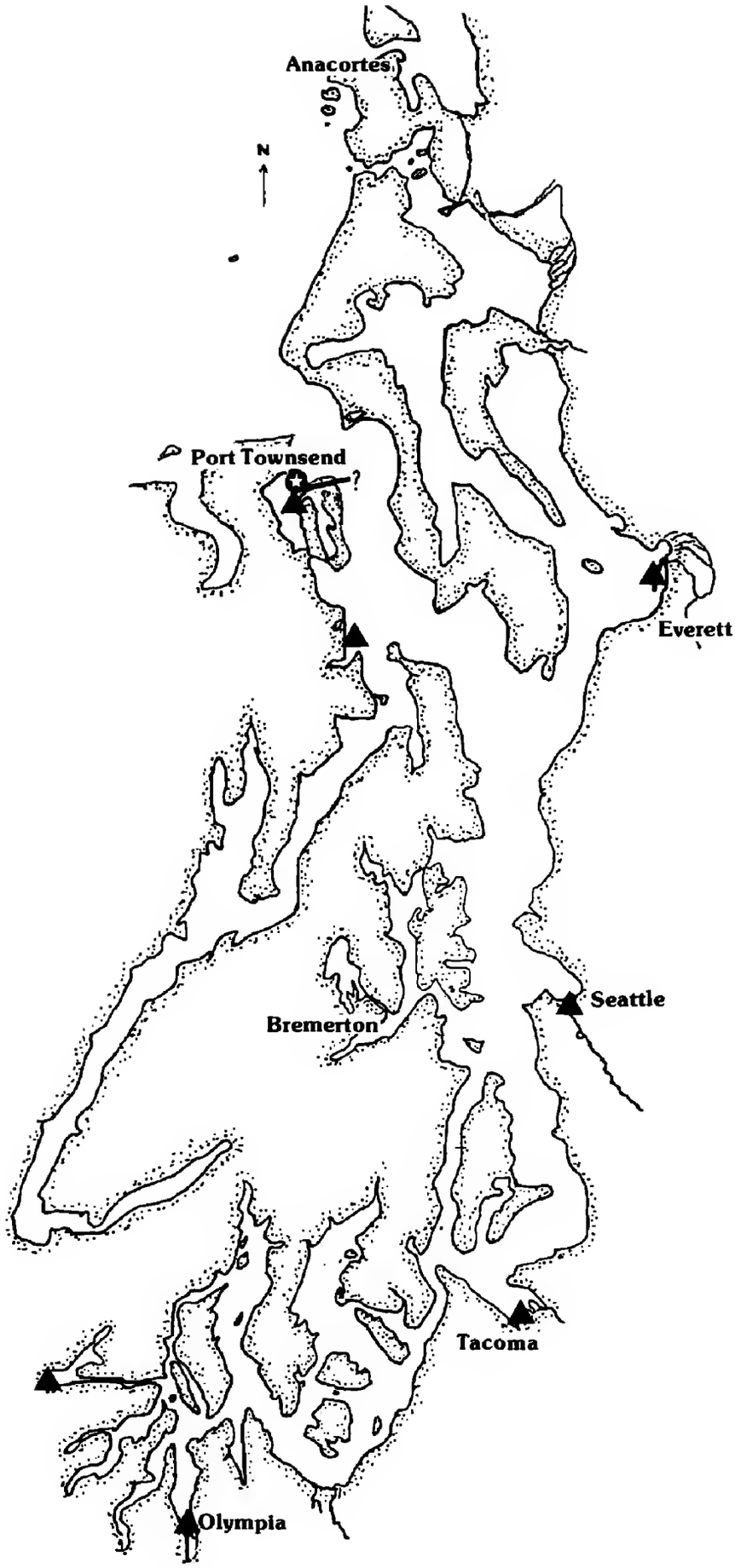

Figure 2. Nesting sites and colonies of Pelagic Cormorant (starred circle), American Black Oystercatcher (question mark) and Glaucous-winged Gull (triangles) in study area, Puget Sound, Hood Canal and waters east of Whidbey Island, Washington, summer 1982.

GLAUCOUS-WINGED GULL *Larus glaucescens*. Although observed in numbers in nearly every subregion, relatively few were breeding. Nearly all birds were in a subadult plumage, in many cases the last recognizable one. The occurrence of subadults was particularly pronounced in areas away from the few nesting colonies. We recorded about 14,000 non-breeding birds, with concentrations near nesting sites and at feeding areas along river deltas and tidal fronts. In addition, a large proportion of the 5400 unidentified gulls observed were probably this species. Many non-breeding birds found in the study area in the summer are progeny from colonies to the north, at Protection Island and in the San Juan Islands (Wahl, unpub. banding data).

Despite the large numbers of Glaucous-winged Gulls in the study area, we found nesting sites in only 9 of the 56 subregions (Tables 1 and 2). Table 2 contains approximate locations, with comments on the colonies within each subregion. The locations of colonies are shown in Figure 2. In total, we observed about 1100 breeding birds at 16 sites (Table 2). Additionally, about 300 nests were scattered on buildings and waterfront areas of Seattle (Eddy 1982) that we could not see from the water. This brings the study area total to about 1700 breeding Glaucous-winged Gulls, or 850 pairs. It is very likely that additional isolated pairs, easily overlooked, are breeding in the study area.

As in other nesting species, the Glaucous-winged Gull nests in larger numbers in more northern regions of Washington's inland waters, outside the study area. Nesting sites inside Puget Sound are essentially confined to the colonies at Shelton, Olympia, Tacoma and Seattle. Apparently, Glaucous-wings do not nest in any numbers along Hood Canal. The colony at Jetty Island, Everett, is the only colony east of Whidbey Island. For comparison with Table 2, about 9000 pairs nest in areas north of the present study area and in total about 40,000 birds nest in western Washington, including the outer coast (Speich and Wahl in press).

PIGEON GUILLEMOT *Cepphus columba*. This is the most widespread seabird which nests in the study area. It also feeds exclusively within marine habitats. It occurs in pairs and small groupings of pairs almost wherever suitable cliffs are found, nesting there and under old piers and in similar situations. We counted in total 1159 individuals; guillemots occurred in all but 4 of the 56 subregions. Many cliffs that appeared to contain suitable nesting habitat lacked birds. This species was more evenly distributed throughout the study area, including Puget Sound, than any other breeding species, except perhaps the Great Blue Heron. From four to six thousand guillemots nest in western Washington (Speich and Wahl in press).

MARBLED MURRELET (*Brachyramphus marmoratus*). We found this species to be widespread in small numbers throughout the study area. It was infrequently observed in the southern reaches of Puget Sound, but was observed much more often in northern areas. Location of birds observed foraging are assumed to be close to mainland nesting locations, though in fact at least some birds may commute considerable distances inland to nest. To help complicate the picture, utilized foraging areas may shift due to prey mobility, and the species, a strong flier, is easily capable of moving rapidly between subregions. However, the overall distribution pattern in this study area is unlikely to be very different.

Nesting locations of Marbled Murrelets are still largely a mystery. Only one egg has thus far been found in Washington, near Saxton, Whatcom County, on the Nooksack River, 19 June 1925 (Anonymous 1927). A nest is yet to be found in Washington (see Kiff 1981, for a review of the few known nests elsewhere), but there is little doubt Marbled Murrelets breed in the state, and probably along many marine shorelines (Wahl et al. 1981; Speich and Wahl in press).

The total population of adult birds using the study area during the breeding season may be considerably higher than the numbers observed. Marbled Murrelets are often difficult to detect during transect counts. We observed 406 individuals, a figure that

could at one extreme represent half their numbers. Thus, maximally about 400 pairs may be present, and minimally about 200 pairs. Similarly, about 2400 birds are known to occur in the inland marine areas east of Cape Flattery, but the actual total is likely twice that number (Speich and Wahl in press). We observed several birds-of-the-year, alone and in the company of adults.

BELTED KINGFISHER *Ceryle alcyon*. This is a widespread species, with at least one breeding pair found in most bays and harbors, and at many stream estuaries. We saw 53 individuals, and as these birds are often difficult to see in shoreline vegetation or may be unobservable in burrows, this count surely represents at best only half of all breeding birds and probably much less than that.

NORTHWESTERN CROW *Corvus caurinus*. This common species was observed throughout the study area and was one of the most widespread species. We observed 1649 individuals, certainly representing only part of their numbers in the study area. The presence of crows along marine shorelines is of course greatly influenced by tidal

Table 2. The location and numbers of Glaucous-winged Gulls nesting in Puget Sound and east of Whidbey Island, summer 1982.

Subregion Number and Name	Nesting Site Name and Description	Numbers of Nesting Birds	
		Pairs	Individuals
6 Possession Sound	Jetty Island		300[1]
8 Port Townsend	Indian Island, bar		100[2]
11 Hood Canal Entrance	Colvos Rock, north	22	44[3]
22 Northcentral Puget Sound	Ferry terminal dolphins	1?	2?
23 Elliott Bay (Seattle)	Pier Three, dolphin	1	2
	Railroad bridge foundation	1	2
	Pier Thirty, decaying	12	24[3]
Seattle, downtown	(See Eddy 1982)	300	600
34 Commencement Bay	Hylebos Waterway (two sites)	3	6
(Tacoma)	Blair Waterway	1	2
	Puyallup River, mouth, pier		116[1]
	Milwaukee Waterway, pier	200	400[2]
	Navigation marker	2	4
	Dolphin	1	2
45 Case Inlet	Dolphin	1?	2?
48 Budd Inlet	Dolphins; old dock; channel markers; small rock (?)		30 +[1]
55 Oakland Bay (Shelton)	sawmill: levee; floating logs	20	40[2]
		Total	1676

[1]Number based on count of adults.

[2]Number based on count of adults and nests.

[3]Number based on count of adults on nests.

level; thus our counts in many cases are minimal. Although this species nests in upland habitats, its impact on marine shorelines should not be underestimated. All the marine shoreline of Puget Sound is probably patrolled daily by crows. NOTE: For purposes of this paper we are attributing crow sightings to *caurinus:* most observers in northwest Washington believe resident birds are simply "crows" and do not attempt to identify them further (see Johnson 1961).

NON-BREEDING SPECIES

COMMON LOON *Gavia immer*. We observed 46, most in southern Admiralty Inlet and Penn Cove. Scattered birds were in deeper passages and inlets. None were in breeding plumage.

ARCTIC LOON *G. arctica*. We saw three in Carr Inlet and two other individuals elsewhere.

EARED GREBE *Podiceps nigricollis*. Two birds in breeding plumage were in Killisut Harbor.

WESTERN GREBE *Aechmophorus occidentalis*. Flocks of non-breeding birds are reported from the study area in summer (W. Harrington-Tweit pers. comm.) as they are in other Washington areas (Wahl et al. 1981). However, we observed only 154 birds, with 79 in Port Susan, 49 in the Great Bend subregion, and 14 in Case Inlet. Non-breeding numbers appeared low elsewhere in Washington inland waters in 1982 (Wahl pers. obs.)

DOUBLE-CRESTED CORMORANT *Phalacrocorax auritus*. We observed 256 birds foraging and resting in Skagit Bay, but elsewhere noted only scattered birds, totalling 30. Nearly 3300 birds breed at about 30 sites in more northern and in the coastal marine areas of Washington (Speich and Wahl in press).

BRANDT'S CORMORANT *P. penicillatus*. Twelve birds were seen in Case and Budd inlets and Peale Passage. In Washington this species breeds only along the outer coast, and in low numbers: four sites with about 560 birds (Speich and Wahl in press).

DABBLING DUCKS *Anas sp*. One Northern Pintail (*A. acuta)* was identified, and about 200 unidentified dabblers were seen during aerial censuses in Skagit Bay.

SCAUP *Aythya sp*. Almost all of 100 scaup observed were in Skagit and Port Susan bays.

COMMON GOLDENEYE *Bucephala clangula*. Five birds were observed.

BUFFLEHEAD *B. albeola*. One bird was observed.

OLDQUAW *Clangula hyemalis*. We observed one bird.

HARLEQUIN DUCK *Histrionicus histrionicus*. We observed 72. Six in Central Puget Sound subregion and one in Rich Passage were the only birds recorded south of the entrance to Hood Canal. We saw 35 near Port Townsend on the Indian Island spit, 11 in Killisut Harbor and 14 in Penn Cove-Crescent Harbor. Harlequin Ducks nest in the mountains of western Washington.

WHITE-WINGED SCOTER *Melanitta fusca*. We identified 913, with over 600 concentrated in Penn Cove-Crescent Harbor and Skagit Bay. In addition, about 3000 unidentified scoters were recorded in these same areas, and some at least were this species.

SURF SCOTER *M. perspicillata*. Skagit Bay and Penn Cove-Crescent Harbor held over 900 of 1250 birds identified. Many unidentified scoters were likely this species. Small numbers were observed in northern Puget Sound and Hood Canal.

COMMON MERGANSER *Mergus merganser*. We saw 162 birds in Skagit Bay and 20 in Oakland Bay. This is a relatively common nesting species along coastal rivers in western Washington.

RED-BREASTED MERGANSER *M. serrator*. Four were in Killisut Harbor and one was observed in Case Inlet.

AMERICAN COOT *Fulica americana*. Three scattered birds were noted. Coots nest commonly in inland freshwater areas in western Washington.

RUDDY TURNSTONE *Arenaria interpres*. Two were observed on the Tacoma waterfront at the Puyallup River delta.

WESTERN SANDPIPER *Calidris mauri*. About 370 birds of this species and unidentified "peeps" were observed, indicating minimum migration in the area. Adequate census coverage of the Nisqually delta area would likely have revealed many more of this and other shorebird species.

CALIFORNIA GULL *Larus californicus*. We identified a total of 393 in small flocks dispersed in appropriate habitats. The species occurs as a non-breeder and post-breeding migrant regularly in summer in inland Washington marine waters.

RING-BILLED GULL *L. delawarensis*. About 170 in Skagit Bay and 50 in Henderson Inlet comprised almost all the birds observed. This gull nests in one and perhaps two sites in outer coastal bays in western Washington, numbering perhaps 100 nesting birds (Speich and Wahl in press).

MEW GULL *L. canus*. We noted 25 birds, mostly in Skagit Bay and Penn Cove-Crescent Harbor. Some of 5451 unidentified gulls observed were likely of this and the preceeding two species.

BONAPARTE'S GULL *L. philadelphia*. Numbers were relatively low, with only 140 noted. Most were in the northern part of the study area, though some may have been present in the Nisqually delta, the outer shoreline of which was observed only from a distance.

HEERMANN'S GULL *L. heermanni*. Small numbers totalling 34 birds were noted north of the entrance to Hood Canal to Port Townsend.

CASPIAN TERN *Sterna caspia*. We noted 41 birds throughout the study area, concentrated near river deltas and estuaries. Twenty-three were in Skagit Bay. In western Washington, about 8000 Caspian Terns nest at three sites in outer coastal bays (Speich and Wahl in press).

COMMON MURRE *Uria aalge*. About 340 birds were seen, with 284 in the passage between Treble Point and Johnson Point and small flocks in Carr Inlet and Pitt Passage.

RHINOCEROS AUKLET *Cerorhinca monocerata*. Of 322 birds observed, 295 were noted from Oak Bay north to Port Townsend. We observed 15 near Seattle and 11 south of Steilacoom. The latter birds were in immature plumage whereas more northerly birds were in breeding plumage. The species breeds at Protection Island, a few miles northwest of Port Townsend and in large numbers at two other sites outside the study area. About 60,000 birds nest at several sites in western Washington (Speich and Wahl in press).

DISCUSSION

Marine bird populations observed in the study area likely reflect a number of factors, though in some instances the effects of these factors and interrelationships are not clear.

Much of the study area is highly developed, some portions are heavily industrialized, and human activities are widespread and intensive.

Populations of seabirds in summer appear generally to be low. Nesting habitat for cormorants is limited. Glaucous-winged Gulls nest predominantly

on man-made habitats. Pigeon Guillemots are widespread, utilizing nest sites throughout the study area, though not all cliffs which appear suitable are used. Guillemots nest in very small numbers in Tacoma and Seattle where piers offer many potential nest sites. Contrasting with this very limited number of breeding "seabirds" in the study area, the adjacent inland waters to the north have sizable numbers of nesting Double-crested and Pelagic cormorants, American Black Oystercatchers, Glaucous-winged Gulls and Rhinoceros Auklets, in addition to large numbers of Pigeon Guillemots and, presumably, Marbled Murrelets. In addition, breeding populations of Great Blue Herons and Bald Eagles are substantially higher to the north (Wahl et al. 1981, Speich and Wahl in press).

Populations of non-breeders include gulls associating with human activities and structures, small numbers of loons, grebes, cormorants and alcids using offshore areas, and many species using suitable nearshore estuarine habitats when disturbance is low. Population sizes of many non-breeding species appear low in comparison to areas in the San Juans, Strait of Georgia and Strait of Juan de Fuca to the north, with the exception of the area east of Whidbey Island including the Skagit and Port Susan estuaries, where large populations are indeed comparable to any in Washington in summer. The Nisqually delta, included in the present study area, is also comparable in many respects, though our survey did not adequately sample that area.

Total numbers of summer resident birds in the study area are, as in more northern areas, lower than corresponding figures for winter resident birds (Wahl et al. 1981, Wahl and Speich unpubl. obs.).

The impacts of increasing human use and development of habitats and comparisons of biological productivity of the study area with regions of the Strait of Juan de Fuca and adjacent waters warrant study and will likely contribute greatly to understanding birds and their place in the ecosystem.

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Pelagic Cormorant—breeding adult

Sketch by Narca Moore-Craig

Pigeon Guillemots on Southeast Farallon Island, California, August 1979. *Photo by Bruce E. Webb*

FALL MIGRATION OF BIRDS AT MALHEUR NATIONAL WILDLIFE REFUGE, OREGON

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In recent years, interest in fall wildlife observations has increased at Malheur National Wildlife Refuge, Harney County, Oregon. Previously, fall visitor use was primarily limited to hunting. An earlier paper (Littlefield and McLaury, West. Birds 4:83-88, 1973) reported the average spring arrival dates for birds. Numerous requests have been received for a similar report for fall migration dates.

Average fall arrival dates are not as precise as spring dates because many species nest at Malheur NWR, and it is not possible to distinguish between local nesters and fall migrants. In Table 1 we present the earliest fall arrival date, approximate peak period of fall migration, and latest fall departure for those species for which adequate information was available. For species that nest locally, "summers" is given instead of a fall arrival date; and for species wintering commonly on the refuge, "winters" is shown instead of a fall departure date. Several species have been observed in the winter, but are not common then or do not winter every year. These species are identified with an asterisk (*).

Fall migration at Malheur NWR begins in late June and extends through mid-December. Migrants move through the area over a 6-month period, but the greatest species diversity occurs in late August and early September. Most large wading birds reach their greatest abundance in September, whereas waterfowl do not peak until October. Migrant shorebirds are common in August, whereas peak passerine numbers and species occur from mid-August through late September.

We wish to acknowledge Fish and Wildlife Service personnel who have accumulated the following information. In particular we would like to thank Eugene Kridler, C. Fred Zeillemaker, Bruce Deuel, Walter Anderson, Eldon McLaury, Sean Furniss, Steve Thompson, Brad Ehlers and Larry Ditto. We would like to thank Larry Ditto, Brad Ehlers, Harry Nehls and Steve Thompson for editorial comments, and Ruth Warneke and Dee Dee Ehlers for typing assistance.

Table 1. Fall arrival dates, peaks of migration, and latest fall departure dates of birds at Malheur National Wildlife Refuge, Oregon.

SPECIES	EARLIEST FALL ARRIVAL DATE	FALL PEAK	LATEST FALL DEPARTURE DATE
Pied-billed Grebe *Podilymbus podiceps*	Summers	1 Sep-1 Oct	4 Dec 71*
Eared Grebe *Podiceps nigricollis*	Summers	5 Sep-5 Oct	23 Nov 71*
Western Grebe *Aechmophorus occidentalis*	Summers	10 Sep-20 Sep	14 Nov 73
American White Pelican *Pelecanus erythrorhynchos*	Summers	1 Sep-1 Oct	8 Dec 75*
Double-crested Cormorant *Phalacrocorax auritus*	Summers	10 Sep-20 Sep	9 Dec 71*
American Bittern *Botaurus lentiginosus*	Summers	10 Sep-1 Oct	9 Dec 59,60*
Great Blue Heron *Ardea herodias*	Summers	10 Sep-1 Oct	Winters
Great Egret *Casmerodius albus*	Summers	1 Sep-1 Oct	19 Nov 74*
Snowy Egret *Egretta thula*	Summers	1 Sep-10 Sep	25 Oct 73,75
Black-crowned Night-Heron *Nycticorax nycticorax*	Summers	1 Sep-1 Oct	13 Dec 63*
White-faced Ibis *Plegadis chihi*	Summers	1 Sep-10 Sep	28 Nov 76*
Tundra Swan *Cygnus columbianus*	Early Oct	10 Nov-25 Nov	Mid-Dec*
Greater White-fronted Goose *Anser albifrons*	21 Aug 80	20 Sep-20 Oct	7 Dec 63*
Snow Goose *Chen caerulescens*	3 Sep 61	20 Oct-1 Nov	20 Dec 58*
Ross' Goose *Chen rossii*	27 Oct 65	3 Nov-12 Nov	16 Nov 65
Green-winged Teal *Anas crecca*	Summers	1 Oct-15 Oct	Mid-Dec*
Northern Pintail *Anas acuta*	Summers	25 Aug-10 Sep	Early Dec*
Cinnamon Teal *Anas cyanoptera*	Summers	15 Aug-30 Aug	7 Dec 64*
Northern Shoveler *Anas clypeata*	Summers	1 Sep-10 Sep	Late Nov*
Gadwall *Anas strepera*	Summers	1 Oct-1 Nov	Mid-Nov*

Table 1 (Cont.)

SPECIES	EARLIEST FALL ARRIVAL DATE	FALL PEAK	LATEST FALL DEPARTURE DATE
American Wigeon *Anas americana*	Summers	25 Sep-10 Oct	Early Dec*
Canvasback *Aythya valisineria*	Summers	10 Oct-1 Nov	Mid-Dec*
Redhead *Aythya americana*	Summers	1 Aug-10 Aug	Late Oct*
Ring-necked Duck *Aythya collaris*	24 Aug 74	1 Nov-30 Nov	Early Dec*
Lesser Scaup *Aythya affinis*	Summers	10 Oct-1 Nov	Early Dec*
Common Goldeneye *Bucephala clangula*	23 Sep 75	1 Dec-10 Dec	Winters
Bufflehead *Bucephala albeola*	22 Sep 64	20 Oct-1 Nov	Early Dec*
Hooded Merganser *Lophodytes cucullatus*	9 Oct 60	20 Nov-1 Dec	Winters
Common Merganser *Mergus merganser*	Summers	20 Oct-10 Nov	Mid-Dec*
Ruddy Duck *Oxyura jamaicensis*	Summers	1 Oct-10 Nov	Mid-Dec*
Turkey Vulture *Cathartes aura*	Summers	1 Sep-15 Sep	20 Oct 65*
Osprey *Pandion haliaetus*	26 Aug 80	10 Sep-15 Sep	18 Sep 62
Bald Eagle *Haliaeetus leucocephalus*	31 Aug 81	15 Oct-15 Nov	Early Dec*
Northern Harrier *Circus cyaneus*	Summers	10 Oct-20 Oct	Early Dec*
Sharp-shinned Hawk *Accipiter striatus*	17 Aug 73	5 Oct-25 Oct	Late Nov*
Cooper's Hawk *Accipiter cooperii*	1 Sep 59	20 Sep-10 Oct	1 Dec 70*
Swainson's Hawk *Buteo swainsoni*	Summers	20 Aug-10 Sep	1 Oct 64
Red-tailed Hawk *Buteo jamaicensis*	Summers	25 Sep-15 Oct	Late Nov*
Rough-legged Hawk *Buteo lagopus*	10 Oct 80	15 Nov-1 Dec	Winters
American Kestrel *Falco sparverius*	Summers	20 Aug-15 Sep	Early Nov*
Prairie Falcon *Falco mexicanus*	Summers	20 Aug-15 Oct	Winters

Table 1 (Cont.)

SPECIES	EARLIEST FALL ARRIVAL DATE	FALL PEAK	LATEST FALL DEPARTURE DATE
Virginia Rail *Rallus limicola*	Summers	20 Aug-1 Sep	1 Nov 73*
Sora *Porzana carolina*	Summers	1 Sep-15 Sep	8 Nov 72*
American Coot *Fulica americana*	Summers	20 Sep-10 Oct	Mid-Dec*
Greater Sandhill Crane *Grus canadensis tabida*	Summers	1 Oct-20 Oct	15 Dec 77*
Black-bellied Plover *Pluvialis squatarola*	30 Jun 73	10 Sep-20 Sep	18 Oct 57
Semipalmated Plover *Charadrius semipalmatus*	18 Jul 67	1 Aug-15 Aug	7 Sep 59
Black-necked Stilt *Himantopus mexicanus*	Summers	1 Aug-10 Aug	9 Oct 71
American Avocet *Recurvirostra americana*	Summers	10 Aug-20 Aug	18 Nov 70
Greater Yellowlegs *Tringa melanoleuca*	21 Jun 69	1 Sep-25 Sep	25 Nov 76*
Lesser Yellowlegs *Tringa flavipes*	22 Jun 40	1 Aug-1 Sep	30 Oct 35
Willet *Catoptrophorus semipalmatus*	Summers	10 Jul-20 Jul	5 Sep 64
Spotted Sandpiper *Actitis macularia*	Summers	20 Aug-1 Sep	25 Nov 76
Long-billed Curlew *Numenius americanus*	Summers	10 Aug-25 Aug	15 Oct 64
Marbled Godwit *Limosa fedoa*	10 Jul 73	None noted	6 Oct 72
Western Sandpiper *Calidris mauri*	7 Jul 69	10 Aug-31 Aug	10 Nov 68
Least Sandpiper *Calidris minutilla*	2 Jul 69	25 Jul-25 Aug	5 Nov 62
Baird's Sandpiper *Calidris bairdii*	28 Jul 59	20 Aug-31 Aug	19 Sep 72,83
Pectoral Sandpiper *Calidris melanotis*	28 Aug 74	10 Sep-20 Sep	21 Oct 79
Dunlin *Calidris alpina*	24 Jul 73	20 Aug-25 Aug	1 Sep 62
Long-billed Dowitcher *Limnodromus scolopaceus*	30 Jun 73	10 Aug-31 Aug	26 Nov 71
Wilson's Phalarope *Phalaropus tricolor*	Summers	10 Aug-20 Aug	22 Sep (?)

Table 1 (Cont.)

SPECIES	EARLIEST FALL ARRIVAL DATE	FALL PEAK	LATEST FALL DEPARTURE DATE
Red-necked Phalarope *Phalaropus lobatus*	2 Jul 25	25 Aug-10 Sep	22 Oct 69
Franklin's Gull *Larus pipixcan*	Summers	1 Aug-5 Aug	2 Oct 76
Bonaparte's Gull *Larus philadelphia*	24 Aug 78	25 Sep-10 Oct	22 Oct 55
Ring-billed Gull *Larus delawarensis*	Summers	1 Aug-20 Aug	9 Dec 65*
California Gull *Larus californicus*	Summers	1 Aug-1 Sep	3 Dec 65
Caspian Tern *Sterna caspia*	Summers	1 Aug-1 Sep	9 Oct 40
Forster's Tern *Sterna forsteri*	Summers	20 Aug-10 Sep	22 Oct 71
Black Tern *Chlidonias niger*	Summers	10 Aug-31 Aug	11 Oct 40
Mourning Dove *Zenaida macroura*	Summers	25 Aug-10 Sep	17 Nov 70*
Short-eared Owl *Asio flammeus*	Summers	25 Oct-25 Nov	7 Dec 40*
Northern Saw-whet Owl *Aegolius acadicus*	9 Sep 62	5 Oct-25 Oct	11 Nov 61*
Common Nighthawk *Chordeiles minor*	Summers	15 Aug-31 Aug	3 Oct 71
Rufous Hummingbird *Selasphorus rufus*	27 June 70	25 Jul-25 Aug	22 Sep 71
Lewis' Woodpecker *Melanerpes lewis*	29 Aug 74	15 Sep-25 Sep	7 Oct 66
Yellow-bellied Sapsucker *Sphyrapicus varius*	18 Aug 77	15 Sep-25 Sep	18 Oct 70
Hairy Woodpecker *Picoides villosus*	1 Oct 77	10 Oct-1 Nov	Mid-Nov*
Northern Flicker *Colaptes auratus*	Summers	10 Oct-10 Nov	Winters
Olive-sided Flycatcher *Contopus borealis*	18 Aug 76	10 Sep-15 Sep	24 Sep 77
Western Wood-Pewee *Contopus sordidulus*	5 Aug 62	25 Aug-10 Sep	30 Sep 62
Willow Flycatcher *Empidonax traillii*	Summers	20 Aug-30 Aug	25 Sep 62
Dusky Flycatcher *Empidonax oberholseri*	15 Aug 65	5 Sep-20 Sep	22 Oct 63

Table 1 (Cont.)

SPECIES	EARLIEST FALL ARRIVAL DATE	FALL PEAK	LATEST FALL DEPARTURE DATE
Gray Flycatcher *Empidonax wrightii*	4 Aug 61	None noted	24 Sep 61
Western Flycatcher *Empidonax difficilis*	12 Aug 65	25 Aug-10 Sep	3 Oct 61
Say's Phoebe *Sayornis saya*	Summers	None noted	10 Oct 70
Ash-throated Flycatcher *Myiarchus cinerascens*	Summers	1 Aug-1 Sep	13 Oct 75
Western Kingbird *Tyrannus verticalis*	Summers	15 Aug-25 Aug	13 Sep 80
Eastern Kingbird *Tyrannus tyrannus*	Summers	None noted	11 Sep 71
Tree Swallow *Tachycineta bicolor*	Summers	10 Sep-1 Oct	27 Nov 79
Northern Rough-winged Swallow *Stelgidopteryx serripennis*	Summers	10 Jul-20 Jul	4 Oct 75
Bank Swallow *Riparia riparia*	Summers	5 Jul-15 Jul	12 Sep 40
Cliff Swallow *Hirundo pyrrhonota*	Summers	10 Jul-25 Jul	7 Sep 70,71
Barn Swallow *Hirundo rustica*	Summers	8 Sep-8 Oct	10 Nov 77
Mountain Chickadee *Parus gambeli*	19 Sep 83	1 Oct-1 Nov	Mid-Nov*
Brown Creeper *Certhia americana*	1 Oct 62	10 Oct-2 Nov	13 Nov 61
House Wren *Troglodytes aedon*	Summers	None noted	9 Nov 75
Golden-crowned Kinglet *Regulus satrapa*	27 Aug 66	25 Sep-25 Oct	1 Nov 40
Ruby-crowned Kinglet *Regulus calendula*	3 Sep 62	24 Sep-15 Oct	13 Nov 61*
Western Bluebird *Sialia mexicana*	30 Sep 71	20 Oct-1 Nov	22 Nov 73
Townsend's Solitaire *Myadestes townsendi*	29 Aug 76	10 Nov-20 Nov	Winters
Swainson's Thrush *Catharus ustulatus*	30 Aug 62	None noted	12 Oct 79
Hermit Thrush *Catharus guttatus*	3 Sep 61	20 Sep-10 Oct	31 Oct 75

Table 1 (Cont.)

SPECIES	EARLIEST FALL ARRIVAL DATE	FALL PEAK	LATEST FALL DEPARTURE DATE
Varied Thrush *Ixoreus naevius*	14 Sep 75	5 Oct-25 Oct	9 Nov 70*
Sage Thrasher *Oreoscoptes montanus*	Summers	25 Aug-15 Sep	9 Nov 77
Water Pipit *Anthus spinoletta*	11 Sep 70	10 Oct-20 Oct	7 Nov 40
Northern Shrike *Lanius excubitor*	7 Oct 80	1 Nov-1 Dec	Winters
Solitary Vireo *Vireo solitarius*	21 Aug 61	15 Sep-5 Oct	24 Oct 63
Warbling Vireo *Vireo gilvus*	24 Jul 66	25 Aug-7 Sep	16 Sep 70
Orange-crowned Warbler *Vermivora celata*	23 Aug 62	4 Sep-22 Sep	17 Oct 62
Nashville Warbler *Vermivora ruficapilla*	16 Aug 65	25 Aug-1 Sep	15 Sep 70
Yellow Warbler *Dendroica petechia*	Summers	15 Aug-10 Sep	8 Oct 63
Yellow-rumped "Myrtle" Warbler *Dendroica coronata*	12 Sep 71,75	1 Oct-10 Oct	15 Nov 71
Yellow-rumped "Audubon's" Warbler *Dendroica coronata*	5 Aug 66	15 Sep-15 Oct	14 Nov 74*
Townsend's Warbler *Dendroica townsendi*	14 Aug 76	23 Aug-7 Sep	4 Oct 75
American Redstart *Setophaga ruticilla*	17 Aug 70	1 Sep-20 Sep	14 Nov 70
MacGillivray's Warbler *Oporornis tolmiei*	7 Aug 61,72	15 Aug-25 Aug	10 Oct 71
Common Yellowthroat *Geothlypis trichas*	Summers	15 Aug-1 Sep	30 Sep 40
Wilson's Warbler *Wilsonia pusilla*	10 Aug 66	5 Sep-30 Sep	22 Oct 62
Yellow-breasted Chat *Icteria virens*	Summers	25 Aug-10 Sep	27 Sep 60
Western Tanager *Piranga ludoviciana*	16 Jul 66	25 Jul-20 Aug	21 Oct 63
Black-headed Grosbeak *Pheucticus melanocephalus*	30 Jul 62	15 Aug-1 Sep	7 Sep 61
Lazuli Bunting *Passerina amoena*	7 Aug 71	12 Aug-20 Aug	25 Aug 71

Table 1 (Cont.)

SPECIES	EARLIEST FALL ARRIVAL DATE	FALL PEAK	LATEST FALL DEPARTURE DATE
Green-tailed Towhee *Pipilo chlorurus*	1 Aug 61	25 Aug-10 Sep	11 Oct 71
Rufous-sided Towhee *Pipilo erythrophthalmus*	27 Aug 66	10 Sep-5 Oct	8 Nov 61*
Chipping Sparrow *Spizella passerina*	8 Aug 61	25 Aug-10 Sep	12 Oct 61
Brewer's Sparrow *Spizella breweri*	Summers	5 Aug-25 Aug	8 Sep 71
Vesper Sparrow *Pooecetes gramineus*	27 Jul 71	10 Sep-20 Sep	23 Sep 70
Lark Sparrow *Chondestes grammacus*	16 Jul 76	5 Aug-23 Aug	16 Sep 71
Sage Sparrow *Amphispiza belli*	Summers	1 Sep-1 Oct	20 Nov 70*
Savannah Sparrow *Passerculus sandwichensis*	Summers	10 Sep-5 Oct	25 Nov 76*
Fox Sparrow *Passerella iliaca*	5 Aug 18	15 Sep-5 Oct	20 Nov 70*
Lincoln's Sparrow *Melospiza lincolnii*	25 Aug 66	15 Sep-1 Oct	23 Oct 61*
Golden-crowned Sparrow *Zonotrichia atricapilla*	6 Sep 61	20 Sep-5 Oct	27 Nov 69
White-crowned Sparrow *Zonotrichia leucophrys*	28 Aug 80	18 Sep-10 Oct	6 Nov 40*
Dark-eyed Junco *Junco hyemalis*	1 Sep 62	5 Oct-25 Oct	Winters
Northern Oriole *Icterus galbula*	Summers	5 Aug-15 Aug	11 Sep 70
Pine Siskin *Carduelis pinus*	5 Sep 63	15 Oct-31 Oct	9 Nov 62
Evening Grosbeak *Coccothraustes vespertinus*	15 Sep 71	15 Oct-30 Oct	Early Nov*

*Has been recorded in winter

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FOOD COLOR PREFERENCE IN THE ANNA'S HUMMINGBIRD

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Food color preference in hummingbirds has been of interest since the early 1900s. The suggestion that hummingbirds innately prefer red food sources has been shared by many (Graenicher 1910, Porsch 1931, McCage 1961, Peterson 1961, Dennis 1975). Yet there are those who continue to find color preference insignificant except in association with other factors, such as the position of the vial, flowers in bloom and perch location (Bene 1941, Wagner 1946, Lyerly et al. 1950, Grant 1966).

I undertook this study to investigate further the response of the Anna's Hummingbird (*Calypte anna*) to variously colored food sources. The objective of this study was to determine if there was a significant color preference.

Determination of color preference in hummingbirds may indicate which naturally-occurring flowers would be visited most frequently. This preference could in turn influence the evolution of color in those flowers which are pollinated by hummingbirds.

STUDY AREA AND METHODS

I collected data for this study in Arcata, Humboldt County, California, between 17 October and 1 December 1980.

A sugar-water solution was used as the food source. The solution contained one part white granulated sugar to three parts water. Vials, filled with sugar solution, were hung from a porch overhang in front of a second level apartment facing south. The hanging apparatus on the vials consisted of red plastic; I assembled caps for the vials from construction paper matching the color of solution being offered. The small red corks were left exposed on all vials. Any bias involving the corks was consistent for each vial and for each trial. None of the food vials were replenished with additional solution once the trials began. After each vial was hung, following trial 4, the vial nozzle was coated with vegetable oil to prevent bees and wasps from landing on the vials and feeding. Early trials indicated that hummingbirds avoided the vials when bees and wasps were present.

I used four colors of vegetable food dye: red, yellow, blue and green. Coloration of the solution did not change during the trials.

In trials 1 through 4, each color was presented alone to the hummingbirds to accustom them to feeding from variously colored vials. These trials were also used to experiment with and remove possible biases. Trials 5 through 11 presented paired choices from the four basic colors. During trial 12, all four colors were placed on the porch edge approximately 0.16 m apart. During trial 13, the feeders were placed 0.55 m from each other. For each of the four mornings during this trial, the vials were arranged in a different color order to remove any bias created by their specific locations.

Aided by 8x 30 binoculars, I observed hummingbird feeding behavior for 40 hours. Vials were suspended for a total of 42 days. "Feeding time" began as soon as the bird approached and made bill contact with the vial nozzle and

ended when the bird flew away from the vial. Time recorded as feeding included the actual hovering time, although bill-to-nozzle contact may not have been constant.

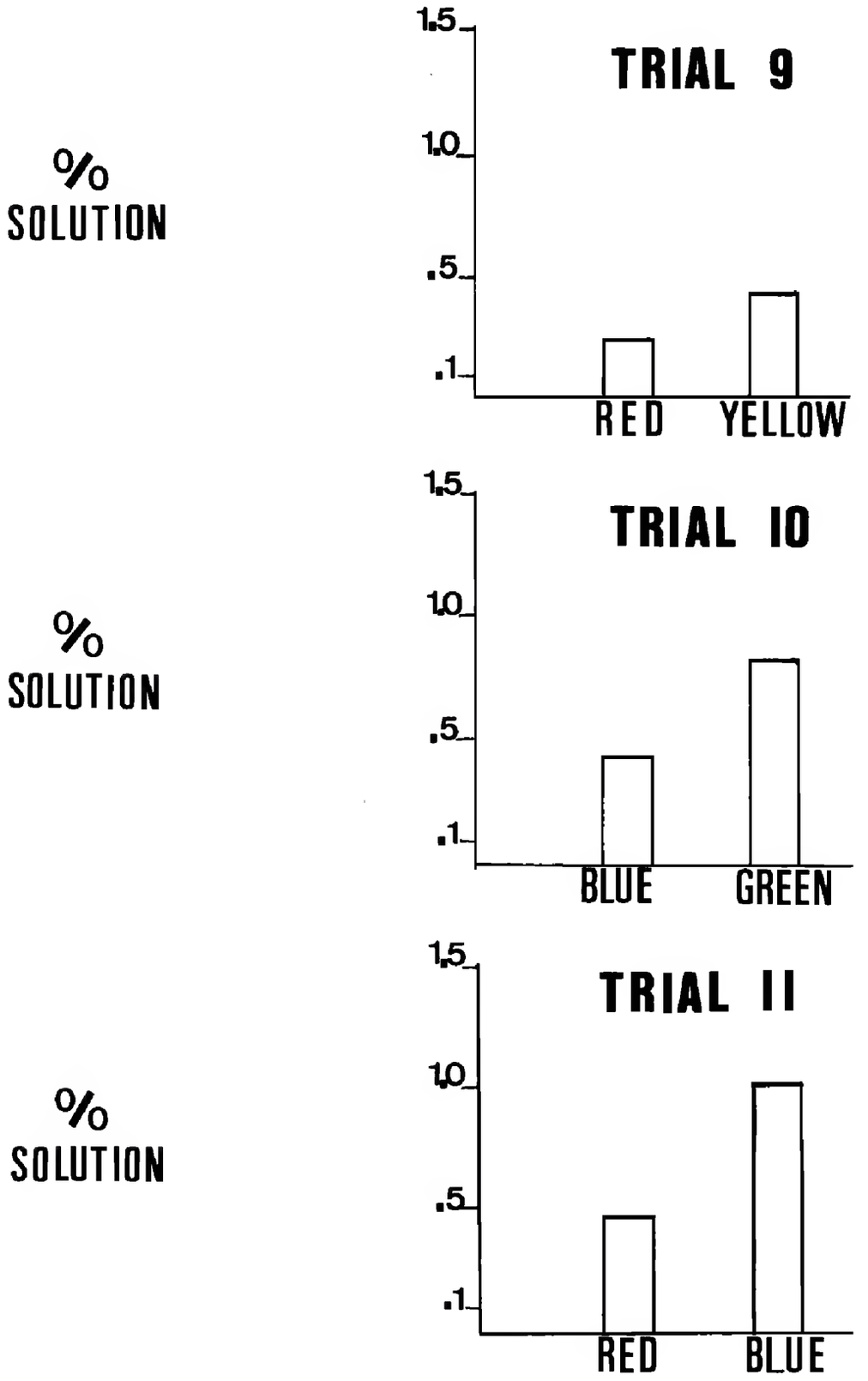

Figure 1. Percent of sugar-water solution removed per hour, in relation to color, by the Anna's Hummingbird.

In addition to color preference, I determined the frequency of visits in relation to time of day and weather conditions by observing the number of times per hour a hummingbird visited a vial.

RESULTS

COLOR PREFERENCE

Despite problems involved in trials 1 through 4 (bee and wasp disturbances, leaky vials and broken nozzles), I compared the amounts of solution removed from the individual vials over their allotted times (Table 1).

Trials 9, 10 and 11 were the only paired choice trials to indicate color preference (Figure 1). Data concerning the amount of solution removed in trial 7 (green vs. red) was rejected. One of the vials used in this trial proved faulty, causing frequent loss of sugar-water. However, the lengths of time spent feeding at particular vials in trial 13 indicated an obvious preference for green over red. Of the total observed feeding time, 78.3% was spent at the green feeder. The outcome from trials 5 and 6 was inconsistent with the results of the other 10 trials. Trial 5 showed a 0.10% preference for red over green and trial 6 showed a 0.18% preference for yellow over blue.

Trial 12 revealed a possible bias which may have occurred earlier in the study. When I presented all four colors at one time, 0.16 m apart, hummingbirds apparently preferred the end feeding positions without consideration for food color. For example, when the feeding vials were presented in the red-yellow-blue-green order, red received 76.5% of the observed attention; green received 23.5%; whereas yellow and blue apparently were not fed upon at all.

Trial 13 showed an overall preference for green food coloring. Of the total solution removed, 42.4% was green and accounted for 81.0% of the observed feeding time. The next most preferred color in trial 13 (as well as trials 8, 10 and 12) was blue, which accounted for 29.5% of the solution removed, then yellow with 23.6%. Red was apparently disfavored, contributing only 4.5% of the total amount of solution removed.

Table 1. Amounts of sugar-water solution removed by the Anna's Hummingbird from feeding vials presented alone between 17 and 28 October 1980 in Arcata, California.

Trial #	Color	Total Solution Amount Removed	Average Amount of Solution Removed Per Hour	% of Total Solution Removed Per Hour
1	Red	23.55 ml/62 hrs.	0.38 ml/hr.	0.27%
2	Yellow	50.05 ml/61.5 hrs.	0.81 ml/hr.	0.59%
3	Blue	38.45 ml/62 hrs.	0.62 ml/hr.	0.45%
4	Green	122.85 ml/73 hrs.	1.68 ml/hr.	1.22%

CIRCADIAN FEEDING CYCLE

The number of visits appeared to be inversely related to the amount of time spent feeding (Figure 2). As the number of visits decreased between 0900 and 1000 and between 1700 and 1800, the length of feeding time per visit increased.

Weather apparently did not affect the number of visits and the length of feeding time. Weather conditions were characterized as cloudy-wet days averaging 5.50 visits per hour at 19.3 seconds per visit by hummingbirds, cloudy-dry days which averaged 5.86 bird visits per hour at 17.3 seconds and sunny days which averaged 4.62 bird visits per hour at 17.2 seconds.

DISCUSSION

This study indicated that Anna's Hummingbirds prefer green food color with red being least preferred. Six trials contained color choices involving green. Each trial indicated green as the preferred color. Red food color was also presented in six trials and was least preferred in each.

These data are not consistent with previous studies; however, the season in which the studies took place could be the key to the discrepancy. Tonna J. Harris (unpubl. data) tested color preference in both Anna's and Allen's (*Selasphorus sasin*) hummingbirds in Arcata, California, during spring. Her results clearly showed a preference for red. Michael Hansen (unpubl. data) also studied food color preference in Anna's, Allen's and Rufous (*S. rufus*) hummingbirds in Humboldt County, California, during summer. All three species preferred red. Numerous flowers which bloom during spring and summer are red, which could encourage a preference for that color. In contrast, few if any red flowers bloom during the late fall and winter, perhaps eliminating the attractiveness of red and encouraging green food color

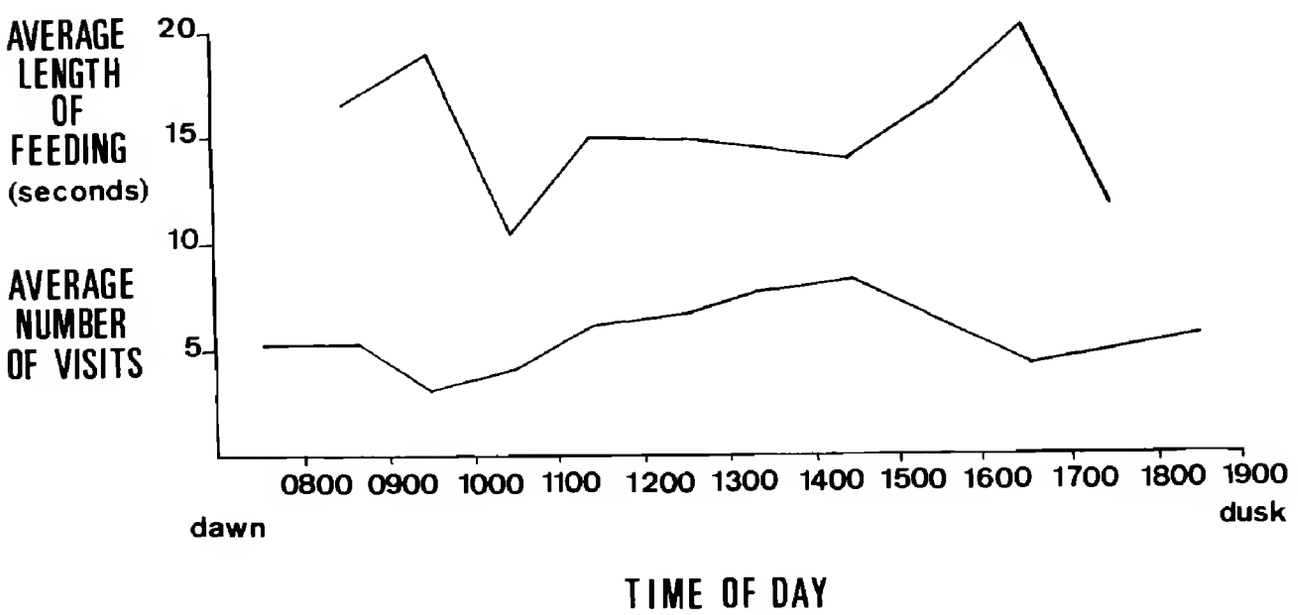

Figure 2. The average number of visits to feeding vials and average duration of feeding by Anna's Hummingbirds during 10-hour daylight periods between 17 October and 4 December 1980.

preference. I have observed hummingbirds feeding directly from water droplets on foliage, a behavior which may or may not be related to color preference.

Whereas numerous studies describe red food color preference in hummingbirds, an equal number of tests suggest no color favoritism (Bene 1941). Wagner (1946) reported that the color of flask receiving most of the attention always matched the color of the preferred flower at that particular season, matching not only the most abundant flower but the most preferred blooming flower as well. Lyerly et al. (1950) suggested that captive hummingbirds preferred the feeder positioned nearest to the bird's favorite perch, no matter what color it was. Food preference of the Anna's Hummingbird could depend on many factors in addition to color.

This study indicated that hummingbirds do not innately prefer red food sources. Their preference for green, at least during the non-flowering season, suggests that color stimuli or the lack of color stimuli may influence the food choice of the Anna's Hummingbird.

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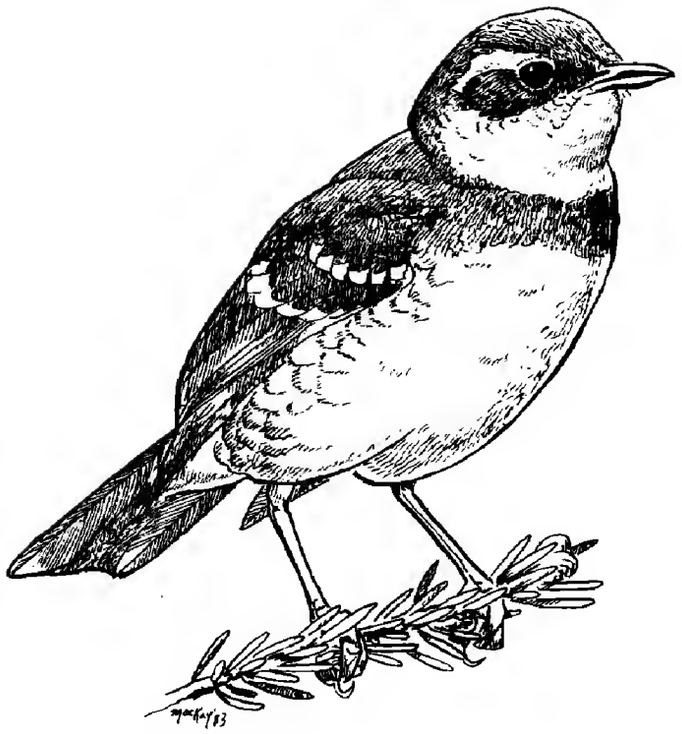

Varied Thrush *Sketch by Barry MacKay*

BIRD RECORDS COMMITTEES

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

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California: B.D. Parmeter, 2500 Emerson Street, Napa, CA 94558
Colorado: CFO Records Committee, Denver Museum of Natural History, City Park, Denver, CO 80205
Oregon: Oregon Bird Records Committee, P.O. Box 10373, Eugene, OR 97440
Utah: Donald A. Hadley, 111 East 3700 South, Bountiful, Utah 84010
Vancouver, British Columbia: Wayne C. Weber, 303-9153 Saturna Drive, Burnaby, B.C. V3J 7K1
Washington: Phil Mattocks, Rt. 2, Box 200, Vashon, WA 98070

The Utah Field Ornithologists have established the Utah Bird Records Committee which solicits, reviews and classifies reports of unusual birds found in Utah. Accepted records are reported in the *Black Rosy Finch* published quarterly by UFO and will be incorporated into an updated Utah state checklist. All reports and supporting documentation are housed in the Utah Museum of Natural History at the University of Utah.

Lists of species for which reports are sought and reporting forms are available from Donald A. Hadley, 111 East 3700 South, Bountiful, Utah 84010, to whom reports should be submitted for the Committee.

NOTES

UNUSUAL BEHAVIOR OF A RED-THROATED LOON

LAURIE J. BRYANT, Department of Paleontology, University of California, Berkeley, California 94720

L.D. COURTRIGHT, JR., 42 Eastfield Drive, Rolling Hills, California 90274

In the summer of 1978, Courtright observed and photographed a solitary Red-throated Loon (*Gavia stellata*) near the mouth of Ballona Creek where it enters the Pacific Ocean in Los Angeles County, California. Its remiges were tattered or poorly developed, perhaps due either to some nutritional deficiency or normal molt. A band of dark brown across the lower neck, extending faintly down the breast and belly, indicates that the bird had encountered oil on the water. Possibly related to these factors was the bird's unusual behavior in coming ashore. It swam rapidly toward the shore on the surface of the water and, without using its wings, leaped forward into the air and alighted on the beach.

This bird was first observed swimming on the water surface near shore, rising from the water occasionally and stretching its wings. It then swam rapidly toward the shore, wings tightly folded against the body. When the water became very shallow, it simply launched itself into the air at a low angle to the water. It glided for some 2 m, back hunched, tail spread and depressed, wings folded, feet trailing and toes appressed, and came to a rest with considerable force on its belly on a concrete boat-launching ramp. The loon lay with wings folded but slightly relaxed, the hind limbs flexed so that the tarsus and toes pointed forward. When alarmed by the nearness of the photographer, the loon made its way back into the water, using its feet to push itself along on its belly, and then swam away. At no time did the loon use its wings in flapping flight.

Harle (1952) and Peakall (1953) reported *G. stellata* alighting on and taking off from land, the only species of loon for which this behavior has been reported (Palmer 1962). Neither Harle (ibid.) nor Peakall (ibid.) illustrated this behavior; Figure 1 is thus the first published illustration of a loon alighting on land. There are no known published reports of loons leaping from water to land as described here, but the Red-throated Loon can leap up from water directly into flight, unlike other loons which require a running start (Terres 1980).

We wish to thank Joseph Morlan for his review and helpful comments.

Figure 1 Red-throated Loon leaping ashore near the mouth of Ballona Creek, Los Angeles Co , California, summer, 1978

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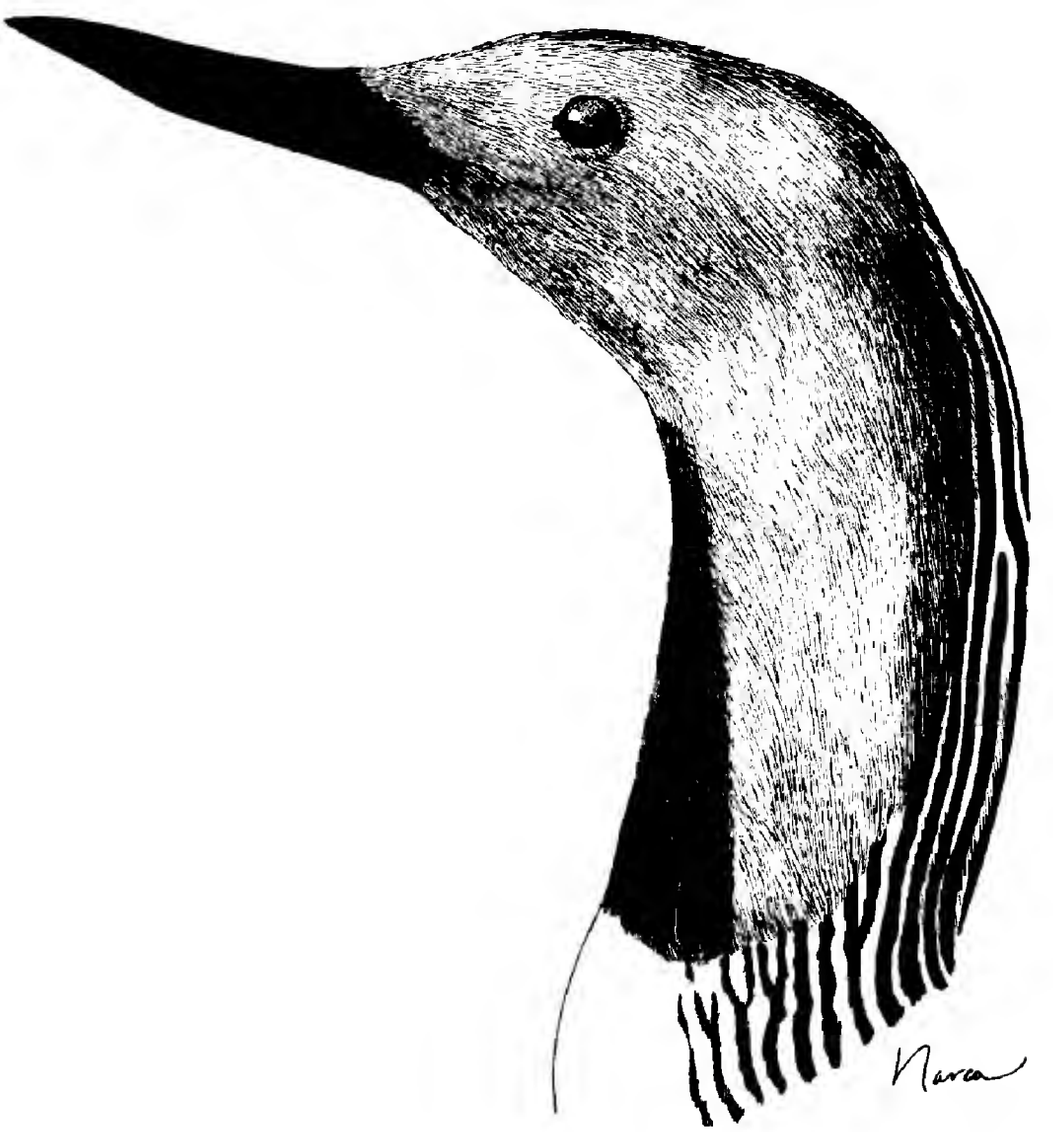
Accepted 7 November 1983



Red-throated Loon

Sketch by Narca Moore-Craig

A HIGH ELEVATION OCCURRENCE OF SCRUB JAYS IN THE SAN BERNARDINO MOUNTAINS

JONATHAN L. ATWOOD, Department of Biology, University of California, Los Angeles, California 90024

The widely distributed Scrub Jay *(Aphelocoma coerulescens)* is primarily limited altitudinally in southern California to elevations below approximately 2300 m (Pitelka 1951). However, on 26 July 1980 I observed two individuals of this species 0.5 km ESE of the peak of Mount San Gorgonio, San Bernardino County, California, at an elevation of approximately 3620 m. Vegetation in this area consisted of sparse, wind-stunted Limber Pine *(Pinus flexilis)*; the only other birds in evidence were Clark's Nutcrackers *(Nucifraga columbiana)*.

Although central and southern Mexican populations have been reported at elevations of up to 3700 m (Stone 1890, Davis 1945), there appear to be no comparable altitudinal records from the United States (Pitelka 1951). The highest previously reported observations from the San Bernardino Mountains involved birds seen during August and September at 2300-2500 m (Grinnell 1908, van Rossem and Pierce 1915). Breeding pairs of Scrub Jays maintain permanent, year-round territories (Atwood 1980, Ritter 1983), and the birds observed on Mount San Gorgonio probably were either non-breeding individuals or young of the year which had wandered upslope from more typical habitats at lower elevations.

This note was improved by the comments of Ned K. Johnson and G. Shumway Suffel.

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A BROWN-HEADED COWBIRD PARASITIZES NORTHERN ORIOLES

LADISLAV R. HANKA, Department of Zoology and Entomology, Colorado State University, Fort Collins, Colorado 80523

The Northern Oriole (*Icterus galbula*) is rarely reported to be parasitized by the Brown-headed Cowbird (*Molothrus ater*) (Friedmann 1963, Friedmann et al. 1977). Rothstein (1977) demonstrated that the Northern Oriole rejects cowbird eggs virtually 100% of the time and often within minutes of laying.

While examining nests in a small riparian woodlot west of Fort Collins, Colorado, I found two parasitized nests of Northern (Bullock's) Orioles. One contained three oriole eggs and one cowbird egg; the second contained one egg of each species. I found the first nest at approximately 0830 and the second at 0930 of the same day, 23 June 1977. Two other oriole nests were situated in the woodlot, but one was inaccessible and the other contained four young orioles.

I collected the cowbird eggs and determined their permeabilities to water vapor. Permeability to water vapor is a property of an egg dependent upon its physical construction. Permeability values are determined by measuring weight loss per day per vapor pressure difference per unit of surface area (see Ar et al. 1974). Observations of Sotherland et al. (1979) indicate that permeability of an egg to water vapor is an expression of the genome of the female and that eggs laid by a single female are likely to have similar permeabilities to water vapor. They found that variance in permeability to water vapor is greater among clutches than within clutches of Yellow-headed Blackbirds (*Xanthocephalus xanthocephalus*) and Black-billed Magpies (*Pica pica*). The two cowbird eggs had identical permeabilities to water vapor (0.54 mg day^{-1} kPa^{-1} cm^{-2}). Volumes of the cowbird eggs, determined by water displacement, were identical (3.1 ml). Additionally, coloring of the two eggs was very similar, further suggesting that they were laid by a single female.

The rejection response of the Northern Oriole weakens approximately 3 days after completion of the clutch (Rothstein 1977). However, the first clutch had been smaller two days previously and the second was incomplete at the time of collection. Cowbirds generally lay at dawn (Harrison 1973, Rothstein 1975). Since both eggs had probably been laid by one female, it is likely that one of the eggs had been in the nest for 26 hours or more and the other for 2 to 3 hours. The orioles thus had ample time in which to notice and reject the cowbird eggs. No other parasitized nests of any species were found in this woodlot, including four nests of Yellow Warblers (*Dendroica petechia*), one of the most frequently reported hosts of the Brown-headed Cowbird (Friedmann 1963, Friedmann et al. 1977).

Both the Northern Oriole and the Brown-headed Cowbird were among the species described by the first naturalists in north-central Colorado (Bailey and Niedrach 1965). This area is part of the original range of the Brown-headed Cowbird before its expansion with agriculture (see Mayfield 1965). Since Rothstein (1977) has shown that the Northern Oriole rejects cowbird eggs even in areas outside of the original range of the cowbird, it seems peculiar to find any orioles accepting cowbird eggs in Colorado. One would expect rejection to be a particularly ubiquitous response in such an area of long standing sympatry.

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Accepted 11 October 1983

Brown-headed Cowbird Northern Oriole

Sketch by Keith Hansen

NOTES ON THE FEEDING BEHAVIOR OF GULLS AND CROWS ON CLAMS AND CRABS AT THE YAQUINA ESTUARY, OREGON

RANGE D. BAYER, Department of Zoology, Oregon State University Marine Science Center, Newport, Oregon 97365 (present address: P.O. Box 1467, Newport, Oregon 97365)

Crows (Grobecker and Pietsch 1978, Zach 1979) and gulls (Tinbergen 1961, Barash et al. 1975, Ingolfsson and Estrella 1978, Kent 1981, Maron 1982, Rockwell 1982) often drop hard-shelled food items to open them. Here, I describe some techniques that gulls and crows used to find and break naturally occurring clams (i.e., clams that were not made available by human clammers) and that gulls used to eat crabs.

I observed clam-handling behavior of gulls and crows for approximately 60 h during April and May 1974. Observations of gulls' crab-handling behavior were made sporadically from 1974 to 1977. All observations were at the Yaquina Estuary, Lincoln County, on the mid-coast of Oregon. The bird species involved were the Common Crow (*Corvus brachyrhynchos*), Western (*Larus occidentalis*) and Glaucous-winged (*L. glaucescens*) gulls and Western x Glaucous-winged Gull hybrids (see Hoffman et al. 1978). As I did not detect any behavioral differences between gull species with respect to handling clams, their behavior is lumped, and, for convenience, I refer simply to gulls and crows.

By examining the shells of clams dropped by gulls or crows, I determined that only Cockles (*Clinocardium nuttalli*) and Littlenecks (*Venerupis staminea*) were captured. Both clams have short siphons and are found on or close to the surface of intertidal mudflats. All clams captured and broken by gulls and crows were between 2-8 cm wide (where width was the maximum anterior-posterior dimension) with 70% of all Cockles (N = 105) and 74% of all Littlenecks (N = 23) 4-6 cm wide.

Gulls used three techniques to locate and capture clams: they hovered about 2-5 m above shallow water (<0.5 m), alighted on the water, surface-dove and grasped the clams with their bills; secondly gulls waded in water about 10 cm deep while looking ahead and down into the water and picked up clams; finally, gulls walked on the mud and picked up or pulled out clams from the surface. I did not observe gulls dig into mud after clams. Gulls also obtained clams from other gulls or from crows by kleptoparasitism.

Crows located clams while walking on the mudflats and used their bills to pick up clams on the surface. To extract buried clams, a crow picked up sand with its bill and dropped the sand beside the clam, and/or used side-wise movements with an open bill to push sand away from the clam. Crows could dig down to about 2 cm and then pull the clam out of the mud with their bills. Crows also pirated clams from other crows or gulls.

I observed gulls attempt to break clams by flying almost vertically to an altitude of about 3-10 m, dropping the clam and then flutter-dropping down to where the clam hit. This flying-drop technique has been previously described (e.g., Tinbergen 1961, Barash et al. 1975, Kent 1981). I observed gulls use only flying drops to break clams, but Barash reported that gulls also dropped clams while standing on the substrate. Barash found that the flying drop, which was more efficient in breaking clams but also more subject to gull kleptoparasitism, was used when gull densities were less than about 12 gulls within 50 m. The absence of standing drops at the Yaquina Estuary may be a result of the low densities of gulls around a gull with a clam; I never observed more than five gulls within 50 m and often no other gulls were present.

Crows exhibited more behavioral plasticity than gulls in handling clams. Some crows used flying drops to try to break open clams, while others attempted unsuccessfully to peck open shells. One crow apparently cached a clam by taking a clam to dry sand, dropping it, then using its bill to place a 7 x 13 cm piece of wood and then sand on the clam (incompletely covering it) and then flying away. Finally, I observed crows several times take unbroken clams into an adjacent forest, presumably to their nests.

I observed gulls fly over shallow water, alight, dive and swim or fly away with live Dungeness (*Cancer magister*) or Red Rock (*C. productus*) crabs. On shore, gulls broke each leg off successively and pecked at the underside of the crabs. Although I have observed a Western Gull drop a large flounder on rocks, in 11 observations of gulls capturing crabs, I did not see a gull using flying drops to open crabs as reported for Herring Gulls (*L. argentatus*) by Ingolfsson and Estrella (1978).

I am grateful to John A. Wiens and Dennis Heinemann for reviewing an earlier draft of this manuscript.

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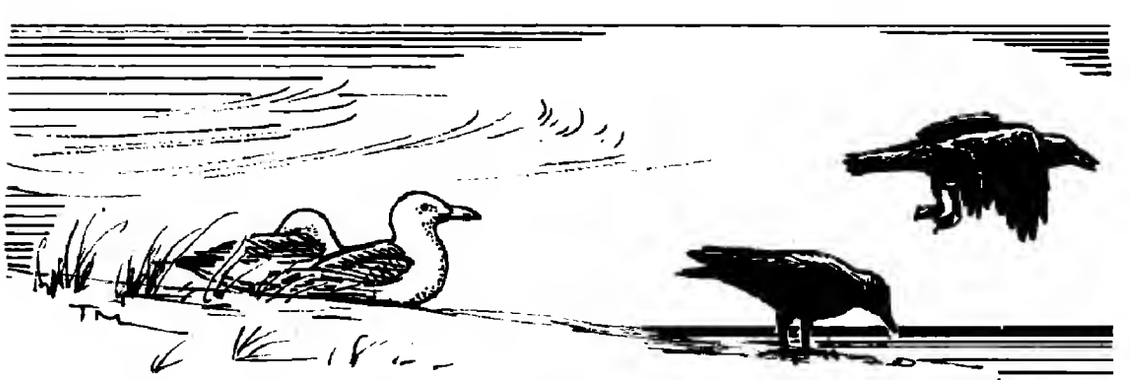
Accepted 24 October 1983



Sketch by Tim Manolis

BEHAVIOR OF LEKKING SAGE GROUSE IN RESPONSE TO A PERCHED GOLDEN EAGLE

KEVIN L. ELLIS, Department of Zoology, Brigham Young University, Provo, Utah 84602

Other investigators (Patterson 1952, Wiley 1973, Hartzler 1974) have described the anti-predator behavior of lekking Sage Grouse *(Centrocercus urophasianus)* to an approaching Golden Eagle *(Aquila chrysaetos)*. However, no accounts exist of the behavioral responses of Sage Grouse to a perched Golden Eagle, largely because most Sage Grouse leks are on open sagebrush plains void of trees that might serve as perches (Patterson 1952). The following observations were made at a somewhat unusual lek in northeastern Utah (Figure 1).

At 0540 on 10 April 1983 I observed a juvenile Golden Eagle as it landed on the ground approximately 2 km southeast of the south mating center. At 0608 the eagle

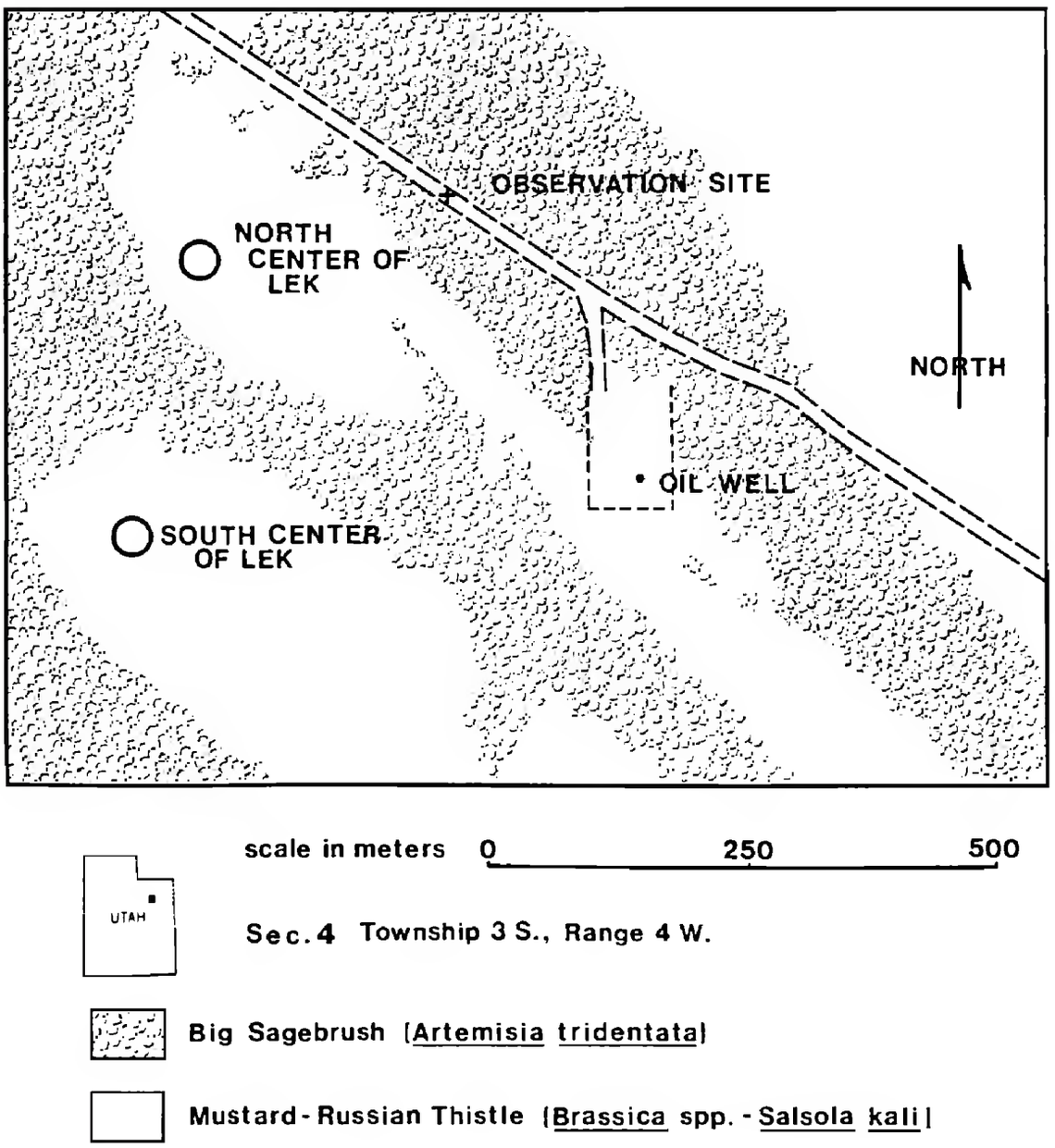


Figure 1. Location of Sage Grouse study area in northeastern Utah.

began flying about 2 m off the ground in the direction of the oil well. When it was approximately 150 m south of the oil well it stooped to the ground. At 0614 the eagle flew directly toward the oil well. Three Sage Grouse flushed directly in front of the eagle as it gained altitude to land on the well pump. The eagle made no attempt to capture any of the grouse, but did circle the area once before landing on the pump. After landing, the eagle sat in a vertical position facing west. Its frequent side-to-side head movements suggested my presence may have distracted it.

Apparently the grouse on both display centers did not see the eagle until just prior to its landing, at which time all display activities came to an immediate halt. A previous count at 0600 revealed that 23 grouse (21 males and 2 females) occupied the south center and 10 males occupied the north center. Immediately following the arrival of the eagle at the well I could only see 12 males on the south center and 4 males on the north center, even though no birds had flushed in the interim. All birds were motionless and in a crouched or semi-crouched position looking in the direction of the eagle. It seems that the grouse froze immediately upon the arrival of the eagle. Air sacs of most males were about half inflated.

All grouse remained motionless until 0628 at which time the master cock of the south center stood and started displaying. The behavior of the eagle remained unchanged. By 0629 seven of the cocks on the south center had resumed displaying. Interestingly, the males displaying were the central males while the males still huddling were the peripheral males. At 0632 all but three males on the south center were displaying with tails fanned. All grouse flushed from the south center at 0636. Flight direction was northerly, the same as that taken during undisturbed lek departure. Again, the attentiveness of the eagle was unchanged.

Meanwhile, at the north center, the master cock was standing while the others remained huddled. By 0639 two cocks were standing with air sacs inflated. At 0641 the grouse flushed from the north center in the same direction as the others. The eagle remained perched until 0646; then it flew south out of sight.

Of particular interest is the fact that the birds previously identified as the master cocks (based on hen clusters and frequent copulation) were the first to stand and initiate lekking activities in the presence of a potential predator. Other observations I have made, as part of an ongoing study of aerial predation of breeding Sage Grouse, suggest that the central cocks are also more reluctant to huddle when a raptor approaches the lek. Such apparently non-uniform anti-predator behavior may be related to age, and thus experience, of the males occupying the lek.

I wish to thank Deseret Generation and Transmission Cooperative, Utah Division of Wildlife Resources Upland Game Section and the Department of Zoology, Brigham Young University, for their support. Joseph R. Murphy and Tim Manolis reviewed the note and offered helpful suggestions. John Martin provided Figure 1.

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Accepted 27 September 1983

MOUNTAIN BLUEBIRD USE OF TREELESS LAVA FLOWS FOR NEST SITES

TERRELL RICH, U.S. Bureau of Land Management, Shoshone District, Shoshone, Idaho 83352

The Mountain Bluebird (*Sialia currucoides*) is a cavity-nesting species that breeds in a variety of open woodland habitats. Breeding habitats include groves of aspen and cottonwood (*Populus spp.*), pine woods, including Pinyon Pine (*Pinus edulis*), and junipers (*Juniperus sp.*) (Bent 1949). The breeding territory usually includes a large area of open space where the nest is located and areas of trees or brush that provide cover nearby (Power 1966). Power (1966) concluded that the Mountain Bluebird had highly specialized nesting requirements and that the use of unusual sites was very rare. However, a few nest sites other than cavities in trees have been recorded. These include eaves, horizontal beams of bridges (Power 1966), holes in banks, crevices in cliffs, sites among rocks, and an old swallow nest (Bent 1949). In Idaho, the Mountain Bluebird nests over a wide elevational range (245 m to 3350 m) and requires open country with trees large enough to provide nesting sites (Burleigh 1972). On the Snake River plain in southcentral Idaho the Mountain Bluebird is a fairly common migrant, but nest sites are lacking over most of the sagebrush steppe. I report here on the nesting of Mountain Bluebirds in a sparsely vegetated and treeless lava flow.

Figure 1. Location of a Mountain Bluebird nest in a rough treeless lava flow in Blaine County, Idaho. Note cap near nest entrance for scale.

On 27 May 1981 I discovered a Mountain Bluebird nest site located 2 m off the ground in a large block of rough lava (Figure 1) in Blaine County, Idaho, at an elevation of 1530 m. The nest itself was deeply recessed in a crevice and could not be seen. However, the sounds of young birds could be heard within and the adults made several feeding trips into the nest. Vegetation on the lava flow was very sparse and consisted of Sandberg's Bluegrass (*Poa sandbergii*), Rock Penstemon (*Penstemon deustus*) and Desert-sweet (*Chamaebatiaria millifolium*), among other species. The adults were not foraging in this habitat but rather flew directly about 200 m to the edge of the flow to forage in habitat dominated by Threetip Sagebrush (*Artemisia tripartita*), Big Sagebrush (*A. tridentata*) and Sandberg's Bluegrass. Three other breeding territories within a 10-km radius of this site have been suspected—one site in 1981 and two in 1982. In each case, I observed a pair of bluebirds perched in the same area of lava in mid-May on two or three consecutive days. However, no nests were located and the pairs may not have been breeding.

This type of nest site must be considered atypical. The nearest trees are scattered Limber Pines (*Pinus flexilis*) 8 km away on similar lava flows in Craters of the Moon National Monument. However, the general requirements of open terrain with cover nearby were met. A nest site located deep within a crevice would be relatively safe from predation and should provide a favorable nest microclimate in a region with intense mid-day heat. Configuration of the recent lava flows provides many miles of edge between the sagebrush and lava itself where potential nest sites appear to be abundant. However, there seems to be some factor limiting the spread of breeding pairs into the lava flow/sagebrush habitat.

In the Eastern Bluebird (*Sialia sialis*), Pinkowski (1979) found little relationship between an individual's type of natal site and the type of nest site subsequently selected. However, if young were successfully raised, adults were likely to select those types of sites again rather than switch to a different type (Pinkowski 1977, 1979). If a similar nest site selection operates in Mountain Bluebirds, then lava nest sites may not be generally successful. An evaluation of nest success and nest site selection by known individuals would be valuable in this regard. Such information would also contribute toward understanding the more general problem of why bird species have limits to their range of breeding habitats and do not continually attempt to invade new habitats and new types of nest sites.

ACKNOWLEDGMENTS

The thoughtful comments of Cameron Barrows greatly improved this note.

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Accepted 24 February 1984

BATHING HABITS OF THE COOPER'S HAWK

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I observed the bathing habits of a Cooper's Hawk (*Accipiter cooperii*), assumed from field marks to be a male, in the North Phoenix Mountain Preserve area, Arizona, for the past 4 years from September through March. Daily between 0800 and 1000 the hawk visited a shallow stone water catchment (56 cm x 36 cm x 7.5 cm) in an otherwise dry desert wash. I had an excellent view using a 20 power scope at a distance of about 60 m. Usually the hawk took several drinks, then stepped into the water and stood there with the feet and legs partially immersed. The time spent standing in the water varied from 15 minutes to 1.5 hours. It would pick up each foot and carefully clean the scales on the tarsi and toes with its mandibles, also giving close attention to the claws. After the cleaning the hawk inspected its feet, including turning them over to examine the undersides. When the soaking, cleaning and inspection were completed the bird flew to a nearby perch and proceeded to oil the tarsi, toes and claws using oil from the oil gland at the base of the tail. The oiling process usually lasted about 10 to 20 minutes.

The hawk took a complete bath only about twice a week and spent little time on feather care, at least at the observed location. I assume that the above procedure occurred shortly after feeding, since its crop appeared full and the hawk showed little interest in other birds near the catchment.

Veterinarians find frequent injuries to the legs and feet of desert dwelling raptors, caused by contact with cacti spines. Whether or not this problem relates to the above observations could not be determined. A comparison of the bathing habits of desert Cooper's Hawks with those of birds from a non-desert environment would be of interest.

I wish to thank Kenn Kaufman for his help in the preparation of the note and Kathy Ingram, DVM, for comments on observations of raptor leg and foot injury.

Accepted 5 March 1984

TREASURER'S REPORT

WESTERN FIELD ORNITHOLOGISTS, INC.

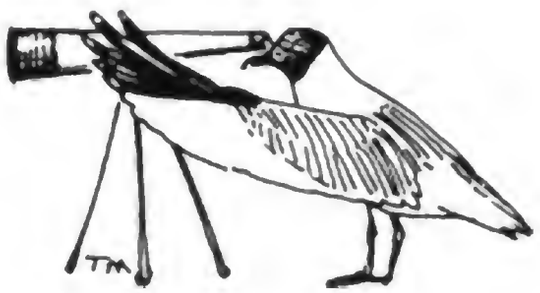
Cash Flow Statement for 1 January 1982 to 31 December 1982

Cash on hand, 1 January 1982		$ 7,248.42
Gibraltar Savings & Loan (savings)	$ 5,594.90	
Bank of America (checking)	1,653.52	
RECEIPTS		
Memberships	$ 7,398.65	
Boat Trips	4,765.00	
Back Issues	421.50	
Reprints	1,338.46	
Annual Meeting	5,184.36	
Interest	121.56	
Miscellaneous	60.00	19,289.53
		$ 26,537.95
DISBURSEMENTS		
Western Birds	$ 10,684.47	
Boat Trips	3,936.72	
Membership/Business Services	495.65	
Postage	395.27	
Annual Meeting	3,774.28	
Miscellaneous	205.89	19,492.28
Cash on hand, 31 December 1982		$ 7,045.67
Gibraltar Savings & Loan (savings)	$ 1,874.12	
Bank of America (checking)	5,171.55	

(prepared without audit)

J. Garth Alton, *Treasurer*

IDENTIFICATION QUIZ



The short, delicate bill, nearly neckless appearance and webbed feet of this bird identify it as some species of small alcid. A number of small alcids show a dark-and-white pattern during the nonbreeding season, but many of these can be eliminated from consideration easily. Least Auklets *(Aethia pusilla)*—and other auklets for that matter—have stubbier, thicker bills. Marbled Murrelets *(Brachyramphus marmoratus)*, Ancient Murrelets *(Synthliboramphus antiquus)* and guillemots *(Cepphus spp.)* all may show a dark face and white throat, but all have the white of the underparts extending up behind the auricular patch to form a half-collar. In addition, a Marbled

Murrelet should show some white on the back even in this view, whereas an Ancient Murrelet would have a pale bill and show contrast between a dark crown and a paler, gray back.

Indeed, the bird must be one of the two species of what we used to call *Endomychura* murrelets (the Sixth Edition of the AOU Check-list has placed them in *Synthliboramphus*—just try calling that out on a pelagic trip!): it is either a Xantus' Murrelet *(S. hypoleucus)* or Craveri's Murrelet *(S. craveri)*. The view is very much like that which one often obtains aboard ship—of a bird flying away or low over the water with fast-beating wings, making it impossible to judge underwing covert color, which is white on Xantus' and dusky on Craveri's. Though the difference in underwing pattern between the two species is a good point to note in making an identification, it is also a difficult one to see in the field.

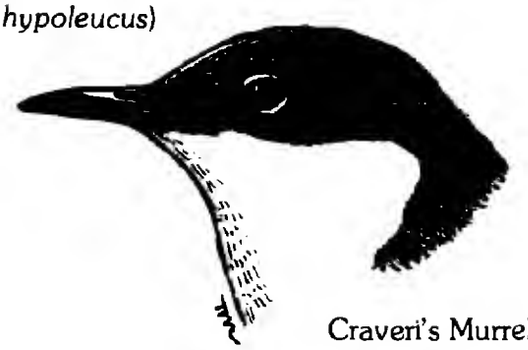
Another point to note is bill shape—distinctly shorter in Xantus' Murrelet, especially the northern race *S. h. scrippsi*, which breeds off southern California. The bird in the photo has a short bill consistent with Xantus'. Furthermore, its chin and malar region are white, as the dark area of its face extends down only to the level of the bill gape. On a Craveri's Murrelet the dark color of the face extends down onto the malar region and chin. Finally, the bird lacks a dark half-collar on the side of the breast as shown by many, but not all, Craveri's.

Beyond identifying the bird as a Xantus' Murrelet, we can also assign it to *scrippsi*, since white feathers do not extend up around the eye as is characteristic of nominate *hypoleucus*. Any white on the eye of this bird is limited to very narrow white eyelids. This Xantus' Murrelet was photographed at Monterey Bay, California, in July 1980.

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

Xantus' Murrelet (*S. h. hypoleucus*)

Xantus' Murrelet (*S. h. scrippsi*)



Craveri's Murrelet (*S. craveri*)

Sketches by Tim Manolis

BOOK REVIEW

Field Guide to the Birds of North America. National Geographic Society. 1983. Available from National Geographic Society, Dep. 100, Washington, DC 20036. $13.95 + 3.00 postage/handling.

Durably bound and well printed, this slightly larger than the back pocket field guide represents the collaboration of thirteen artists; four expert consultants (Jon L. Dunn, Eirik A. T. Blom, George E. Watson and John P. O'Neill); many writers, editors, and researchers; and their many helpful friends, all working under the sponsorship of the National Geographic Society. The result is 464 pages of pleasure and information, arranged in the popular format of range map and text on a page facing the appropriate plate.

The use of thirteen artists guarantees variety. Fortunately, a little over half the plates were done by H. Douglas Pratt, Diane Pierce, and Donald L. Malick, and while each hit trouble spots, the overall results are outstanding. Cynthia J. House (waterfowl) and Thomas R. Schultz (gulls and terns) handled those important groups well. The other eight artists contributed the remaining third, with plates ranging from poor to very good. Since most of the artists were assigned discrete groups, the juxtaposition of so many styles creates only a few problems. The most notable is in the shorebirds, where the use of four artists produces problems of scale, such as toy Surfbirds followed a page later by seemingly giant Dunlin.

One of the strongest features of this guide is that the artists were asked to illustrate much of the diversity of plumages which the birder will encounter. If you have seen one Fox or Song Sparrow, you have not seen them all; the extent of geographic variation is outlined by six races of each. Examples of types of variation in plumage covered by the guide are age (try the gulls), season (learn about male tanagers in winter), sex (see Bushtit and American Avocet), plumage wear (look at Hammond's Flycatcher), interbreeding (five Golden-winged x Blue-winged Warblers), color phases (Ross' Goose), and individual (see Lesser Goldfinch). Twenty-two figures of the four longspurs, fourteen of the three goldfinches, and seven of Common Tern are examples of the wealth of illustrative material largely unmatched by other guides.

While the breadth of coverage for each species is admirable, I feel that there is a mistaken emphasis on another type of "completeness"—the attempt to cover virtually every accidental. About 50 people a year go to Attu; the first printing of this guide is 250,000. Yes, this guide was helpful when I spent yesterday missing California's first Rustic Bunting (at least I knew what I was looking for), but an entire plate is devoted to four other species of old world buntings for which there are only about a dozen records for North America combined, all from Alaska. This is the same amount of space given to the five common small peeps. I know that many birders could benefit from a thorough treatment of the peeps; they don't get it here. Some of the space given to three figures of Red-throated Pipit (helps you sex the adults in breeding plumage) could have been used to show a second Sprague's Pipit, particularly one with fewer streaks on the breast and a richer color of buff.

The equality given to accidentals also leads to a visual confusion that will probably be particularly difficult for beginners. The Eurasian Kestrels dominate the plate for small falcons, the Asiatic eagles partly displace the American ones, and there are almost as many vagrant thrushes as native species. Everything is clearly labelled and the range maps (or the lack of one) will give a quick, general idea about distribution, but for the inexperienced there is a great deal to sort through; some alterations in layout would have helped. Most purchasers will appreciate all the accidentals, but, if a choice has to be made, virtually everyone might find an illustration of a dark Ferruginous Hawk (not included) more useful than that of the immature female Aplomado Falcon.

The text is the best of all the currently available field guides. Tucked away are many tips on identifying such difficult groups as female teal, dowitchers, small flycatchers, and sparrows. Comments include not only notes on plumage but also on calls and behavior, including gems on wing flicking and tail wagging in *Empidonax*, tail pumping in shrikes, and speed of bobbing in waterthrushes. If there is a problem with the text, it is that there should be more, and I mean that as both a compliment and a complaint. Too many pages end with room for extra lines, and there is much white space between the range maps. Given the importance of good text and compactness in a field guide, an artistic layout may be sacrificed for a merely functional one.

I also feel that the text lacked cohesive editing by a knowledgeable birder. Terms such as rare, casual and accidental are used inconsistently. In many cases, important problems of identification are not addressed. Separating female and young male Orchard and Hooded orioles rates only ten words; evidently female Scott's and Hooded are too dissimilar to warrant comment. Although not often a problem, how does one tell Crissal from California Thrasher? Red and Red-necked phalaropes are not easily told apart in flight in winter plumage; this problem is not addressed, and so the light gray back, whiter underwing, and broader white stripe on the upper wing of the Red are not mentioned, nor is the higher, squeakier call of the Red. Calls are given for Scarlet, Summer and Hepatic tanagers; why is the call not given for Western (often rendered pit-er-ick)? Call and flight notes of warblers are valuable aids to identification. The call of Arctic Warbler is given, and its similarity to that of Dusky Warbler is mentioned. But you will find nothing about the metallic chink typical of Nashville, Virginia's and Lucy's warblers, or the distinctive zeep-zeep of a Worm-eating Warbler.

The maps accompanying the text are the least well executed major component of this guide. I suspect that there is considerable accuracy, particularly in the breeding ranges, but that accuracy is lost by the tiny size of the maps and the anemic yellow used for the breeding ranges. Most unfortunate was the decision not to show the main routes of migration; the system of cross hatching in the Golden Guide's *Birds of North America* may provoke quibbles, but imparts much information on routes in spring and fall. For instance, from the National Geographic guide it is difficult to determine which shorebirds are regular in the interior. For some birds a dashed line was used to indicate that migration occurs to the east of the line. While a step in the right direction, that line was not used often enough, and it just begs for another type of line to show the eastern border of more westerly birds (e.g. Townsend's Warbler); such a line could also have been used to show which typically eastern warblers are rare in Florida, something which is easily seen in the Golden Guide. The maps could have offered more information, but they will answer most "Should it be around here?" questions about breeding and wintering ranges. Most purchasers of this volume will rely on regional publications for detailed distributional information, so the problems with the maps will not detract greatly from the tremendous value of this volume.

More consistent editing of the text could also have helped with information on distribution. The text does helpfully mention the spring/fall routes of Hudsonian Godwit; the same could have been done for White-rumped Sandpiper or any of a number of other species. In turn, a number of comments about extralimital status could have been eliminated. "Very rare in south Florida" (Winter Wren) and "Rare vagrant to southern California during migration, chiefly in fall" (Grace's Warbler, less than 15 records, some from summer) are comments which do not seem necessary in a general field guide. In particular, there seems to be an unnecessary bias toward explaining the status of vagrants in California, when shorter, more general comments about the west as a whole would be more appropriate.

Leafing through the book, some of my specific cautions are about: winter loons, which should be ignored; most of the storm-petrels should not be trusted in terms of shape; cormorants have some gloss, but usually appear black, not green and purple; colors on many of the herons seem a bit exaggerated; and the ducks in flight are not

shown at a very useful angle—other guides do better. I was disappointed with the shorebirds, but I wouldn't refer you to any other guide first; Marbled Godwits are buffy like Long-billed Curlews; yellowlegs were named for a reason, although occasional individuals show legs as orange as here; the juvenile Long-billed Dowitcher looks like a bird from late October—birds from earlier in the fall are much rustier, although differing in pattern from young Short-billed, as explained in the text; juvenile Baird's Sandpipers are a rich buffy early in fall; Wilson's Phalaropes in winter are light gray, not dark gray above; the plates of shorebirds in flight should be trusted for little more than major features, such as the presence or absence of white rumps and wing stripes.

The twisted central tail feathers of Pomarine Jaegers are much longer than illustrated; as noted in the text, South Polar Skuas often show prominent gold on the nape; while the gulls are well aged, many birds labelled second winter (e.g. Herring and California gulls) would have been better illustrated with much grayer backs, rather than still in molt; the bill of Royal Tern seems a bit too long and slender; avoid most of the flycatchers, specifically the kingbirds (easier to tell than shown here; patterns on head and underparts more distinct), the *Myiarchus*, and the *Empidonax* (text and plumages not bad, but shapes way off); the wings on the swallows are much too broad, just as the wings on the swifts are too narrow; immature MacGillivray's Warblers have gray or whitish throats, not yellow; I like the sparrows both for the races and the habitat backgrounds, but keep an eye on the dimensions—species such as Harris' Sparrow are large sparrows; I would like a painting of Lark Bunting which has the long white panel along the edge of the wing; and young Bobolinks in fall are really quite bright yellow below, with strong head stripes.

I am aware that the tone of this review may seem negative. In part, I am frustrated because this guide is so well done, and yet could have been even better. I suspect that the exigencies of publishing led to some unfortunate haste, but outright errors are rare; many of my complaints are because I wanted more of the quality typical of this guide. I have listed a number of features which I disliked; I could have compiled a much longer and even more boring list of pitfalls which this guide avoided. My final two comments are: there is much for everyone, no matter how expert (just take a look at Red-legged Kittiwake or Bachman's Sparrow—did you know all that?), and when a friend of mine shows an interest in birds, this will be his or her first field guide.

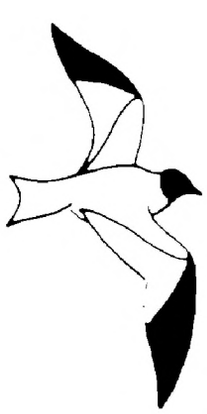
RICHARD WEBSTER, P.O. Box 6318, San Diego, California 92106

Volume 15, Number 1, 1984

Cover photo by Don Roberson: Juvenile Pectoral Sandpiper (*Calidris melanotos*), Crespi Pond, Pacific Grove, Monterey Co., California, September 1981

Manuscripts should be sent to Alan M. Craig, P.O. Box 374, Lakeview, CA 92353. For matters of style consult *Suggestions to Contributors to Western Birds* (6 pp. mimeo available at no cost from the Editor) and *Council of Biology Editors Style Manual* 4th edition, 1978 (available from the American Institute of Biological Sciences, 1401 Wilson Boulevard, Arlington, VA 22209 for $12.00).

Papers are desired that are based upon field studies of birds, that are both understandable and useful to amateurs, and that make a significant contribution to scientific literature. Appropriate topics include distribution, migration, status, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, the techniques for identifying, 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 papers dealing with studies accomplished in or bearing on Rocky Mountain states and provinces westward, including Alaska and Hawaii, adjacent portions of the Pacific Ocean and Mexico, and western Texas.



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WESTERN BIRDS

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DECLINE, STATUS AND PRESERVATION OF THE YELLOW-BILLED CUCKOO IN CALIFORNIA

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> "In contrast with those good old days . . . the large thickets have been replaced by farms and pastures, the trees cut down, and the evergrowing population has crowded in on the old haunts of the cuckoos to such an extent that if they come here now at all they must be exceedingly rare . . ."
>
> Wilson Hanna (1937) describing the San Bernardino Valley.

The Yellow-billed Cuckoo (*Coccyzus americanus*), formerly a "fairly common" breeding species in "willows of fairly old growth, often mixed with cottonwoods . . . on the broad flood-bottoms of larger streams" (Grinnell and Miller 1944), has become one of California's rarest birds. The paucity of recent records justifies concern for its survival in the state.

Between 1 June and 10 August 1977 we conducted surveys in floodplain riparian forests throughout California where the cuckoo has been reported in the past or where habitat appeared to meet the requirements of the species. We timed the surveys to coincide with the period between the onset of courtship and the beginning of pre-basic molt, when cuckoos are most easily detected on the nesting grounds.

In this paper we present the results of the surveys and discuss the cuckoo's past and present status and survival prospects in California. The paper is divided into geographic sections discussing the North Coast, Klamath-Modoc, Central Coast, Sacramento Valley, San Joaquin Valley, Sierra Nevada, South Coast, Mojave Desert and Lower Colorado River regions (Figure 1). Concluding sections consider causes of decline and preservation and management of existing populations.

METHODS

Past distribution of the Yellow-billed Cuckoo was determined through a review of the literature and of specimens and egg sets in museum collections. We located extant floodplain riparian forest through examination of topographic maps and aerial photographs of river-bottoms, and through correspondence with wildlife biologists and local residents.

We surveyed areas on foot or by canoe, using tape recordings of the Yellow-billed Cuckoo's vocalizations to stimulate responses (Hamilton and Hamilton 1965; Gaines 1974a, 1974b). At each stop, calls were played at intervals of about 60 seconds for 10-30 minutes. We used Cornell Laboratory of Ornithology recordings of the "kowlp" call, recorded in New York State, until mid-July, at which time we obtained usable field recordings of the "kowlp" and "cooing" calls of the California bird.

When a Yellow-billed Cuckoo was detected, we recorded the following habitat data: (1) estimated height and percent cover of canopy foliage; (2) estimated percent cover of woody understory foliage; (3) estimated species composition of woody vegetation by percent cover; (4) presence of sloughs, creek mouths, oxbow lakes and/or marshes (exclusive of main river channel); and (5) extent of the habitat and proximity to similar areas. If a cuckoo was seen, the substrate it occupied and its behavior were noted. Most sites were photographed.

NORTHCOAST REGION

History of occurrence. The Yellow-billed Cuckoo has nested in Napa and Sonoma counties. Individuals have also been observed in Humboldt, Lake and Marin counties (Table 1). In the Napa Valley, Napa Co., two cuckoos were collected in 1862 (Cooper 1870), and a nest was collected in 1881 (egg set WFVZ).

Shelton (1911) described the nesting habitat along the Laguna de Santa Rosa in Sonoma Co. as "a chain of long, rather narrow ponds" bordered by "a thick growth of willow, small ash and scrub oak" and "tangled together with an undergrowth of poison-oak, wild blackberry and various creepers, forming, as it were, an impenetrable jungle hanging far out over the water." The cuckoos arrived in early June but kept "to higher ground among the oaks and other timber, for a period of 2 or 3 weeks before retiring to the willow bottoms to breed." An effort to locate the species here on 20 July 1972 was unsuccessful (Gaines unpubl. rep).

A cuckoo at the south end of Clear Lake, Lake Co., in June 1973 may have been nesting in the willow(*Salix* sp.)-cottonwood (*Populus* sp.) habitat nearby [Am. Birds (hereafter AB) 27:915, 1973]. The Marin and Humboldt county records (Tables 1 and 2) probably pertain to transient birds.

Results. We conducted surveys near Willits, Mendocino Co., 1 June 1977 and at Clear Lake, Lake Co., 2 June 1977. No cuckoos were detected.

Discussion. The willow and willow-cottonwood forests we surveyed appear to meet the habitat requirements of the Yellow-billed Cuckoo. Possibly the forests are not extensive enough to support a viable population, or they are too isolated from other suitable habitat to be readily colonized.

Nesting cuckoos may be found in extensive willow thickets along the immediate coast, such as those near Humboldt Bay. They have nested in similar habitats in northwestern Washington and southwestern British Columbia (Jewett et al. 1953, Godfrey 1966).

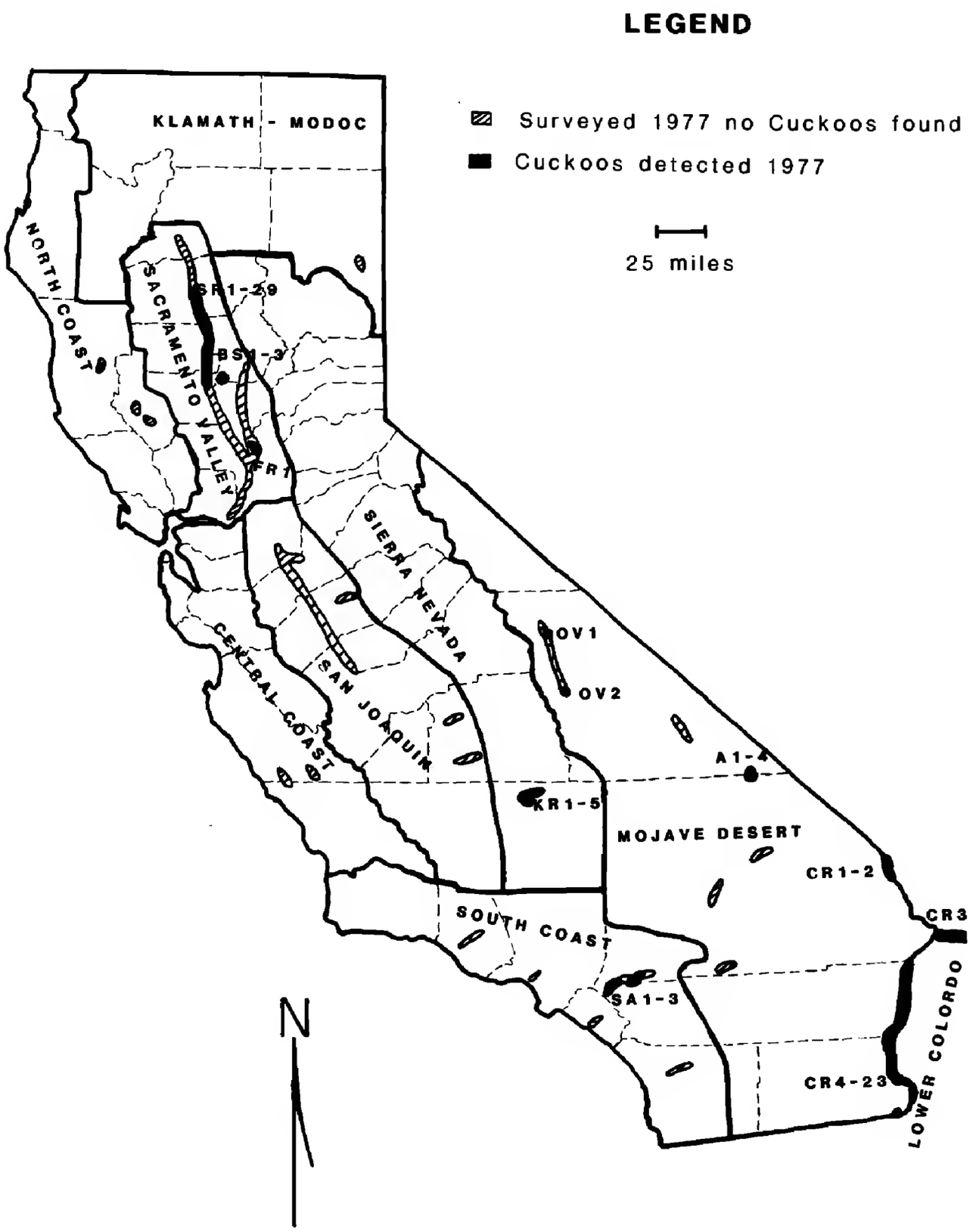

Figure 1. Areas surveyed for Yellow-billed Cuckoos in 1977.

KLAMATH-MODOC REGION

History of occurrence. The Yellow-billed Cuckoo has nested in Siskiyou Co., and has been observed in Modoc and Lassen counties (Table 1). A nest was discovered in July 1951 near the "old fish hatchery" at Mt. Shasta, Siskiyou Co. [Audubon Field Notes (hereafter AFN) 5:307, 1951]. Along the nearby Shasta River one cuckoo was collected and others observed in July 1899 (Merriam 1899). Another was seen in late May 1920 (Mailliard 1921).

Mailliard (1927) listed cuckoos as regular visitors and probable breeders in Surprise Valley, Modoc Co. Local residents said the species was present "in mid-summer, even in the village streets."

Results. During late July and early August 1977, Al Lapp surveyed apparently suitable habitat on Honey Lake Wildlife Area, Lassen Co. No cuckoos were detected.

Discussion. Scattered nesting populations may still be discovered in this region. Suitable habitat may exist along the Pit River.

CENTRAL COAST REGION

History of occurrence. The Yellow-billed Cuckoo has nested in Santa Clara and San Luis Obispo counties and has been recorded in Alameda, San Benito and San Francisco counties.

A nest was discovered 10 miles north of San Jose, Santa Clara Co., in June 1899. It was situated in a "growth of young willow and maple trees" near a running stream. Cuckoos bred "sparingly" at that locality yearly (Atkinson 1899). Another nest "housed in a willow clump in the Santa Clara Valley" contained eggs at the end of May (Wheelock 1904).

A cuckoo collected near Paicines, San Benito Co., in June 1899 (CAS) is the only indication of nesting in the seemingly ideal willow-cottonwood habitat which formerly lined the San Benito and Salinas rivers. The lack of sightings may reflect the absence of ornithologists rather than of cuckoos.

A set of cuckoo eggs (SBNHM) collected in San Luis Obispo Co. indicates former nesting. A specimen was obtained near San Luis Obispo in 1921 (SBCM) and a cuckoo was recently observed near Morro Bay (Thomas Heindel pers. comm.).

Results. On 2 July 1977 we surveyed along the Salinas River near Bradley and along the Nacimiento River on Camp Roberts Military Reservation, Monterey Co. No cuckoos were detected. The cuckoos found on the Farallon Islands and at Lake Merced, San Francisco Co., during 1977 were undoubtedly transients.

Discussion. The willow-cottonwood forests along the Salinas and Nacimiento rivers, Monterey Co., appear to meet the cuckoo's habitat requirements. The recent sighting near Morro Bay raises the possibility that cuckoos nest in coastal San Luis Obispo Co. According to Eric Johnson (pers. comm.), Coon Creek in Montana de Oro State Park and the last mile or two of San Luis Obispo Creek might have suitable cuckoo habitat. All of these areas need to be surveyed.

Table 1. Records of the Yellow-billed Cuckoo in California, 1854-1976.

Locality	Date	Abundance	Status	Source
NORTH COAST REGION				
Humboldt County				
Ferndale	24 May 1958	1	T	AFN 12:383, 1958
Arcata	9 Nov 1963	1	T	Yocum & Harris 1975
Prairie Creek Redwoods State Park	2 Sep 1975	1	T	AB 30:121, 1976
Lake County				
S end of Clear Lake	28 Jun 1973	1	N?	AB 27:915, 1973
Sonoma County				
Laguna de Santa Rosa	3 Aug 1884	1	N	Specimen CAS
5 mi SE of Sebastopol	Jun-Jul pre-1910	FC	N	Shelton 1911
Petaluma	18 Jun ?	?	?	Bent 1940
Copeland Ck, Sonoma State College	May 1975	2	N?	Erik Ferry pers. comm.
Napa County				
Napa Valley	Summer 1862	?	N	Cooper 1870
Napa Valley	15 May 1881	?	N	Egg set WFVZ
Marin County				
Point Reyes	19 Jul 1919	1	?	Hansen 1919
Point Reyes	19 Jun 1976	1	?	AB (regional records)
KLAMATH-MODOC REGION				
Siskiyou County				
Edgewood	Jul 1899	several	N?	Merriam 1899
Edgewood	late May 1920	several	N?	Mailliard 1921
Sisson (Mt. Shasta City)	Jul 1916	1	T	Dawson 1923
Mt. Shasta Fish Hatchery	3 Jul 1951	?	N	AFN 5:307, 1951
Modoc County				
Surprise Valley	July pre-1927	FC?	N?	Mailliard 1927
Lassen County				
Honey Lake Wildlife Area	27 Aug 1971	1	?	Tim Manolis pers. comm.
CENTRAL COAST REGION				
Alameda County				
Oakland	pre-1927	1	?	Grinnell & Wythe 1927
Hayward	1882	1	?	Emerson 1894
Hayward	late Jul 1894	1	?	Specimen CAS
Santa Clara County				
Palo Alto	22 Jul 1901	1	?	Specimen CAS
10 mi N of San Jose	17 Jun 1899	UC	N	Atkinson 1899
Santa Clara Valley	pre-1904	?	N	Wheelock 1904
San Jose	6 Jun 1885	?	?	Belding 1890
San Benito County				
Paicines	4 Jun 1899	?	N?	Specimen CAS

Table 1 (Cont.)

Locality	Date	Abundance	Status	Source
San Francisco County				
SE Farallon Island	7 Aug 1965	1	T	Condor 69:582
	24 Sep 1974	1	T	AB 29:115, 1975
	Jun 1975	1	T	AB 29:1027, 1975
	19 Jun 1976	1	T	AB 30:999, 1976
San Luis Obispo County				
San Luis Obispo	30 Jun 1921	?	N?	Specimen SBCM
San Luis Obispo County	5 Jul 1932	?	N	Egg set SBNHM
Morro Bay	Jul 1961	1	?	Thomas Heindel pers. comm.
SACRAMENTO VALLEY REGION				
Shasta County				
Near Redding	1854	?	N?	Newberry 1857
Tehama County				
3 mi W of Paynes Creek	14 Jul 1930	1	?	Compton 1932
Woodson Bridge St. Recr. Area	8 Sep 1971	1	?	Laymon pers. obs.
Todd Island	12 Sep 1975	2	N?	Laymon pers. obs.
Butte County				
Chico	4 Jun 1884	VR	N?	Belding 1890
Butte Sink	Jun-Jul until 1950s	FC	N?	Roger Wilbur pers. comm.
E Bank of Sacramento River	16 Jun-14 Jul 1974	2	N?	Syd Thomas pers. comm.
Between Indian Fisheries Slough and mouth Big Chico Creek	17 Jun-30 Jul 1975	2	N?	AB 29:1027, 1975
Lower Butte Sink	5 Jul-2 Aug 1973	5	N?	Gaines 1974b
Wild Goose Country Club	27 Jun 1976	1	N?	AB 27:915, 1973
Gray Lodge W.A.	27 Jun 1974	1	?	Bruce Deuel pers. comm.
Glenn County				
W bank of Sacramento River	16 Jun-14 Aug 1974	2	N?	Louis Heinrich pers. comm.
0.5 mi N of Jacinto	11 Jun-4 Aug 1975		N?	AB 27:815, 1973
	24 May-25 Aug 1976		N?	AB 29:1027, 1975
1.5-2 mi N of Princeton	6-29 Aug 1973	2	N?	Michny et al. 1975
Colusa County				
Vicinity of Colusa	Jun-Jul until 1940s	FC	N?	Roger Wilbur pers. comm.
Colusa State Park	1 Sep 1963	1	?	AFN 18:70, 1964
Sutter County				
Vicinity of Yuba City	Jun-Jul until 1940s	FC	N?	Roger Wilbur pers. comm.
Berry Patch Gun Club	19 Jun 1974	2	N?	Bruce Deuel pers. comm.
Confluence Yuba and Feather rivers	27 Jun 1976	1	N	Bruce Deuel *fide* Jon Winter
Yuba County				
Vicinity of Marysville	Jun 1878	C	N	Belding 1879
	19 May-7 Jul 1884			Belding 1890
	1 May 1885			Belding 1890

Table 1 (Cont.)

Locality	Date	Abundance	Status	Source
Sacramento County				
Vicinity of Sacramento	1 May-1 Sep 1865	C	N	Cooper 1870
Orangevale	2 Jul 1962	1	?	AFN 16:504, 1962
Carmichael	23 Apr-6 May 1964	1	?	Peter Brown pers. comm.
Sacramento	1 Aug 1962	1	?	AFN 16:504, 1962
Yolo County				
Sacramento Bypass	Jul 1952	?	N	AFN 7:325, 1953
	Jun 1953	?	N	AFN 15:73, 1961
	18 Sep 1960	?	N	*fide* Betty Kimball
Yolo Bypass	4 Aug 1956	1	N?	AFN 10:407, 1956
Sacramento River	4 Jun 1941	1	N?	John Emlen pers. comm.
Clarksburg	5 Jun 1896	?	N?	Specimen MVZ
Putah Creek near Davis	28 Aug 1937	R	N?	John Emlen pers. comm.
	31 Jul, 17 Sep 1939		?	John Emlen
	25 Aug, 17 Sep 1940		?	John Emlen
	26 Jun, 6 Jul 1941		N?	John Emlen
	4 Jul 1942		N?	John Emlen
Willow Slough	29 Jun 1965	1	?	*fide* Betty Kimball
Sacramento Bypass	29 Sep 1962			Richard Stallcup pers. comm.
Regionwide				
15 localities Tehama -Colusa counties	18 Jun-10 Aug 1972	28	N	AB 26:898, 1972; Gaines 1974a
21 localities Tehama -Colusa counties	16 May-28 Jul 1973	29	N	Gaines 1974b, Michney et al. 1975
SAN JOAQUIN VALLEY REGION				
Kern County				
near Bakersfield	17-20 Jul 1891	C	N?	Fisher 1893
Buena Vista Lake	11 Jun-8 Jul 1921	C	N	17 specimens UCLA
	7 Jun-22 Jul 1922	C	N	Specimen SDNHM, egg set WFVZ
Tulare County				
Visalia	22-25 Jul 1891	?	?	Fisher 1893
Fresno County				
S of Clovis	10 Jul 1902	UC	N	Tyler 1913
6 mi NE Fresno	10 Jul 1907	UC	N?	Tyler 1913
San Joaquin River	4 Jul 1907	UC	N?	Tyler 1913
Mendota Pool	14 Jun 1918	C?	N	Specimen MVZ
	21 Jun 1918	C?	N	Specimen MVZ
	Jun-Aug 1950	C?	N	AFN 4:291, 1950
Merced County				
Gustine	Jun 1915	?	?	Specimen MVZ
Hatfield State Park	8 Aug 1971	1	?	AB 25:902, 1971

Table 1 (Cont.)

Locality	Date	Abundance	Status	Source
Stanislaus County				
Tuolumne River, Modesto	11 Jun 1914	?	N?	Specimen CAS
	17 Aug 1916	?	?	Specimen CAS
Mouth of Stanislaus River	Sep 1962	5	N	AFN 17:65, 1963
	Jun-Aug 1963	2	N	AFN 18:70, 1964
	14 Jul 1965	3	N	Betty Kimball pers. comm.
SIERRA NEVADA REGION				
Kern County				
Weldon	10 Jul 1911	?	?	Specimen MVZ
Kelso Creek 8 mi SSE of Weldon	13 Sep 1975	1	?	AB 30:127, 1976
Placer County				
Truckee River near Squaw Valley	18-19 Sep 1976	1	T	*fide* Phillip Schaeffer
SOUTH COAST REGION				
Ventura County				
Santa Clara River, Santa Paula	Jun 1904	?	N	Willett 1912
Mouth, Santa Clara River	18 Jul 1920	FC	N	Egg set WFVZ
	31 Jul 1921	FC	N	Egg set WFVZ
Montalvo	4 Jul 1942	?	N	Egg set WFVZ
Hueneme	4 Jul 1936	?	N	Egg set WFVZ
	21 Jul 1936	?	N	Egg set WFVZ
Sespe Canyon	24 May 1969	1	T	AB 24:645, 1970
Santa Barbara Island	1 Jun 1973	1	T	AB 27:821, 1973
Santa Barbara County				
Santa Barbara	30 Jun 1963	1	?	Metcalf 1967
Montecito	22 Jun 1967	1	?	Metcalf 1967
Los Angeles County				
E of Santa Barbara	7 Jun 1889	FC	N	Grinnell 1898
Los Angeles River, Compton	Jun-Aug pre-1918	FC	N	Jay 1911; Cookman 1915; Willett 1912, 1933; 2 specimens CAS; 3 specimens LACNHM; specimen MVZ; specimen WFVZ; 2 egg sets WFVZ
Pasadena	16 May 1895	?	?	Specimen MVZ
San Gabriel River, El Monte	12 Aug 1897	FC	N	Specimen UCLA
	16 May 1911	FC	N	Specimen UCLA
	20 Jul 1929	FC	N	Specimen UCLA
	Jun-Aug 1949	?	N?	AFN 3:251, 1949
	May 1951	?	?	AFN 5:309, 1951
San Gabriel River, Pico Rivera	5 May 1907	?	?	Jay 1911
San Gabriel River, Artesia	22 Jun 1912	FC?	N	Egg set WFVZ

Table 1 (Cont.)

Locality	Date	Abundance	Status	Source
San Bernardino County				
Lake Arrowhead	2 Jun 1950	1	T	Baumgardt 1951
Chino	16 May 1931	?	N	Egg set SBNHM
Santa Ana River and Warm Ck 3 mi E San Bernardino-Riverside County line	Jun-Aug until 1930s	C	N	Hanna 1937: specimens SBCM. MVZ: 7 egg sets SBCM: 6 egg sets WFVZ
Rialto	5 Jul 1970	1	?	AB 24:717. 1970: specimen SBCM
Riverside County				
Santa Ana River. Riverside	20 Jun 1890	?	?	Specimen MVZ
	9 Jun 1888	?	?	Specimen MVZ
	Jun-Aug until 1950s	C	N	Eugene Cardiff pers. comm.
Santa Ana River. Corona	26 May 1915	?	?	Specimen SDNHM
Santa Margarita River. Temecula	18 May 1947	C	N	Specimens MVZ
	19 Jun 1948			Egg set SBCM
	Jun-Aug until 1950s			Eugene Cardiff pers. comm.
Orange County				
Santa Ana River. Anaheim	Jun-Jul 1899	C	N	Schneider 1899
	10 Jul 1918	?	N	Egg set WFVZ
San Diego County				
Escondido	20-22 Aug 1896	?	N	Hatch 1896
	30 Jun 1915	?	N	Dixon 1916
	2 Jul 1932	?	N	Willett 1933: specimen MVZ
Poway	1875-1876	?	?	Belding 1890
Sweetwater River. Bonita	1 Jul 1915	?	N	Willett 1933
	3 Jul 1915	?	N	Specimen SDNHM
Tijuana River	20 Jul 1931	?	?	Von Bloeker 1931
Oceanside	23 Aug 1969	1	?	AFN 24:100
MOJAVE DESERT REGION				
Inyo County				
Bishop	11 Aug 1891	?	?	Fisher 1893
	Aug 1956	?	?	Specimen CSULA
2 mi N Independence	29 Jun 1917	?	N?	2 specimens MVZ
2 mi SW Big Pine	Jul 1968	?	N?	Steven Cardiff pers. comm.
Scotty's Castle. Death Valley	30 May 1975	1	?	AB 29:909. 1975
Furnace Creek Ranch. Death Valley	20 Jun 1891	1	?	Fisher 1893
	3 Sep 1972	1	?	AB 27:915. 1973
	29 May 1976	1	?	AB 30:891. 1976
	13 Jun 1976	1	?	AB 30:1004. 1976
Amargosa River. Tecopa	15 Jul 1976	1	N?	AB 30:1004. 1976

Table 1 (Cont.)

Locality	Date	Abundance	Status	Source
San Bernardino County				
Mojave River, Yermo	6-7 Aug 1910	1	?	Lamb 1912
Kelso	1 Jul 1976	1	?	AB 30:1004, 1976
Morongo Valley	27 Jun 1964	1	?	AFN 18:536, 1964
LOWER COLORADO RIVER REGION				
San Bernardino County				
Needles	Jun 1902	FC?	N?	Stephens 1903
Earp	27 Jun 1968	1	T	Guy McCaskie pers. comm.
Imperial County				
Potholes, 1 mi N of Laguna Dam	8 Jun-20 Jun 1930	FC?	N?	4 specimens SDNHM
Laguna Dam	24 Jun 1930	FC?	N?	5 specimens SDNHM
	26-28 Jun 1952	FC?	N?	5 specimens SDNHM
Bard	22 Jun-3 Jul 1915	FC?	N?	2 specimens SDNHM
Above Laguna Dam	18-19 Jul 1964	10	N?	Guy McCaskie pers. comm.
	Jun-Jul 1965	12	N?	Guy McCaskie
	25 Jun 1966	1	N?	Guy McCaskie
	16 Jun 1967	3	N?	Guy McCaskie
	Jun-Jul 1968	10	N?	Guy McCaskie
	14-15 Jun 1969	3	N?	Guy McCaskie
	Jun-Jul 1970	4	N?	Guy McCaskie
	5 Jul 1971	2	N?	Guy McCaskie
	24 Jun 1972	4	N?	Guy McCaskie
	Jun-Jul 1975	?	N?	Guy McCaskie
Colorado River, Davis Dam to Morelos Dam, Mexico	Jun-Jul 1975-1976	244	N	Bertin Anderson pers. comm.
Bill Williams River Delta	Jun-Jul 1975-1976	114	N	Ken Rosenberg pers. comm.
Near Blythe, Yuma County, Arizona	15 Jun 1929	?	N	Egg set SBCM

Status	
T	Transient
N	Positive nesting
N?	Suspected nesting
?	Status unknown

Abundance	
FC	Fairly common
UC	Uncommon
VR	Very rare
C	Common
R	Rare
?	Abundance unknown

Source	
AFN	Audubon Field Notes
AB	American Birds
WFVZ	Western Foundation of Vertebrate Zoology
CAS	California Academy of Sciences
SBCM	San Bernardino County Museum
SBNHM	Santa Barbara Natural History Museum
MVZ	Museum of Vertebrate Zoology
UCLA	University of California, Los Angeles
SDNHM	San Diego Natural History Museum
LACNHM	Los Angeles County Natural History Museum
CSULA	California State University, Los Angeles

SACRAMENTO VALLEY REGION

History of occurrence. The Yellow-billed Cuckoo has been recorded in every county in this region with the exception of Placer. Breeding has been verified in Tehama, Butte, Glenn, Colusa and Yolo counties (Tables 1 and 2).

Early reports suggest that the cuckoo was formerly numerous along most, if not all, of the wooded streams and sloughs of the Sacramento Valley. Between 1 May and 1 September 1865, Cooper (1870) found them "quite common" in large cottonwoods near Sacramento. Belding (1879) found them "common in willow and poplar thickets at Marysville in June 1878."

Roger Wilbur, a naturalist and long-time resident of Colusa County, observed cuckoos in Colusa, Butte, Sutter and Yuba counties during the 1920s and 1930s. He considered them to be fairly common during the summer. He often found cuckoos in peach and prune orchards where they "were evidently feeding on tent caterpillars and canker worms." He found a nest in a small willow thicket "surrounded by tules and weeds" in the Butte Basin, and another in a shrub overhanging Butte Creek (Wilbur pers. comm.).

Cuckoos bred in Yolo County until the 1950s. Between 1937 and 1942 John T. Emlen (pers. comm.) recorded the species along Putah Creek and the Sacramento River. At least one pair nested in the Sacramento Bypass in 1952 and probably in 1953 (*fide* Betty Kimball, AFN 7:325, 1953). Individual birds were recorded from this and adjacent areas from 1956 to 1965 (AFN 10:407, 1956; 15:73, 1961; *fide* Betty Kimball). None have been found since.

By 1970 most authorities believed that Yellow-billed Cuckoos had been extirpated from the Sacramento Valley. On 16 June 1971 the discovery of an individual near the mouth of Big Chico Creek revived hope that a few might still nest along the upper Sacramento River (AB 25:902, 1971).

During the summers of 1972 and 1973, Gaines surveyed riparian habitat throughout the Sacramento Valley. In 1972, he found 28 cuckoos at 15 sites along the Sacramento River between Todd Island, Tehama Co. and Colusa State Park, Colusa Co. (Gaines 1974a, 1974b). The following year 29 cuckoos were detected at 21 sites along this same stretch (Gaines 1974b, Michny et al. 1975), and five additional birds were detected along Sanborn Slough in the Butte Sink, Butte Co. (Gaines 1974b). From 1974 to 1976 additional observations were made in these areas. Birds were also sighted along the Feather River near Nicolaus, Sutter Co., in July 1977 (AB 29:898, 1975) and at the confluence of the Feather and Yuba rivers, Yuba Co., in June 1976 (Bruce Deuel *fide* Jon Winter).

Results. Surveys were conducted along the Sacramento River on 20 days between 5 June and 31 July 1977; the Butte Sink on 3 days between 15 June and 31 July; along the Feather River on 26 June and in the Sacramento-San Joaquin Delta on 27 June.

We detected 54 cuckoos at 33 sites: 44 at 29 sites along the Sacramento River, 9 at 3 sites in the Butte Sink (Figure 2), and 1 near Nicolaus, Sutter Co., along the Feather River (Figure 3). We did not find cuckoos on the Sacramento River south of Colusa or in the Delta.

Of the 57 times cuckoos were actually seen, 68% were in willows, 26% in cottonwoods, 4% in English Walnuts, and 2% in Box Elders (*Acer*

negundo). Habitat used by the cuckoo varied from dense willow-cottonwood forests to marshy bottomlands with scattered thickets of willows. Canopy height ranged from 5 to 25 m, canopy cover from 20 to 90%, and understory cover from 30 to 90%. Willows and open water were common to all sites.

At most sites habitat was relatively extensive, being at least 100 m in width and 25 ha in surface area. Where the habitat was more confined, it was usually close to other more extensive patches of similar vegetation.

The cuckoos occurred in very low densities. In all but three areas only a single bird or pair was found. The exceptions were site SR7, with five cuckoos in 50 ha, sites SR11-13, with six individuals in 600 ha, and sites BS1-3 with nine cuckoos in 550 ha.

We detected cuckoos at about 50% of the sites that were thoroughly surveyed and that appeared to meet the habitat requirements delineated by Gaines (1974b). The Sacramento River from Red Bluff to Woodson Bridge, Tehama Co., is a good example of an area with considerable habitat but few cuckoos. Only four were found (sites SR1-3) despite two surveys of the area.

Discussion. When the 1972-73 survey results are compared with those of 1977, the raw figures indicate that the cuckoo has maintained or increased its population, at least along the Sacramento River. If the amount of coverage each year is taken into account, however, the opposite conclusion is plausible.

Only one cuckoo was detected along the Feather River in 1977, at the same site where one was reported in 1972, despite the existence of extensive and seemingly suitable habitat.

In the Butte Sink, nine cuckoos were found at three sites in 1977 compared to five at two sites in 1973. In the earlier survey only the habitat east of Butte Creek was searched. In 1977 the entire area was surveyed and one pair was found west of Butte Creek (site BS2). In the areas checked both years, there was an increase of two birds.

Along the Sacramento River from Todd Island to Colusa State Park, 44 cuckoos at 29 sites were found in 1977 compared to 44 at 28 sites in 1972-73. These totals seem identical but are misleading; only about half of the stretch was surveyed in 1972-73, whereas the entire stretch was surveyed in 1977. If the new areas covered in 1977 are deleted, the results drop to 32 cuckoos at 22 sites, suggesting a substantial decline. A decline of this magnitude is possible, but far from certain. Two factors need to be considered: the reliability of the survey technique and the year to year site attachment of breeding cuckoos.

In the absence of wind or rain, the tape recorded calls have proven reliable in eliciting a response from most cuckoos from the onset of courtship in mid-June until the pre-basic molt begins in early August (Gaines 1974a). Since every site where cuckoos were found in 1972-1973 was thoroughly surveyed in 1977, it is improbable that cuckoos were missed at 11 of these sites. Either the birds and their progeny at 11 sites died since 1972-73, or they emigrated to other sites. In 1977 cuckoos were found at five sites that had been surveyed without success in 1972-73. These findings indicate that cuckoos may not breed in precisely the same location every year.

Figure 2. Scattered willow thickets at Site BS3, Butte County, are typical of the habitat of the Yellow-billed Cuckoo in the Butte Sink.

Figure 3. The forest along the Feather River at Site FR1, Sutter County, is typical of the tall, very dense old-growth willows and cottonwoods inhabited by the Yellow-billed Cuckoo in the Sacramento Valley.

The combined 1972-73 total must be re-examined. Some sites occupied in 1972 may not have been occupied in 1973 and vice versa. The 1972-73 total may overestimate the population. Of the eight sites surveyed in both 1972 and 1973, six had cuckoos both years. If the totals are reduced by 25% the combined total is 33 cuckoos at 21 sites, almost identical to the 1977 totals, suggesting no decline.

The total cuckoo population along the Sacramento River was estimated at 96 pairs as a result of the 1972-73 survey based on 10 ha per pair, 1200 ha of suitable habitat, and 80% occupancy (Gaines 1974b). The 1977 survey suggests that this figure is too high. The main problem lies in the occupancy rate of 80%, which was derived from the percent of occupied sites that were thoroughly surveyed under favorable weather conditions. It was then assumed that the entire river would have the same occupancy rate. The riparian areas in Tehama County have a much lower occupancy rate than the rest of the valley. This area was surveyed under less than optimum conditions in 1972-73 and was not used in occupancy calculation. If this area is included, the occupancy rate drops to 60%, which is close to the 50% rate found in the 1977 survey.

When the 50% figure is used, the 1972-73 population estimate for the Sacramento River drops from 96 to 60 pairs. In 1977, 15 pairs and 14 solitary birds were found. If all solitary birds were mated, the minimum Sacramento River population is 29 pairs and the maximum is 60 pairs. If the Butte Sink and Feather River birds are added, the regional estimate is 35 to 68 pairs.

Table 2. Records of the Yellow-billed Cuckoo in California during 1977.

Locality	Site No.	Date(s)	Total	Status	Principal Observer
NORTH COAST REGION					
Point Reyes, Marin Co.	---	2 Jul	1	T	Binford
CENTRAL COAST REGION					
SE Farallon Island, San Francisco Co.	---	2 Jul	1	T	Point Reyes Bird Observatory
Lake Merced, San Francisco Co.	---	7 Oct	1	T	Metropolous
SACRAMENTO VALLEY REGION					
Sacramento River					
Red Bluff to Woodson Bridge, Tehama Co.					
Mooney Island	SR1	29 Jul	1	N?	Laymon
Unnamed island 1.6 mi S of Tehama Bridge	SR2	7 Jun	1	N?	Gaines
Kopka Slough, Woodson Bridge State Park	SR3	7 Aug	2	N?	Laymon
Woodson Bridge to Hamilton City, Tehama and Glenn Counties					
Mouth of Jewett Ck	SR4	8 Jun	1	N?	Gaines
W bank 0.5 mi S of McIntosh Landing	SR5	2 Jul	1	N?	Laymon

Table 2 (Cont.)

Locality	Site No.	Date(s)	Total	Status	Principal Observer
Hamilton City to Ord Ferry Bridge, Glenn and Butte Counties					
Pine Ck 1.0 mi above Sacramento River	SR6	11 Jul	1	N?	Laymon
Inside of bend 0.5 to 1.5 mi W of mouth of Pine Ck	SR7	11 Jul	5	N?	Laymon
Indian Fishery	SR8	9 Jul	1	N?	Laymon
Mouth of Indian Fishery Slough	SR9	11 Jul	1	N?	Laymon
Mouth of Big Chico Ck	SR10	25 Jun	2	N?	Thomas
		20 Aug			
W bank 0.6 mi SW of mouth Big Chico Ck	SR11	29 Jun	3	N?	Laymon
E bank 0.7 mi S of mouth Big Chico Ck	SR12	12 Jul	2	N?	Laymon
E bank 1.3 mi S of mouth Big Chico Ck	SR13	12 Jul	1	N?	Laymon
Slough on W bank N of Ord Ferry	SR14	14 Jun	2	N?	Gaines
Ord Ferry Bridge to Butte City, Butte and Glenn Counties					
E bank 0.2 mi S of Ord Ferry Bridge	SR15	22 Jul	1	N?	Snowden
W bank across from Parrott Landing	SR16	14 Jun	2	N?	Gaines
W bank 0.2-0.5 mi N of Jacinto	SR17	10 Jun	2	N?	Heinrich
		18 Jul			
Jacinto (Hawaiian Gardens)	SR18	14 Jun	1	N?	Gaines
Unnamed Island N of Hartley Island	SR19	18 Jul	2	N?	Laymon
E bank NE of Hanson Island 0.2 mi N of river mile 171	SR20	18 Jul	1	N?	Laymon
E end of Hanson Island	SR21	18 Jul	1	N?	Laymon
E bank near river mile 170 0.8 mi N of Butte City	SR22	25 Jul	1	N?	Snowden
W bank below Hanson Island 0.3 mi NW of Butte City	SR23	18 Jul	1	N?	Laymon
Butte City to Colusa, Colusa Co.					
S end of Packer Lake	SR24	18 Jul	1	N?	Laymon
W bank 1.5-2.0 mi N of Princeton (W.C.B. site)	SR25	23 Jul	1	N?	Laymon
E bank 0.7 mi N of Glenn-Colusa Co. line	SR26	23 Jul	1	N?	Laymon
W bank 0.5 mi SSE of Stegeman	SR27	23 Jul	1	N?	Laymon
0.6 mi NE of Hamilton Bend	SR28	23 Jul	2	N?	Laymon
W bank 0.5 mi N of Colusa (Colusa State Pk)	SR29	31 Jul	2	N?	Laymon
Butte Sink, Butte County					
0.8 mi S of Sanborn Slough Gun Club	BS1	31 Jul	1	N?	Laymon
Angel Slough 0.4 mi E of White Mallard Hunting Club	BS2	24 Jul	2	N?	Laymon
1.0 mi WNW of Wild Goose Country Club	BS3	15 Jun	6	N?	Gaines
		24 Jul	6	N?	Laymon

Table 2 (Cont.)

Locality	Site No.	Date(s)	Total	Status	Principal Observer
Feather River, Sutter County					
Slough on E bank 0.1 mi N of Garden Highway (SW of Nicolaus)	FR1	25 Jun	1	N?	Gaines
SIERRA NEVADA REGION					
South Fork Kern River, Kern County					
0.2 mi E of bridge on road to Onyx Ranch	KR1	13 Jul	1	N?	Gaines
0.5 mi E of bridge on road leading N of Weldon	KR2	4 Jul	1	N?	Gaines
0.5 mi E of Sierra Way Bridge	KR3	4 Jul	1	N?	Gaines
Sierra Way Bridge	KR4	3 Jul	2	N?	Gaines
0.2-1.3 mi W of Sierra Way Bridge	KR5	14 Jul 31 Jul	4	N?	Gaines
SOUTH COAST REGION					
Santa Ana River, Riverside County					
S of sewage disposal plant 1.5 mi SSW of Rubidoux (Santa Ana Regional Park)	SA1	20 Jul	1	N?	Gaines
Prado Co. Park 0.5 mi W of River Rd (on Willow Flat Nature Trail)	SA2	20 Jul	1	N?	Gaines
Prado Flood Control Basin 0.9 mi N of Prado Dam	SA3	24 Jul	1	N?	Gaines
MOJAVE DESERT REGION					
Owens Valley, Inyo County					
Owens Valley Ranch 2.0 mi SW of Big Pine	OV1	16 Jul	3	N	Gaines
Hogback Creek 6.0 mi NW of Lone Pine	OV2	16 Jul	1	N?	Gaines
Amargosa River, Inyo and San Bernardino Counties					
Amargosa River 0.3-0.9 mi S of Tecopa	A1	17 Jul 31 Jul	2	N?	Gaines
0.5 mi W of Willow Spring	A2	2 Sep	1	?	Tarble
China Ranch	A3	31 Jul	2	N?	Tarble
Confluence of Amargosa River and Willow Creek	A4	18 Jun	1	N?	Henderson
Furnace Creek Ranch, Death Valley N.M., Inyo Co.	---	4 Jun	2	?	Heindel
Fort Piute, NW of Needles, San Bernardino Co.	---	25 May	1	?	Bailey
LOWER COLORADO RIVER REGION					
San Bernardino County					
Willow Valley Estates, 5.0 mi N of Needles, AZ	CR1	Jun-Aug	+	N?	Anderson
Havasu NWR (Topock Swamp) and vicinity 2.0-4.5 mi SE of Needles, CA-AZ	CR2	Jun-Aug 31 Jul-1 Aug	+ 7	N? N?	Anderson Gaines
Bill Williams River from its mouth to Planet Ranch, AZ	CR3	Jun-Aug 30 Jul	+ 11	N	Anderson Gaines
Deer Island, CA-AZ	CR4	Jun-Aug	+	N?	Anderson

Table 2 (Cont.)

Locality	Site No.	Date(s)	Total	Status	Principal Observer
Riverside County					
NW of Lost Lake Resort, CA	CR5	Jun-Aug	+	N?	Anderson
Unnamed island 5.0 mi SW of Poston, CA-AZ	CR6	Jun-Aug	+	N?	Anderson
Inside of bend 1.5 mi	CR7	Jun-Aug	+		Anderson
SE of Waterwheel Camp, CA		29 Jul	2	N?	Gaines
0.7 mi N of Blythe Boat Club (Clark Ranch), CA	CR8	Jun-Jul	2	N?	Clark
E bank 2.0 mi SE of Palo Verde Dam, AZ	CR9	Jun-Aug	+	N?	Anderson
Backwater at end of 10th Ave., 3.0 mi ENE of Blythe (Big Hole), CA	CR10	2 Aug	2	N?	Gaines
Backwater 0.8 mi N of Ehrenberg, AZ	CR11	Jun-Aug	2	N	Anderson
Backwaters 2.2-3.6 mi S of Ehrenberg Bridge	CR12	Jun-Aug	+	N?	Anderson
(Goose Flats), CA		1 Aug	2		Gaines
Imperial County					
0.6 mi S of 35th St. Horace Miller Co. Park,	CR13	Jun-Aug	+	N?	Anderson
CA-AZ		28 Jul	2		Gaines
E of Oxbow Lake, AZ	CR14	Jun-Aug	+	N?	Anderson
0.3 to 2.6 mi N of Paymaster Landing (Walter's	CR15	Jun-Aug	+	N?	Anderson
Camp), CA-AZ		28 Jul	2		Gaines
Gilmore's Landing, CA	CR16	5 Aug	1	N?	Gaines
Walker Lake to N end of Draper Lake, Imperial NWR, CA-AZ	CR17	4 Aug	10	N?	Gaines
Inside of bend NW of Taylor Lake, Picacho St. Recr. Area and opposite bank, Imperial NWR, AZ	CR18	5 Aug	8	N?	Gaines
W bank and islands from Picacho Mill 0.6 mi S, Picacho State Recr. Area and	CR19	27 Jul	3	N?	Gaines
Imperial NWR, CA-AZ		5 Aug			
Ferguson Lake, CA	CR20	26 Jul	1	N?	Gaines
E of Imperial Rd. 2.0 mi N of Laguna Dam and 0.3 mi S of Ferguson Rd., CA	CR21	26 Jul	3	N?	Gaines
0.4-0.8 mi S of Laguna Dam between Imperial Rd. and Laguna Settling Basin	CR22	25 Jul	6	N?	Gaines
(Shantytown), CA		26 Jul			
1.7 mi W of Winterhaven, CA	CR23	26 Jul	1	N?	Gaines

Status

N nesting
N? suspected nesting
T transient
? probable transient

SAN JOAQUIN VALLEY REGION

History of occurrence. The Yellow-billed Cuckoo has been recorded in every county in the San Joaquin Valley region except Kings Co. (Table 1). Breeding has been verified in San Joaquin, Stanislaus, Fresno and Kern counties.

Early reports vary in the assessment of cuckoo abundance. In mid-July 1891 Fisher (1893) found them "common" near Bakersfield, Kern Co., in the willows and cottonwoods which then lined the Kern River. They must have been numerous at the mouth of the Kern River in the early 1920s, for Van Rossem collected 17 specimens (UCLA) at Buena Vista Lake.

In Fresno Co., according to Tyler (1913), the Yellow-billed Cuckoo could not "be called common" but "their retiring habits" made "it difficult to determine in what numbers they are present." He described the cuckoo as a summer resident in the "tangles of willow brush and vines" along the San Joaquin River and "a number of the larger canals." A nest which held two newly hatched young on 10 July 1902 was situated in a "small, somewhat isolated willow" at the edge of an irrigation ditch.

Cuckoos continued to breed along the San Joaquin River through at least the 1940s. In 1950 three pairs were located on 30 acres of open willow brush and marshland at Mendota Pool, Fresno Co. (AFN 4:291, 1950).

The records suggest that cuckoos formerly nested along most of the wooded streams and sloughs of this region. The lack of sightings along the Tule, Kings and Merced rivers probably reflects an absence of ornithologists.

Observations during the 1960s and 1970s suggest that a few cuckoos may still breed in the region. At the mouth of the Stanislaus River, San Joaquin and Stanislaus counties, the cuckoo was observed in 1962, 1963, 1965, 1972 and 1973. The numbers at this site fell gradually from five to one (AFN 17:65, 1963; 18:20, 1964; AB 26:878, 1972; 27:915, 1973; Betty Kimball pers. comm.).

Results. We surveyed nine sites along the San Joaquin River between South County Park, San Joaquin Co., and Mendota Pool, Fresno Co., from 29 June to 1 July 1977. We surveyed the Stanislaus River from Caswell State Park to its mouth, San Joaquin and Stanislaus counties, on 29 and 30 June; the Merced River from Snelling to Merced Falls, Merced Co., on 30 June; the Kaweah River below Lake Kaweah, and the Tule River below and above Lake Success, Tulare Co., on 3 July. No cuckoos were found.

Discussion. If Yellow-billed Cuckoos still breed in the San Joaquin Valley, the population is very small. Little habitat is extant, and that which remains may be too confined or widely scattered to support a viable population.

SIERRA NEVADA REGION

History of occurrence. Within the Sierra Nevada region, the Yellow-billed Cuckoo has occurred in Kern and Placer counties. A cuckoo was collected along the South Fork Kern River near Weldon, Kern Co., in 1911 (specimen MVZ). The only other pre-1977 records are of probable transients.

Results. We surveyed the South Fork Kern River between Bloomfield Ranch and Isabella Reservoir, Kern Co., on 3-4, 12-14 and 31 July 1977. Nine cuckoos—two pairs and five individuals—were observed at five sites.

All sites were situated in the extensive, continuous and relatively broad strip of cottonwood-willow forest along the South Fork Kern River from Bloomfield Ranch west to Isabella Reservoir, a distance of 16 km (Figure 4). At its broadest point the strip is 1000 m wide and is probably the largest contiguous cottonwood-willow forest extant in California.

We observed cuckoos in the foliage of willows on 13 occasions and in cottonwoods on 2. Canopy height ranged from 10 to 18 m, canopy cover from 10% to 70% and understory cover from 50% to 80%. Water was present at sites KR1-3, but not at sites KR4 and 5. At site KR5, we heard three cuckoos cooing simultaneously within about 120 ha of forest.

Discussion. Grinnell and Miller (1944) include the "vicinity of Weldon" in the Yellow-billed Cuckoo's breeding range, based on the specimen collected in 1911. This survey substantiates the presence of a nesting population in this area.

At sites KR4 and KR5, cuckoos were found in the immediate vicinity of the dry riverbed. The lack of surface water was attributed to the drought conditions of the previous two years. Surface water is normally present.

Figure 4. The forest of willows and cottonwoods at Site KR5, Kern County, is typical of the habitat of the Yellow-billed Cuckoo along the South Fork of the Kern River near Weldon and Onyx.

A thorough survey is needed to assess the density of this population. Two pairs and five solitary cuckoos were detected. Assuming the solitary birds were mated, seven pairs were present. Adjusting this total to take into account areas that were not surveyed yields an estimate of 17 pairs. Observations at Site KR5 suggest that a pair requires a territory of about 40 ha. At this density, the forest could support 25 pairs if all the habitat were occupied. If the adjusted survey total is considered a minimum, and the calculated total a maximum, a tentative population estimate is 17 to 25 pairs.

SOUTH COAST REGION

History of occurrence. The Yellow-billed Cuckoo has occurred in every county in the South Coast Region. Numerous nesting records imply that the coastal lowlands of Ventura, Los Angeles, San Bernardino, Riverside, Orange and probably San Diego counties were once a stronghold of the species (Table 1). Grinnell (1898) and Willett (1912, 1933), for example, considered cuckoos "fairly common" in the region.

Six egg sets from Ventura Co. indicate that a population of cuckoos nested along the Santa Clara River and in the marshy coastal bottomlands between its mouth and Port Hueneme until at least 1942. The nests, found between 4 June and 31 July, were situated in willow thickets (Willett 1912; egg sets WFVZ).

Jay (1911) studied the cuckoo near the Los Angeles River, Los Angeles Co., "within a few miles of the ocean." The birds inhabited "swampy places and river bottoms surrounded by willows." In some groves they were common, whereas none were found in others. Between 1900 and 1910, 40 nests were found in willows less than 4.2 m tall. Nesting was at its peak from mid-June through mid-July.

Between 1919 and 1930 Hanna (1937) discovered 24 cuckoo nests along Warm Creek and the Santa Ana River in the San Bernardino Valley, San Bernardino Co. The nests were concealed in "damp willow thickets mixed with cottonwood trees and with heavy underbrush of nettles, wild grape vines and cattails." All but two were in willows at an average height of 4 m. Breeding reached its peak in late June and early July.

Additional nesting records from throughout the region indicate the widespread breeding distribution of the cuckoo in the coastal lowlands.

The cuckoo's decline in southwest California has been attributed to habitat destruction. Soon after the turn of the century, the clearing of willows along the Los Angeles River became a threat to local populations (Jay 1911). During the 1920s and 1930s, Hanna (1937) watched the "miles of cottonwood and willows" where he studied the species give way to "farms and pastures."

Cuckoos were present until the early 1950s. Nests were located along the Santa Clara River, Ventura Co., in 1942 (egg set WFVZ), along the Santa Margarita River near Temecula, Riverside Co., in 1948 (egg set SBCM), and along the San Gabriel River near El Monte, Los Angeles Co., in 1949 and 1951 (AFN 3:251, 1949; 5:309, 1951).

Decline of the cuckoo along the Santa Ana River between Riverside and Corona, Riverside Co., cannot be attributed to habitat destruction. Between 1 and 11 June 1963 Hamilton and Hamilton (1965) intensively surveyed

this area without success. They found the habitat reduced from Hanna's times, but "considerable stretches of seemingly favorable habitat" remained. Eugene Cardiff found the cuckoo common in this area until the early 1950s, when it declined and disappeared abruptly without obvious cause. During this period the riverbottom was repeatedly sprayed with pesticides, probably DDT, by county mosquito abatement authorities (E. Cardiff pers. comm.).

Despite increasingly thorough coverage by field ornithologists, the cuckoo was observed only six times in the region from 1952 to 1976. Only an individual at Rialto, San Bernardino Co., in July 1970 raised hope that cuckoos might be breeding along the nearby Santa Ana River (AB 24:717, 1970).

Results. We surveyed along the Santa Clara River, Ventura Co., 22 July 1977; at Harbor Park, Los Angeles Co., 7 August; on the San Joaquin Marsh Preserve, University of California, Irvine, Orange Co., 23 July; along the San Luis Rey River near Bonsall, San Diego Co., 24 July; and along the Santa Ana River and in the Prado Basin, Riverside Co., 20, 21 and 24 July and 8 August.

On 20 July we found two cuckoos at two sites along the Santa Ana River between Riverside and Corona, Riverside Co. On 24 July we found a third cuckoo in the Prado Flood Control Basin north of Prado Dam. All three sites were situated in willow forest in the floodplain of the Santa Ana River between Riverside and Prado Dam, a distance of 19 km. The forest varies in width from 100 to 1000 m along the river and broadens to 5 km in the Flood Control Basin. It is the largest continuous willow forest in California.

Cuckoos were observed only in willows, the dominant tree at all sites. Vegetation varied from low dense thickets with intervening open ground (site SA1) to continuous forest (sites SA2 and SA3). Canopy height ranged from 5-10 m and canopy cover from 70% to 90%. At sites SA2 and 3, willows and blackberries (*Rubus* spp.) formed leafy understories with 80% cover. Open water and emergent marsh plants were present within 30 m of all sites.

Despite intensive coverage of identical areas, we found no other cuckoos along the Santa Ana River. Sites SA1 and SA2 were resurveyed 24 July and 8 August without success.

Discussion. The scarcity of Yellow-billed Cuckoos in this region is attributable to the loss of suitable habitat. Of the sites surveyed, only the Santa Ana River still supports a continuous growth of willow more than 50 m in width or 10 ha in area.

Low densities of cuckoos along the Santa Ana River, however, cannot be attributed to lack of habitat. In 18 hours afield, we found only three individuals in 3400 ha of suitable habitat. Eugene Cardiff (pers. comm.) says the vegetation has not changed appreciably since he and Wilson Hanna found "good numbers" of cuckoos in the area during the 1940s. Since that time, despite relatively thorough coverage, cuckoos were not found again until this year. Their reappearance suggests that the species may be resettling this extensive area.

Some possible suitable habitat was not surveyed, e.g., along the San Luis Rey River and at Camp Pendleton, San Diego Co. Even if these areas support cuckoos, the region's population is very low.

MOJAVE DESERT REGION

History of occurrence. The Yellow-billed Cuckoo has been recorded in Owens Valley, Death Valley and near Tecopa, Inyo Co., and at Yermo, Morongo Valley, Kelso and Fort Piute, San Bernardino Co. (Table 1). Most of these records are of transients. Between 1972 and 1976 cuckoos were reported four times in Death Valley and once in nearby Tecopa (AB 27:915, 1973; 29:909, 1975; 30:891, 1004, 1976). These records suggest that a scattered population of cuckoos breeds in isolated pockets of suitable habitat across the deserts of the Great Basin.

During July 1968 a cuckoo was heard cooing near Big Pine in the Owens Valley (Steven Cardiff pers. comm.). Its behavior and site attachment suggested it was nesting in the vicinity.

Results. We conducted surveys in the Owens Valley, Inyo Co., on six days between 5 July and 10 August 1977; in Death Valley, Inyo Co., 17 July; along the Amargosa River near Tecopa, Inyo Co., on 17 July; along the Mojave River at Afton Canyon, San Bernardino Co., on 17 July; along the Mojave River south of Mojave Narrows, San Bernardino Co., on 18 July; and at Morongo Valley, San Bernardino Co., on 18 and 19 July.

Between 25 May and 2 September we found a total of 14 cuckoos at nine sites in this region. Six at four sites near Tecopa and four at two sites in the Owens Valley were nesting, whereas the remaining birds were probably transients.

We found three cuckoos at site OV1 southwest of Big Pine, Inyo County, on 16 July. Two appeared to be a mated pair; they were carrying twigs and long-horned grasshoppers (Tettigoniidae), but no nest was located. The same day we found a fourth cuckoo at site OV2 northwest of Lone Pine.

Groves of willows were dominant at both Owens Valley sites, with boggy meadows interspersed among the groves. Canopy height ranged from 10-13 m, canopy cover from 40% to 50%, and understory cover from 50% to 70%. Habitat was extensive, but isolated from similar stands of willows by many miles of desert vegetation. At site OV1 three birds were found in 40 ha, and at site OV2 one bird was in 120 ha of willow groves and moist meadows. No cuckoos were detected in the more open willow groves along the Owens River.

We observed six cuckoos in the dense willow and mesquite (*Prosopis juliflora*) thickets south of Tecopa, Inyo and San Bernardino counties. This corridor of mesic habitat covers 480 ha along 10 km of the Amargosa River and 3 km of its tributary, Willow Creek. About 30% of the suitable habitat was surveyed.

Two cuckoos were found at site A1, where willow and mesquite formed impenetrable thickets about 5 m high. The thickets covered 70% of the canyon bottom and were watered by the cattail-lined Amargosa River and by many springs.

We found no cuckoos in seemingly suitable habitat along the Mojave River, San Bernardino County. This area warrants further study.

Discussion. The existence of nesting populations in the Owens Valley and near Tecopa indicates that cuckoos are able to colonize "islands" of mesic

habitat within the desert. These habitat islands are characterized by surface water and dense groves of willows dispersed over several hundred contiguous hectares. Only a few widely scattered localities meet these requirements. Aside from those surveyed, the following areas might qualify: in Inyo Co., the area around Bishop and along the Owens River to Big Pine, the Owens River near Lone Pine Station, and Saline Valley; and Zzyxx Spring in San Bernardino Co.

In contrast, the narrow bands of willow which line small streams in many desert canyons have not been found to support nesting cuckoos. Morongo Valley and Fort Piute, San Bernardino Co., for example, have both been surveyed intensively, but only transient cuckoos have been found.

COLORADO RIVER REGION

History of occurrence. The Yellow-billed Cuckoo has been recorded along most of the portion of the Colorado River that forms a boundary between California and Arizona (Table 1). Sightings in San Bernardino, Riverside and Imperial counties and in Arizona are included in this discussion.

Early records for the region are few. Grinnell and Miller (1944) cite only Stephen's (1903) observation of several cuckoos near Needles, San Bernardino Co., in 1902. Specimens were collected in Imperial Co. in 1915, 1930 and 1952 (SDNHM), and an egg set was collected near Blythe 15 June 1929 (SBCM). The paucity of historical data probably reflects an absence of observers at the proper time of year.

Since 1974, B.W. Anderson, R.D. Ohmart and their co-workers have been censusing bird densitites along the Lower Colorado River. By extrapolation of their data, they estimated a population of 244 cuckoos between Davis Dam and the Mexican border (Anderson pers. comm.) and an additional 114 near the mouth of the Bill Williams River (Ken Rosenberg pers. comm.).

Centers of population are on the west side of Topock Swamp and near the mouth of the Bill Williams River, Havasu National Wildlife Refuge, California and Arizona, and on the Imperial National Wildlife Refuge and Picacho State Recreation Area, Imperial Co., California (Ken Rosenberg, Tim Brush, Paul Mack and Bertin Anderson pers. comm.). Another substantial population was found by Guy McCaskie (pers. comm.) north of Laguna Dam, Imperial Co., during the 1960s and 1970s.

Results. We conducted surveys from 25 July to 5 August 1977, and found 65 cuckoos at 16 sites scattered along the river. Between June and August, other field ornithologists found cuckoos at seven additional sites.

Of the 51 cuckoos actually sighted, 79% were perched in willows, 11% in mesquite, 8% in cottonwood and 2% in salt cedar (*Tamarix* sp.) Fledglings were observed at sites CR2, 10, 11 and 22.

The seven cuckoos found in Topock Swamp area (site CR2) occupied a large expanse of Arrowweed (*Pluchea sericea*), salt cedar, willow and mesquite 3-4 m high. Willows 7-9 m tall formed an open overstory. Canopy cover varied from 10% to 20%, and understory cover, from 80% to 90%.

Habitat at sites CR10-16 from 5 km north of Blythe, Riverside Co., to Gilmore Landing, Imperial Co., and sites CR20-23 from Ferguson Lake to 3

km west of Winterhaven, Imperial Co., was similar to that at Topock Swamp. Canopy height varied from 8-13 m, canopy cover from 20% to 40%, and understory cover from 60% to 90%. The highest cuckoo density was at site CR22, 0.8-1.3 km north of Laguna Dam, Imperial Co. At least three pairs were found in 12 ha. Similar uncensused habitat stretches east and northeast 2-3 km to Mittry Lake National Wildlife Refuge in Arizona.

We also found high population densities on Imperial National Wildlife Refuge and in Picacho State Park (sites CR17-19), with 21 cuckoos in 120 ha of dense willows. The canopy varied from 4-10 m and canopy cover from 80% to 90%. The willow groves formed 70 m wide strips along the river channel.

The forests on the Bill Williams River floodplain (site CR3), Mojave Co., Arizona, supported the highest density of cuckoos. We detected 11, including 8 in about 12 ha of willows and cottonwoods. The canopy height of 17 m and canopy cover of 80% exceeded that of any other Colorado River site.

In general, sites inhabited by cuckoos were characterized by at least 20% willow cover, dense shrub or understory foliage, and open water or marsh within 100 m. Cuckoos were found at every site which had these characteristics. Even patches of as little as 2 ha at times harbored the species.

Only at Site CR7, a scrub forest of mesquite, salt cedar and Arrowweed in Riverside County, was a cuckoo found in the absence of willows. No cuckoos were found in areas dominated by salt cedar.

Discussion. The survey supports Anderson's and Rosenberg's estimate of 358 Yellow-billed Cuckoos along the lower Colorado River. There is no evidence that suitable habitat is not being used, suggesting that habitat availability is limiting the population in this region.

Willows and cottonwoods were formerly more widespread along the lower Colorado. When Grinnell (1914) studied the river in 1910, the entire floodplain was densely wooded. The Palo Verde Valley was covered by 40,000 ha of forest. The cottonwood trees south of Blythe extended 8 km inland from the river in 1920 (Heath Angelo pers. comm.).

The loss of these forests to agriculture, channelization and reservoirs has been accompanied by the encroachment of salt cedar, a native of northern Africa and Eurasia. Arriving in the southwest in the late 1800s, it has spread into riverbottoms "at the expense of nearly all the native plant life" (Robinson 1965). Salt cedar's ability to out-compete willow is not well understood, but lack of flooding and increase in soil salinity may be responsible.

Survival of the cuckoo in this region will require preservation of habitat. Sites such as CR4-16 and 21-23 are vulnerable to agricultural development and channelization projects. In 1974, for example, 5200 ha were cleared on the Fort Mojave Indian Reservation. Willow habitat near Cibola and Three Finger Lakes has been lost to channelization during the last 10 years (James Snowden, Gordon Gould pers. comm.). Fortunately, three of the major cuckoo population centers are on national wildlife refuge or state park lands. Even here, salt cedar control may be necessary to maintain the habitat. The fourth center near Laguna needs protection.

CAUSES OF DECLINE

The Yellow-billed Cuckoo is at a critically low population level, not only in California, but in the northern Rocky Mountains, the Great Basin, and the Pacific Northwest as well (Tom Lund, Hugh Kingery pers. comm.). Declines are suspected in other parts of North America. The closest population to California that has not declined in recent years is in the riverbottoms of southern Arizona (Richard Stallcup pers. comm.).

It is unlikely that the cuckoo's decline has been caused by factors affecting its migratory route or wintering habitat in southern Brazil and Argentina. The clearing of forests in Latin America has probably favored the cuckoo by fostering the second-growth thickets it prefers (De Schaunsee 1970). Maintenance of populations in portions of North America suggests that the decline in California was caused by local changes.

Loss of habitat is the most important cause of decline. By the late 1800s, large tracts of floodplain forest had already been cut or cleared for fuel or agriculture (Cronise 1868, Thompson 1961). Probably the density of cuckoos was even greater than the early literature suggests. Reclamation, flood control and irrigation projects accelerated this loss over the past 80 years, leading to only remnant riparian habitat in 1977.

DDT and other chlorinated hydrocarbon pesticides may have hastened the cuckoo's decline during the 1940s and 1950s when aerial spraying became common in fields, orchards and riverbottoms (Greib 1948, Eugene Cardiff pers. comm.). These sprayings undoubtedly affected non-target insect populations as well as the crop pests and mosquitos for which they were intended. This reduction in food might have caused an immediate decline in cuckoo populations already stressed by loss of habitat. The critical role of food supply as well as the abrupt disappearance of cuckoos from the Santa Ana River area during the 1950s supports this theory.

PRESERVATION AND MANAGEMENT

The presence of breeding populations of Yellow-billed Cuckoos in five regions of California gives hope that with preservation, enhancement and appropriate management of habitat, cuckoos will continue to nest at these localities and to recolonize other suitable habitat.

To formulate a management strategy it is necessary to understand the factors that limit the cuckoo's population density. The few published studies and the data presented in this paper suggest that dense foliage, high humidity, extensive habitat and adequate food are conditions that must be met before a cuckoo will nest.

Vegetation. Groves of broad-leaved deciduous hardwoods, especially willows and cottonwoods, are characteristic of the cuckoo's habitat throughout California. Height and dispersion of trees seem less important than foliage density. Yellow-billed Cuckoos occupy scattered groves and thickets as well as unbroken expanses of forest. Saplings 3-10 m in height and old-growth trees 10-27 m in height are both used. Dense foliage, especially within 10 m of the ground, is common to all areas. Forests with

Table 3. Habitat analysis of selected Yellow-billed Cuckoo sites in California during summer 1977.

	Sacramento River	Butte Sink	Feather River	Kern River	Santa Ana River	Owens Valley	Amargosa River	Colorado River
Number of sites	24	2	1	5	3	2	1	20
Canopy height (m) range: mean	10-27:22.5	5-7:6	23	10-17:13	5-10:8	10-13:12	5	3-17: 9
Canopy cover (%) range: mean	20-90:60	30:30	90	10-70:44	70-90:83	40-50:45	70	10-90:35
Understory cover (%) range: mean	0-90:78	---	80	50-80:70	0-80:53	50-70:60	---	0-90:71
% cover range: mean								
Willow	30-80:58	20-30:25	70	30-70:48	70-90:80	50-70:60	40	0-90:33
Cottonwood	30-80:49	---	30	0-30:14	---	---	---	0-40: 4
Box Elder	0-30: 6	---	10	---	---	---	---	---
White Alder[a]	0-20: 3	---	---	---	---	---	---	---
Blackberry	0-10: 0	---	20	---	0-60:30	---	---	---
Grape (*Vitis* sp.)	0-30: 3	---	---	---	---	---	---	---
Buttonwillow[b]	---	0-20:10	---	---	---	---	---	---
Mule Fat[c]	---	---	---	0-40:26	0-10: 3	---	---	---
Mesquite	---	---	---	---	---	---	20	0-50:10
Saltbush[d]	---	---	---	---	---	---	10	---
Salt Cedar	---	---	---	---	---	---	---	0-60:25
Arrowweed	---	---	---	---	---	---	---	0-50:10
% near slough or marsh	67	100	100	60	67	100	100	80
% near similar extensive habitat	67	100	100	100	100	0	100	75

[a]*Alnus rhombifolia* [b]*Cephalanthus occidentalis* [c]*Baccharis viminea* [d]*Atriplex* sp.

taller trees have well-developed leafy understories. Dense low-level foliage is an important factor in the selection of nesting territories.

Willows and cottonwoods are primarily riparian trees dependent on ground water near streams. An ample supply of subsurface water not only keeps their foliage green throughout the long summer dry period, but promotes high productivity. These trees thrive on unstable floodplains of meandering, aggrading streams. On the outside of curves such streams undercut their banks, dislodging soil and toppling trees. On the inside of curves they deposit sediment and form bars where new trees can germinate. Under these conditions, copious seed production, wind dispersal, and rapid sapling growth favor willows and cottonwoods. When streams are channelized or their flows modified by dams, the more stable conditions and/or lower water tables may favor other species of trees not utilized by the Yellow-billed Cuckoo.

Dense groves of willow need to be maintained. It is essential to assure that extant habitat is not cleared. Once a preserve has been established, it may also be necessary to manage the vegetation in the interests of the cuckoo. Periodic flooding may be requisite to a dense growth of willows. If flooding is impossible, cultivation and selective removal of competing trees may be a viable alternative. The ecology of California willows needs further study.

Reforestation warrants serious consideration. The Yellow-billed Cuckoo is not restricted to old-growth willows and cottonwoods, but inhabits young trees as well. At 54% of the analyzed sites, canopy height was 10 m or less. Under favorable conditions, willows and cottonwoods attain this height in 10 to 15 years. In many areas, as along the rivers of the Central Valley, the Santa Clara River in Ventura Co., the San Luis Rey River in San Diego Co., and the Owens River in the Owens Valley, planting willows would create additional habitat in a relatively short time. Along the Colorado River, methods for controlling the spread of salt cedar, and for restoring conditions that favor more desirable native trees, need to be developed.

Humidity. Throughout the arid west, breeding populations of the Yellow-billed Cuckoo are restricted to riverbottoms, ponds, swampy places and damp thickets where humidity is relatively high. In 1977 we detected the species only where surface water was usually present. Sloughs, creek mouths, oxbow lakes and marshes further increased local humidity at 74% of the analyzed sites.

In eastern North America, where the species probably evolved, the cuckoo occurs in deciduous forests which are consistently humid during the summer. Hamilton and Hamilton (1965) suggest that such conditions may be necessary to prevent cuckoo eggs from dessicating. Colonization of western North America may have been possible only because riverbottoms offered sufficiently humid habitat.

Surface water, such as oxbows, sloughs and marshes, needs to be maintained. Maintenance of water will not pose a problem along the Sacramento, Colorado and other large rivers as long as they are employed for commercial water transport. Other areas, especially the Owens Valley, must be closely monitored.

Wetland habitat is in greater danger. Channelization and flood control have stopped rivers from changing their courses, thus arresting the process by which riparian oxbows and marshes are formed. This process, which provides ideal habitat for the cuckoo, is occurring only during "hundred-year floods" or not at all. Hence it may be necessary to maintain existing oxbows through dredging or manipulation of water levels.

Dredging of new oxbows also deserves consideration. In conjunction with willow plantings, such a project holds promise of restoring viable habitat for the cuckoo.

Habitat Breadth. Habitat breadth may be another important factor in the selection of nesting territories. In California, very few cuckoos were found where suitable vegetation was less than 100 m wide and under 10 ha in surface area (Gaines 1974b). A study of avian distribution patterns on forest "islands" in New Jersey suggests that cuckoos are very rare or absent on patches of under 24 ha (Galli et al. 1976).

The Yellow-billed Cuckoo occupied 2 to 11 ha, a larger area than most birds of comparable size (Platt 1975, Ken Rosenberg pers. comm.). In acquiring preserves or undertaking habitat restoration or enhancement, priority should be given to areas with over 25 ha of contiguous habitat. Wherever possible, discontiguous parcels should be joined by acquiring or restoring habitat corridors between them (MacClintock et al. 1977).

Food Supply. Fluctuations in Yellow-billed Cuckoo breeding densities from place to place and year to year have been attributed to cycles in the abundance of caterpillars, cicadas and other large insects on which they subsist (Clay 1929, Forbush 1927, Nolan and Thompson 1975). Hamilton and Hamilton (1965) postulate a nomadic phase prior to breeding during which the cuckoos appraise local food resources before establishing territories and laying eggs.

The cuckoo may have adaptations for exploiting windfall outbreaks of suitable prey. In proportion to body weight, the eggs of *Coccyzus* cuckoos are among the heaviest of any nidicolous bird (Lack 1968). Energy cost of egg production may be as high as 30 percent of the female's daily intake (Nolan and Thompson 1975). These energy-expensive eggs facilitate rapid development of both embryos and nestlings (cf. Schifferli 1973). The 17-day combined incubation and nestling period is shorter than that of any other known species (Hamilton and Hamilton 1965, Skutch 1976). Eggs may be laid at irregular intervals during a relatively prolonged breeding season. Clutch size, usually three to four, frequently varies from one to five and sometimes more depending on level of food supply (Hanna 1937, Bent 1940, Nolan and Thompson 1975). Hence the cuckoo can raise more young during years of abundant food.

Because incubation begins with the initiation of egg-laying, nests may harbor eggs and nestlings at strikingly different stages of development. This phenomenon, termed asynchronous hatching, permits survival of the oldest nestlings in the event that food supply proves inadequate to nourish the entire brood (Hamilton and Hamilton 1965).

A healthy environment should produce an adequate supply of the large insects on which the cuckoo depends. Steps should be taken to assure that

pesticides sprayed on adjacent agricultural lands do not affect the vegetation in which cuckoos forage. Under no circumstances should spraying in riparian areas be allowed.

Because of fluctuations in food supply, the Yellow-billed Cuckoo may not nest in the same areas every year. Importance of habitat must be judged over an extended period of time. Large-sized preserves will increase the probability that pockets of food abundance will provide the conditions for optimal reproductive success.

Research Needs. Past studies of cuckoos in California provide virtually no data on home range, foraging substrates and food sources. This information is needed for successful preserve design and habitat management. Hence a habitat use study involving radio telemetry should be undertaken.

Knowledge of the context of the Yellow-billed Cuckoo's calls and displays would augment the value of the surveys. Hamilton and Hamilton (1965) attribute the "cooing" call to unmated males and the "kowlp" series to territorial pairs. This information, if valid, would permit estimates of the numbers of mated and unmated birds. Such estimates could be confirmed by the type of study proposed above.

SUMMARY

Between June and August 1977 we attempted to locate the breeding populations and describe the habitats of the Yellow-billed Cuckoo in California. Historic occurrences were researched through published literature and museum records. Surveys were conducted where the species nested historically or where habitat appeared suitable. We detected a total of 141 cuckoos in six widely separated parts of the state: 54 in the Sacramento Valley, Tehama, Butte, Glenn, Colusa, and Sutter counties (estimated total 35 to 68 pairs); 9 along the South Fork Kern River near Weldon, Kern Co. (estimated total 17 to 25 pairs); 3 along the Santa Ana River, Riverside Co.; 4 in Owens Valley, Inyo Co.; 6 along the Amargosa River south of Tecopa, Inyo and San Bernardino counties; and 65 along the Colorado River (including the Arizona side) between the Nevada line and the Mexican border (estimated total 180 pairs). Most sites were characterized by willows, dense low-level or understory foliage, high humidity and suitable foraging space in excess of 120 m in width and 10 ha in area. Cuckoos were found to have undergone a major contraction of range and decline in numbers in the past 80 years. Based on the surveys and a review of the literature, we discuss management and preservation of the Yellow-billed Cuckoo and its habitat.

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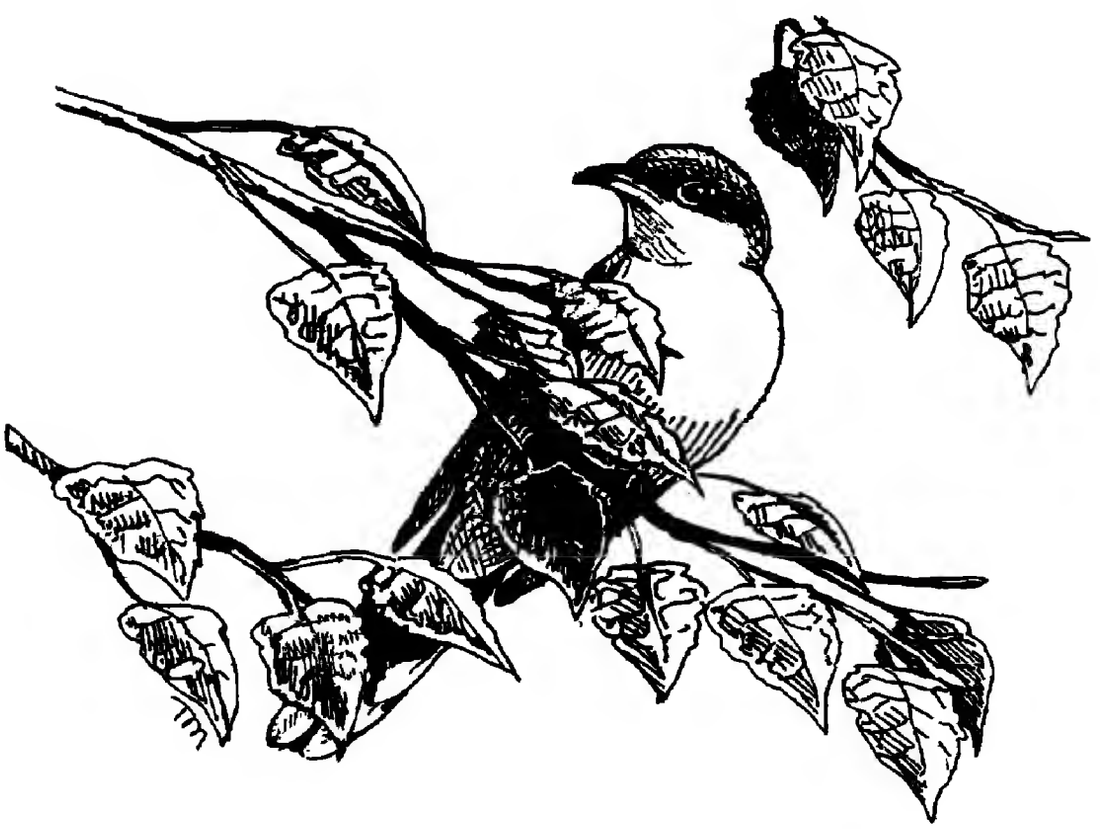

Yellow-Billed Cuckoo *Sketch by Tim Manolis*

POST-BREEDING AVIFAUNA AND MIXED INSECTIVOROUS FLOCKS IN A COLORADO SPRUCE-FIR FOREST

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Few data are available on post-breeding behavior and migration dates for birds of many geographic areas, especially for mountainous regions like western Colorado whose avifaunas are poorly known in general (Bailey and Niedrach 1965, Davis 1969). This paper presents information on the late-summer birds of a high-altitude forest in western Colorado, with particular attention to the foraging and flocking behavior of small foliage- and bark-gleaners. The study site is of special interest because it is thought to be virgin forest, in a region much of which has been heavily logged.

STUDY AREA AND METHODS

My study site was part of the Gothic Natural Area, located at almost 3000 m elevation near the confluence of Quigley Creek and the East River, 5 km NW of the Rocky Mountain Biological Laboratory (RMBL) at Gothic, Gunnison County, Colorado. The site supports a forest of Engelmann Spruce (*Picea engelmannii*) and Douglas-fir (*Pseudotsuga menziesii*) reaching 20 m in height, with a diverse herbaceous understory which becomes dense and waist-high in openings near water. There are few shrubs except for small individuals of the currant *Ribes montigenum*. There are many dead trees and fallen logs on the site.

Bird species known to have occurred in the Gothic area are summarized in Keeler-Wolf et al. (1973), but few observations have been made later in the year than early August.

I collected the data summarized here while making one or two complete circuits of a marked path (requiring about 1.5 hr per circuit) each morning from 10 August through 3 September 1976, except for 11, 15, 20, 21 and 23 August. All bird species seen or heard on the plot were recorded; in addition, perch sizes and heights and group sizes were noted for small foliage- and bark-gleaning species. Wagner (1977, 1981) provides further detail on methods.

Weather data were not available for the site, but rain fell on about half the days in the study period, often alternating quickly with bright sunshine; many of the nights were frosty.

RESULTS

SHARP-SHINNED HAWK (*Accipiter striatus*). Considered very rare in the Gothic area (Keeler-Wolf et al. 1973), this hawk was seen once on 25 August, when it was mobbed by Gray Jays.

BROAD-TAILED HUMMINGBIRD (*Selasphorus platycercus*). Observed twice, on 17 and 19 Aug. Fed at *Delphinium barbeyi*, a tall herb of moist openings.

RUFOUS HUMMINGBIRD (*S. rufus*). Observed twice, on 12 and 14 Aug. Also fed at *Delphinium*.

NORTHERN FLICKER (*Colaptes auratus*). Seen once, on 10 Aug.

YELLOW-BELLIED SAPSUCKER (*Sphyrapicus varius*). Seen on four occasions between 19 and 26 Aug.

WILLIAMSON'S SAPSUCKER (*S. thyroideus*). An adult male was observed on 19 Aug. This species is rare in the Gothic area (Keeler-Wolf et al. 1973).

STELLER'S JAY (*Cyanocitta stelleri*). Seen once, on 19 Aug. A rare species in the Gothic area (Keeler-Wolf et al. 1973).

GRAY JAY (*Perisoreus canadensis*). Observed throughout the study, on 16 of the 20 observation days.

MOUNTAIN CHICKADEE (*Parus gambeli*). Observed on every day of the study. Foraged almost entirely at heights of 3-12 m from perches on twigs <1 cm in diameter (38% of the observations) or on small branches 1-5 cm (56%). These results are similar to those of Manolis (1977) for pine-juniper woodland, although collected differently. Of 89 individuals recorded, 6 were alone; the remainder were seen in 20 single-species and 9 mixed groups. Mixed flocks (except one whose members were not all identified) always included kinglets and sometimes other species (see below).

RED-BREASTED NUTHATCH (*Sitta canadensis*). More often heard than seen, only five individuals of this species were observed, although the species was recorded on 9 days between 10 and 25 Aug. Four of the birds seen were alone and one was with a flock of chickadees and Ruby-crowned Kinglets. This species is considered rare in the RMBL area (Keeler-Wolf et al. 1973) and the ones I observed may have been post-breeding wanderers.

BROWN CREEPER (*Certhia americana*). Recorded on 10 days between 12 Aug and 1 Sep. The 12 observations were of five single birds, one pair, and five members of four mixed flocks of chickadees and kinglets.

GOLDEN-CROWNED KINGLET (*Regulus satrapa*). Flocks of this kinglet were seen on 12 of the 16 observation days from 14 Aug-2 Sep, but not before. These were very likely post-breeding wanderers. The 49 individuals recorded were observed in nine single-species groups, four mixed flocks with chickadees and sometimes other species, and one flock whose members were not all identified. This species perched almost exclusively on conifer twigs <1 cm in diameter.

RUBY-CROWNED KINGLET (*R. calendula*). Apparently bred on or near the site: A male was observed feeding fledglings on 10 Aug. Eighteen individuals were seen during this study, on 8 days between 10 and 27 Aug. Of these, four were alone, eight were as pairs, and six were in four mixed flocks with chickadees and sometimes other species; one flock also included Golden-crowned Kinglets. As in California oak woodland (Wagner 1977, 1981), Ruby-crowned Kinglets perched almost entirely on twigs <1 cm in diameter.

AMERICAN ROBIN (*Turdus migratorius*). Recorded on four days between 10 and 16 Aug.

HERMIT THRUSH (*Catharus guttatus*). Observed once, on 13 Aug.

YELLOW-RUMPED WARBLER (*Dendroica coronata*). Seen on only four occasions, on 12, 25, 28 and 30 Aug. In each case single-species groups of at least two birds were observed.

TOWNSEND'S WARBLER (*D. townsendi*). Single individuals of this species were identified on 10 and 18 Aug. Not recorded by Keeler-Wolf et al. (1973).

WILSON'S WARBLER (*Wilsonia pusilla*). Observed on 4 days between 10 and 14 Aug and on 3 days between 30 Aug and 3 Sep. The later birds may have been migrants from outside the Gothic area. All observations were of single birds, although one appeared to be associated with a flock of chickadees and Ruby-crowned Kinglets.

DARK-EYED JUNCO (*Junco hyemalis*). The Gray-headed (*caniceps*) form of this species was observed on 15 days throughout the study, in single-species flocks which never associated with chickadees or kinglets.

PINE GROSBEAK (*Pinicola enucleator*). Seen on 12 days throughout the study, generally in small flocks which were always of this species alone. Observed feeding fledglings on 10 Aug.

PINE SISKIN (*Carduelis pinus*). Observed only on 10 and 12 Aug, though large flocks were seen almost daily throughout the study period in weedy fields on the RMBL property 5 km away.

DISCUSSION

Although this study documented a period of turnover in the avian community, the most common and conspicuous species were probably all resident: Gray Jay, Mountain Chickadee and Dark-eyed Junco. There was no period of very high species diversity during the study; no large flocks of migrants were observed, although apparent migrant flocks have been seen at the same time of year on the forested slopes and ridges above the study area (R. L. Willey pers. comm.).

In a detailed study of late-summer flocks, Morse (1970) reported a high diversity and rapid turnover of migrant species, especially paruline warblers, associated with flocks of Black-capped Chickadees (*Parus atricapillus*) in Maine spruce forest and mixed forest. In that study Red-breasted Nuthatches were more common flock members than in my observations in Colorado. Golden-crowned Kinglets were apparently more usually seen in mixed flocks with chickadees than in separate, single-species flocks, again in contrast with my observations. It is not known what differences between Maine and Colorado forests or between Black-capped and Mountain chickadees might account for the predominance of single-species flocking in the Colorado study. In winter in California, where the high diversity of parulines is also lacking, Manolis (1977) observed the Mountain Chickadee most commonly in mixed flocks with highly gregarious species like Bushtits (*Psaltriparus minimus*) and Pygmy Nuthatches (*Sitta pygmaea*).

The scarcity of woodpeckers in my observations is surprising, especially since there were many dead trees on the site. Three species considered common or very common in the Gothic area (Northern Flicker, Yellow-bellied Sapsucker, and Downy Woodpecker *Picoides pubescens*; Keeler-Wolf et al. 1973) were recorded rarely or not at all on my site. The distribution and possible migration of woodpeckers in the Gothic area would make an interesting study. Other groups missing from my data (e.g., flycatchers) are likely to be early migrants. Some common breeding species (e.g., Ruby-crowned Kinglet and Yellow-rumped Warbler) were seen in August but in small numbers; many individuals apparently leave the Gothic area soon after breeding and do not join late-summer mixed flocks. We need more information on altitudinal migration and post-breeding wandering for many species of mountainous regions like western Colorado.

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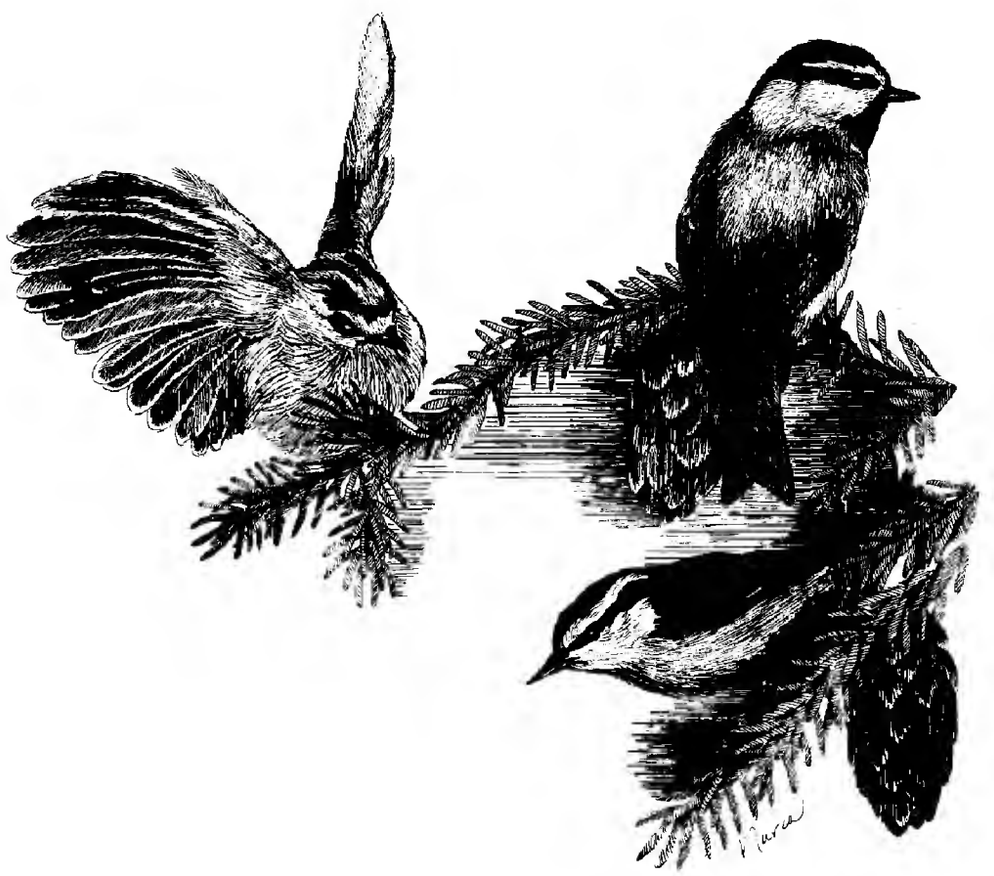

Mountain Chickadee, Red-breasted Nuthatch and Golden-crowned Kinglet

Sketch by Narca Moore-Craig

WYOMING'S JUNIPER BIRDS

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The avifauna associated with Wyoming's juniper plant community has largely been ignored. The purpose of this paper is to communicate information regarding 10 species of birds virtually confined, during the breeding season, to the Utah Juniper (*Juniperus osteosperma*) community in Wyoming.

Since 1979 we have made over 60 trips to juniper stands statewide. Most of our field work was conducted in 1982 in southern Sweetwater County of southwestern Wyoming. Few or no juniper-dependent birds were found on our visits to other portions of the state. Equal time was spent in the extensive stands of the Little Firehole Canyon area 13 km southeast of Green River and along the east-west ridge called Powder Rim 100 km southwest of Rawlins. Our objectives at each juniper stand were to document the presence and when possible the nesting of certain indicative species.

The pinyon-juniper community of Utah and Colorado becomes the Utah Juniper community in Wyoming. Pinyon Pine (*Pinus edulis*) is very rare along the Utah-Wyoming border near Flaming Gorge Reservoir and absent elsewhere in the state. Nearly homogenous stands of Utah Juniper can be found widely scattered throughout the state but are most extensive in the southwestern quarter (Figure 1). The other species of erect juniper in Wyoming, the Rocky Mountain Juniper (*Juniperus scopulorum*), is found most often in association with Ponderosa Pine (*Pinus ponderosa*) or Limber Pine (*Pinus flexilis*) and less frequently in association with Utah Juniper. Therefore, it is not a critical component of the juniper birds' habitat. Wyoming's juniper-dependent birds occupy habitats in Colorado (Kingery and Graul 1978) and Utah (Behle 1981) that are not found in Wyoming. The pinyon-juniper community is the only habitat similar.

The 10 species of birds that we found confined to the Utah Juniper habitat in Wyoming are Gray Flycatcher, Ash-throated Flycatcher, Scrub Jay, Plain Titmouse, Bushtit, Bewick's Wren, Blue-gray Gnatcatcher, Gray Vireo, Black-throated Gray Warbler and Scott's Oriole. Their distributions are shown in Figure 1. The Gray Vireo is reported in Wyoming for the first time. The Scrub Jay, Bushtit and Black-throated Gray Warbler are documented as nesting species for the first time in the state. The ranges of the remaining six species are expanded considerably from those depicted in the last treatment of the state's avifauna (Oakleaf et al. 1982).

GRAY FLYCATCHER, *Empidonax wrightii*. The Gray Flycatcher is an abundant summer resident of the Utah Juniper community in southwestern and south-central Wyoming and occupies most conditions of canopy cover wherever mature trees are found (Figure 1). The 10 nests that we observed were built 1.0 to 2.4 m above the ground close to the trunk or substantial lateral branch of a juniper. The nest information for 1982 is as follows: four nests with three young each, 25, 26 and 27 June at Firehole Canyon; five nests with three young each and one nest with four young, 28

and 29 June at Powder Rim. The nests were made of loosely entwined juniper bark strips and lined with fine grass blades, feathers and hair. In 1982 nests were most easily found during the last week of June when the adults were feeding the nestlings.

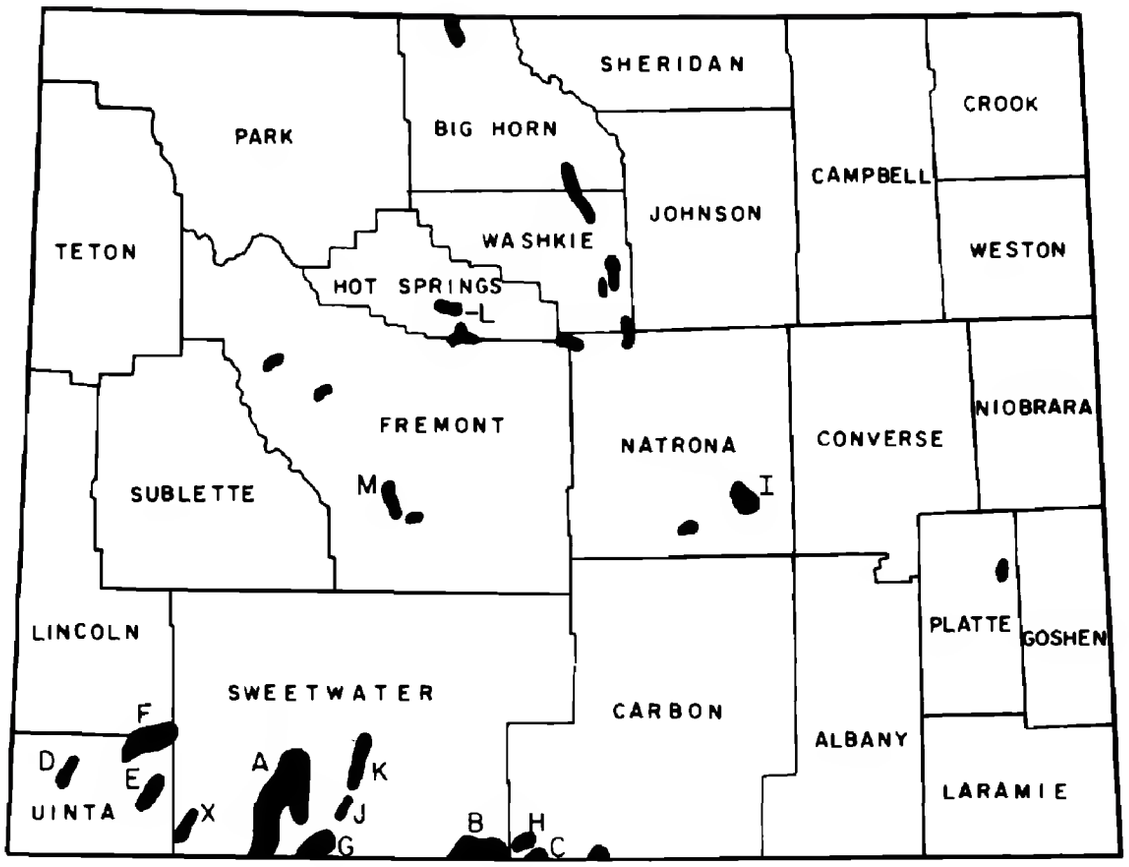
Confusion in the nomenclature led some Wyoming ornithologists to assign the wrong name to the Dusky Flycatcher (formerly *E. wrightii*, now *E. oberholseri*). Any reference to "Wright's Flycatcher" in Wyoming's literature refers to the Dusky Flycatcher, not the Gray Flycatcher.

ASH-THROATED FLYCATCHER, *Myiarchus cinerascens*. This species is an uncommon summer resident of southwestern and south-central portions of the state and is rarely seen elsewhere (Figure 1). The species is found most commonly among the old gnarled junipers growing on steep hogbacks or in low areas of severe erosion. We observed the Ash-throated Flycatcher using the tips of dead snags as perches from which to look out for flying insects. The two nests found near the Little Firehole Canyon were less than 1.8 m above the ground in the natural cavities of Utah Junipers. Two pairs of territorial adults were observed defending the above mentioned cavities, 27 June 1982.

SCRUB JAY, *Aphelocoma coerulescens*. The Scrub Jay is an uncommon permanent resident of southwestern and south-central Wyoming (Figure 1). This jay prefers dry rocky slopes or ravines covered with sparse to medium tree cover. Most foraging takes place on the ground and in Mountain Mahogany (*Cercocarpus montanus*), sagebrush (*Artemisia* spp.) and the lower branches of junipers. We usually observed the species shyly swooping and gliding among the junipers and rocks making it one of the community's more elusive species. On 30 May 1982 we found a nest containing four fledglings at Powder Rim. The nest, 1.5 m above the ground, was constructed of large juniper and sagebrush twigs and lined with grass. The breeding record for latilong 27 in the *Wyoming Avian Atlas* (Oakleaf et al. 1982) is erroneous because the observer was actually in Colorado Springs, Colorado (Holden 1872).

PLAIN TITMOUSE, *Parus inornatus*. A common permanent resident of southwestern and south-central Wyoming, the Plain Titmouse is found in most situations where mature Utah Junipers grow (Figure 1). It is restricted to stands of junipers old enough to have natural cavities or large enough to attract woodpeckers. Both types of cavity nest were found from 1.0 to 3.6 m above the ground. One nest was found in Little Firehole Canyon, 17 May 1982, with an undetermined number of young heard calling from within; and another nest, also with an unknown number of young, was found 29 May 1982 at Powder Rim. Small family groups of up to six individuals were often seen after fledging. The species forages among the thicker lateral branches of junipers, smaller deciduous shrubs and sagebrush.

BUSHTIT, *Psaltriparus minimus*. The Bushtit is an uncommon resident of southwestern and south-central Wyoming (Figure 1). It is found at the edges of juniper stands foraging in Mountain Mahogany, sagebrush and the lower branches of junipers. The species' distribution seems to be local within the Utah Juniper habitat. For example, in Little Firehole Canyon 29 km southwest of Rock Springs we found four breeding pairs, at least three of which had successfully reared young by 25 June 1982, in an area of less than 1 km^2. We did not see the species elsewhere in spite of intensive search. The nesting phenology of one of the above mentioned breeding pairs was followed. We found the nest under construction 17 May 1982, full of an undetermined number of chirping juveniles 25 June, and empty 26 July. This nest (a long pendant intricate affair of juniper scales, fine grasses, seed hulls, and flowers interwoven with spider webbing) was collected 9 October 1982 and is now in the Zoological Museum at the University of Wyoming.



Stands where Juniper dependent birds were found.

Species	A	B	C	D	E	F	G	H	I	J	K	L	M
Gray Flycatcher	*	*	✓	✓	*	✓	✓	✓					
Ash-throated Flycatcher	✓	*											
Scrub Jay	*	*			✓								
Plain Titmouse	*	*	*										
Bushtit	*	✓											
Bewick's Wren	*	*	✓	✓	✓	✓	✓	✓		✓	✓		
Blue-gray Gnatcatcher	*	*		✓					*			✓	
Gray Vireo	✓												
Black-throated Gray Warbler	*	✓	✓	✓					✓				–
Scott's Oriole	✓	*											

Utah Juniper Stands
* Nest or dependent young found
✓ Nest behavior observed
– Observed
X No data available

All unlettered stands were visited but no Juniper birds were found.

Figure 1. Bird distribution in Wyoming's Utah Juniper stands.

BEWICK'S WREN, *Thryomanes bewickii*. This wren is probably the most common juniper-dependent bird (Figure 1). During years with mild winters a few individuals may remain year-round. Bewick's Wrens are found in most conditions of juniper size and canopy cover so long as natural or excavated cavities are present. The eight cavity nests we observed were at heights varying from 15.0 cm to 9.1 m above the ground. We found five nests containing an undetermined number of young, 28 and 29 June 1982 at Powder Rim, and three nests also containing an unknown number of young, 26 and 27 June 1982 at Firehole Canyon. But adults feeding up to four fledglings were commonly observed after these dates. Although juniper is the most commonly used nest substrate in Wyoming, the first documented nest was found in a cottonwood tree (*Populus* sp.) along the Green River (White and Behle 1960). This wren forages on the ground, in shrubs, and in branchlets and foliage of junipers. Even in the heat of the day we observed the Bewick's Wren singing from the tops of juniper trees. Intruders are harassed by loud scolding until they are out of the first wren's territory and into the next where the defense begins anew.

BLUE-GRAY GNATCATCHER, *Polioptila caerulea*. This fairly common summer resident can be found nesting in several widely scattered juniper stands in the state and is currently the most widespread of the juniper-dependent species (Figure 1). It is probably most common in the extreme southwest, less so in the Casper area, and least common on the north slope of the Owl Creek Mountains. This species frequents areas where deciduous shrubs, sagebrush and junipers grow in close proximity. One nest was found near Powder Rim, 28 June 1982, containing three ready-to-fledge young. Blue-gray Gnatcatchers forage on the tips of branches of all available woody plants from ground level to the highest trees.

GRAY VIREO, *Vireo vicinior*. This is the first report of the Gray Vireo for Wyoming. We came into contact with three or four different individuals in the junipers 13 km southeast of Green River from 26 June to 27 July 1982 (Figure 1). We must consider it a rare summer resident until additional information can be gathered. More investigation may document nesting; a singing male was followed 26 June 1982 until it dropped from cover and briefly but loudly scolded us. The birds were found in areas of moderate juniper canopy cover generously interspersed with Mountain Mahogany. We observed that this species uses its gray background-matching color, slow movements and quiet disposition to remain unnoticed while being only a tree or two away from the would-be observer.

BLACK-THROATED GRAY WARBLER, *Dendroica nigrescens*. This species is a common summer resident of the Utah Juniper community. It and the Blue-gray Gnatcatcher are the only juniper-dependent species regularly found northeast of the continental divide. This warbler is most common in the Casper area, less common southwest of Rock Springs and least common at Powder Rim (Figure 1). It frequents mature stands with a relatively high degree of canopy closure. These stands are found usually in protected and gently sloping areas where moisture is more readily available to plants. In 1982 we observed four nests at Little Firehole Canyon from 1.2 to 2.4 m above the ground in junipers; three nests with four young each and one nest with one young Brown-headed Cowbird (*Molothrus ater*), 16 and 17 May. The nests were made of fine strips of juniper bark and lined with fine grass blades, feathers and hair. Foraging took place mostly in junipers and to a lesser degree in deciduous shrubs and sagebrush.

SCOTT'S ORIOLE, *Icterus parisorum*. This species appears to be a rare summer resident. Recent records for this species in Wyoming, including the first nesting record, have been summarized by Findholt and Fitton (1983). An additional record not treated in the above mentioned summary needs clarification. In 1930 Kemsies added

this species to the list of Wyoming's birds as hypothetical. The record was based on what he referred to as "a perfect description of the Scott's Oriole" which had been sent to him by Park Ranger Albert Bicknell. The ranger apparently had ample time to observe the birds since they reportedly nested near the Bechler River District Ranger Station in Yellowstone National Park. With that area's lush meadows and tall dense stands of Lodgepole Pine (*Pinus contorta*), a more atypical setting for a nesting pair of this species can hardly be imagined when compared to the habitat in which recent observations have been made.

All writers subsequent to Kemsies have either decided to ignore this record or were unaware of it. Kemsies' business documents, stored in the Cincinnati Museum of Natural History, are so unorganized that even if Bicknell's descriptive letter was retained, it would be impossible to find according to Arthur Wiseman, the museum's curator of ornithology (pers. comm. 1982). Voucher specimens are no longer needed for a species to be included on the Wyoming list of avifauna, and the hypothetical designation is reserved for species for which some question exists concerning details given in the written documentation. Since Bicknell's description cannot be obtained, we believe this record can be put to rest after 50 years of uncertainty.

Two additional species that we usually found in junipers are not necessarily juniper-dependent. The Pinyon Jay (*Gymnorhinus cyanocephalus*) is found essentially in pinyon-juniper habitat in Colorado (Bailey and Niedrach 1965), Utah (Behle 1981) and Idaho (Burleigh 1972). In Wyoming, the Pinyon Jay exhibits more flexibility in its habitat requirements; it is found wherever there are extensive juniper stands, but also in areas of Limber Pine and Ponderosa Pine. The only part of the state that lacks this bird is the northwest mountain region. In contrast, the House Finch (*Carpodacus mexicanus*) is found in a wide variety of low elevation habitats in Colorado (Bailey and Niedrach 1965), Utah (Behle 1981) and Idaho (Burleigh 1972), but in Wyoming this species is restricted to juniper stands in the southern part of the state or to habitats adjacent to human dwellings throughout the state. Because of its close association with man, in addition to its use of the juniper habitat, we do not consider it juniper-dependent.

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Accepted 2 November 1983

Scott's Oriole, Ash-throated Flycatcher, Gray Vireo, Black-throated Gray Warbler and Blue-gray Gnatcatcher.

Sketch by Keith Hansen

NOTE

FIRST RECORD OF HOODED WARBLER FOR THE SOUTHERN CALIFORNIA CHANNEL ISLANDS

BRENT S. STEWART, Hubbs-Sea World Research Institute, 1700 South Shores Road, San Diego, California 92109

The Hooded Warbler (*Wilsonia citrina*) is a rare visitor to the southern California mainland (38 records reported, mostly from the interior), primarily in spring (Garrett and Dunn 1981). To my knowledge, it has never been recorded on any of the Southern California Channel Islands despite several recent surveys of the islands' avifauna (Hunt and Hunt 1974, Jones and Diamond 1976, Diamond and Jones 1980, Hunt et al. 1980) and my own incidental observations while conducting pinniped research at San Miguel and San Nicolas islands since 1978.

On 22 May 1983 I observed a male Hooded Warbler and a male Wilson's Warbler (*W. pusilla*)foraging at the western tip of San Nicolas Island (33°15'N, 119°33'W). They foraged within 100 m of my field quarters, just below the main Western Gull (*Larus occidentalis*) rookery, from about 1700 through at least sunset (1900). The two birds foraged within 5 m of each other during this period except occasionally when one or the other flew to a new location; the birds generally reunited within 10 to 15 minutes. At 2030, the Hooded Warbler flew into the field quarters, apparently attracted by the lights. I captured and photographed the bird (Figure 1) before releasing it at 2100. Neither bird was seen again. Wilson's Warblers are common spring visitors

Figure 1. Hooded Warbler, San Nicolas Island, California, 22 May 1983.
Photo by Brent S. Stewart

to San Nicolas Island (Townsend 1968, G. McCaskie pers. comm., H.L. Jones pers. comm.). Although Hooded Warblers are rare visitors to the South Farallon Islands in northern California (DeSante and Ainley 1980), the observation reported here is apparently the first record of this species on the Southern California Channel Islands.

I thank Joseph R. Jehl, Jr., Ralph W. Schreiber, Guy McCaskie, Kimball L. Garrett, Dennis M. Power, H. Lee Jones and William T. Everett, for commenting on the manuscript.

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Accepted 17 March 1984

BIRD ART

Watercolor originals by L.B. McQueen, published in *Audubon Society Master Guide to Birding*, Chanticleer Press, New York, 1983. Sizes from 5" x 7" to 9" x 12". Prices from $200 to $500. For requests and information write L.B. McQueen, P.O. Box 3037, Eugene, Oregon 97403.

Original 14" x 21" watercolor plates by L.B. McQueen for forthcoming field guide to the birds of Peru, by Ted Parker and Dr. John P. O'Neill, are now available for sale. Prices start at $1000. For slides and information please write L.B. McQueen, P.O. Box 3037, Eugene, OR 97403.

BOOK REVIEW

Birds of Southern California's Deep Canyon. Wesley W. Weathers, 1983. University of California Press. Berkeley. 266 + x pp., 60 line drawings, 28 color plates, 33 halftones, 45 tables. $35.00.

This book is the fifth in a series of natural history volumes originating from the Philip L. Boyd Deep Canyon Desert Research Center near Palm Desert, California. On the one hand it is a work of narrow geographic scope, set along a transect from the floor of the Coachella Valley (elevation 9 m) to the highest portions of the Santa Rosa Mountains (which crest at Toro Peak, 2657 m). On the other hand, this book should enjoy wide appeal among birdwatchers and ornithologists over a vastly larger area.

One reason for such an appeal is that altitudinal transects which cover a gradient from harshly xeric desert to relatively mesic coniferous forest are repeatable over wide areas of western North America (and, indeed, elsewhere in northern Mediterranean and subtropical regions). Elevational gradients have enjoyed a special appeal among vertebrate ecologists, especially from the time of C. Hart Merriam to the present (the work of Terborgh and Weske et al. in the Andes, as just one example). Thus, Weathers' book describes patterns which are relevant far beyond Deep Canyon.

A second, and perhaps more important, reason why this book will be of wide interest is that the author employs a sophisticated yet intelligible ecological perspective throughout the work. Voluminous strip census data are interpreted for the reader vis a vis the ecology of competition, predation, and individual and community energy flux. In short, Weathers goes well beyond the basic "when" and "where" questions of standard distributional works. His attention to the "whys" (ecological/evolutionary causation) sets his work apart.

Introductory chapters discuss the physical setting of the Deep Canyon region and outline the census methodology. From 43 to 142 censuses were conducted in each of nine habitats. These censuses provide the raw data for subsequent analyses; also drawn upon was a wealth of unpublished observations in the files of the Research Center.

The bird census data are combined with data on the body mass of each species and with experimentally pre-derived formulas for daily energy expenditure to arrive at an estimate of community energy demand. Much of Weathers' analyses center around such considerations of avian energetics and inter-seasonal and inter-habitat comparisons thereof; such discussions prove to be enlightening and are never too technical for those lacking formal training in ecology.

A series of chapters discussing each habitat forms, along with the species accounts which follow, the bulk of the text. The habitats are described and the census data from each is interpreted season by season. Also included are specialized discussions of habitat modification by man and of fire succession in the chaparral.

The species accounts (128 pp.) cover all but the scarcest visitors to Deep Canyon. Additionally, all species are treated in an appendix which shows seasonal occurrence and habitat use in standard bar-chart format. Species accounts include body mass, appropriate synonyms, overall range, status in Deep Canyon, and a discussion (variable in length) of certain interesting aspects of the biology of the species. The publication schedule of the book required that the taxonomy employed be that of the fifth edition of the AOU Check-list (with supplements through 1973). By early 1984 this is already an annoying, yet unavoidable, drawback.

The reader will gain much from the potpourri of modern biological tidbits liberally spread through the species accounts. Much of this is borrowed (and duly cited) from other researchers; thus the book also serves as a welcome, if somewhat erratic, introduction to the literature of avian ecology (particularly physiological ecology).

Some of Weathers' interpretations may be open to alternative explanations, e.g. the assertion that different densities of Verdins (*Auriparus flaviceps*) and Black-tailed Gnatcatchers (*Polioptila melanura*) in the desert washes may be a result of differential predation by Loggerhead Shrikes (*Lanius ludovicianus*) on nestlings living in the

respective very different types of nest. But all such statements are exciting food for thought.

One must question the implication (p. 34) that Deep Canyon's wintering Savannah Sparrows (*Passerculus sandwichensis*) come north out of Baja California; the Colorado River delta race *rostratus* now only very rarely comes as far north as the Salton Sea (south of the study site), and breeding races of the interior such as *nevadensis* are common in winter in the Coachella Valley. Weathers' reference (pp. 96, 98) to breeding Tree Swallows (*Tachycineta bicolor*) in the coniferous forest of the Santa Rosa Mountains would seem to require confirmation. The statement (p. 153) that, among *Empidonax*, only the Western Flycatcher (*E. difficilis*) sings in migration is simply not true: Such singing is common, for example, in the Willow Flycatcher (*E. traillii*).

Whereas much of the data is apparently (hopefully) on file at the research center, many records of distributional interest are "lost" from easy access by being presented only in the format of the bar-charts in the appendix. Single records of Red-throated Loon, Western/Yellow-footed Gull, Black Tern (February), and Common Nighthawk (April) are without any more information than a month of occurrence. Rufous-crowned Sparrows (not in the index) are sparse, local residents on the desert slopes of southern California. A total of four dots from the valley floor, alluvial plain, and streamside habitats are from odd elevations and habitats. Any extralimital record of such a sedentary bird would be extremely interesting. All of the noteworthy records would have benefited from an assessment of their significance by the author and a definite date. As with the record of a migrating Bald Eagle from "March 1980," very little extra space would have been needed to present a precise, citable date. Such problems (or surprises?) are rare, and one feels confident that the data base is indeed very sound.

Also frustrating is the fact that the bar-charts do not attempt precision of greater than one month increments; surely it would not have been difficult to present more information in the bar-charts and the species accounts on arrival and departure dates and peak periods for some common migrants. It is entirely possible that the author has more experience with the arrival and departure of Gray Vireos than anyone else in California; more detail than "March" and "September" would certainly have been welcome. Still, there is much information for the student of distribution, and the lack of some detail does not change the fascinating description of the Deep Canyon transect.

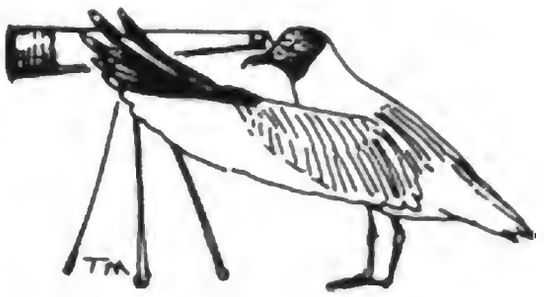
The book's charts and figures are bountiful, attractive, and informative. The graphs of density by habitat along the elevational transect (e.g. p. 124) include a visually pleasing diagrammatic sketch of the habitat gradient.

Although the uncredited line drawings of birds scattered through the text vary from acceptable to poor, the numerous black-and-white and color photographs are uniformly stunning. These photographs, by the author and his wife Debra, show a representative sample of Deep Canyon birds and go a long way toward justifying the relatively high price of the book. Many of the photographs appear to be of birds in a photographic cage set-up, but I say this only because they are so stunning and close. The photograph of a Yellow-rumped Warbler (*Dendroica coronata*, p. 199) is a "Myrtle," not an "Audubon's," as implied in the text. A number of black-and-white photographs effectively show the tremendous range in elevation and the accompanying changes in vegetation.

In summary, Wesley Weathers, The University of California Press, and the Boyd Deep Canyon Desert Research Center are to be congratulated for producing a stimulating and informative work. The price, while a bit steep, is not out of line with current books containing superbly reproduced color photographs. I recommend it.

KIMBALL GARRETT, Section of Ornithology, L.A. County Natural History Museum, 900 Exposition Blvd., Los Angeles, CA 90007

IDENTIFICATION QUIZ



Those of us with more than just a little knowledge of North American birdlife will unhesitatingly identify this issue's quiz bird, at least generically, as a vireo. A small songbird with a uniformly deep, non-conical bill leaves no other choice except, perhaps, Northern Beardless Tyrannulet (*Camptostoma imberbe*). A tyrannulet, however, would have a smaller, daintier bill than the bird shown here.

Let me add at this point (in an attempt to further confuse the issues) that although this is a black and white print, the color original reveals little more. In life, this bird was white below and gray above with scarcely a trace of green or yellow.

The first step in keying out North American vireos is noting the presence or absence of wingbars. Because the bird shown here clearly has them, Red-eyed (*Vireo olivaceus*), Black-whiskered (*V. altiloquus*), Philadelphia (*V. philadelphicus*) and Warbling (V. gilvus, which otherwise would be a definite contender) may be eliminated. White-eyed (*V. griseus*), Black-capped (*V. atricapillus*), Yellow-throated (*V. flavifrons*), and Solitary (*V. solitarius*) vireos may be rejected because of bright yellows and greens in the plumage (a bit hard to see in a black and white photo, eh?) and/or the presence of bold, sharply defined spectacles. Hutton's Vireo (*V. huttoni*) may be excused because it has a stubbier bill, is never clear white below and does not appear "cresty." This leaves only Bell's (*V. bellii*) and Gray (*V. vicinior*) vireos as finalists.

Although Gray Vireo fits the basic pattern shown here, it does not show two distinct wingbars and would always show a round, discreet white eyering on a medium gray face. This leaves as the correct answer Bell's Vireo, subspecifically one of the southwestern races, *pusillus* or *arizonae* (the probable race of the bird shown here).

The older field guides generally neglected western races of Bell's Vireo, which are longer-tailed and less brightly-colored than eastern races. The new wave of bird guides has helped solve this problem in part, two of them actually showing western birds. A western type is fairly well done on page 351 of the National Geographic Society's *Field Guide to the Birds of North America* (Washington, D.C., 1983), although the line through the eye is not strong enough and the white superciliary should wisp out behind the eye, not curl down behind it. Also, the anterior wingbar should be more distinct, as is evident in the photo shown here.

The Audubon Society Master Guide to Birding, Part 3 (Alfred A. Knopf, New York, 1983) contains a photo of *V.b. pusillus* showing the white eyering broken by a dusky transocular line and pale but indistinctly margined lores that definitely do not qualify as spectacles. The Master Guide photo also shows the distinctly crested look typical of Bell's Vireo. Gray Vireos typically look sleek and round-crowned, but can occasionally look a bit "cresty," as when scolding intruders near a nest.

The poorest representation of Bell's Vireo in any of the major North American guides is that by Arthur Singer in Robbins et al. (*A Guide to Field Identification—Birds of North America*, Golden Press, New York, 1983). The coloration and shape are acceptable for eastern races, but the facial markings and cheek-throat contrast are unrealistic. Any attempt to use the illustrations in this guide to identify a Bell's Vireo in the southwestern U.S. would probably result in misidentification as a Gray Vireo. Additionally, pre-1983 editions of this book erroneously state that Gray is "the only vireo that nervously twitches its tail." Bell's Vireos are easily as twitchy-tailed as Grays. The revised 1983 edition makes brief reference to gray and white races of Bell's Vireo, but only alludes to tail-twitching by Bell's in the text for Gray Vireo.

The bird shown here was photographed in San Blas, Nayarit, Mexico, in December 1975 by Bruce Webb.

RICHARD STALLCUP, Box 533, Inverness, California 94937

Volume 15, Number 2, 1984

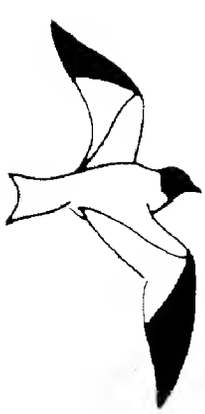
Cover Photo by Roger D. Harris: Northern Hawk-Owl (*Surnia ulula*) 17 June 1982, Cantwell, Yukon-Kuskokwim Co., Alaska

Manuscripts should be sent to Alan M. Craig, P.O. Box 254, Lakeview, CA 92353. For matters of style consult *Suggestions to Contributors to Western Birds* (6 pp. mimeo available at no cost from the Editor) and *Council of Biology Editors Style Manual* 4th edition, 1978 (available from the American Institute of Biological Sciences, 1401 Wilson Boulevard, Arlington, VA 22209 for $12.00).

Papers are desired that are based upon field studies of birds, that are both understandable and useful to amateurs, and that make a significant contribution to scientific literature. Appropriate topics include distribution, migration, status, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, the techniques for identifying, 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 papers dealing with studies accomplished in or bearing on Rocky Mountain states and provinces westward, including Alaska and Hawaii, adjacent portions of the Pacific Ocean and Mexico, and western Texas.

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. 15, No. 3, 1984

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Published November 26, 1984

WESTERN BIRDS

Volume 15, Number 3, 1984

ANNOTATED CHECKLIST OF BIRDS OF HALEAKALA NATIONAL PARK, MAUI, HAWAII

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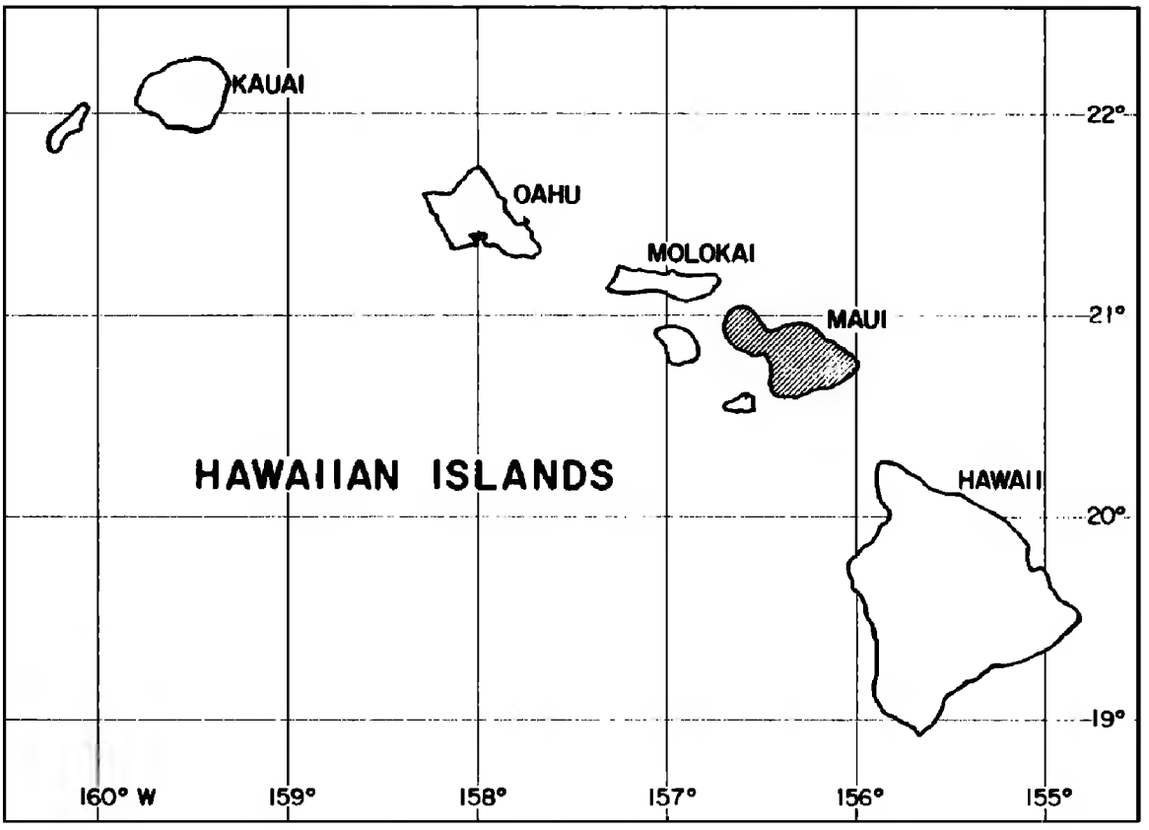
Haleakala National Park (Figure 1), especially its Crater District (Figure 2), is one of the natural areas in Hawaii most frequently visited by backpackers, day hikers and motorists. The Kipahulu District (Figure 3) of the park, a formally designated Wilderness Area, is not open to public access because it contains sensitive ecosystems with rare plants and animals. The park is Maui's largest nature reserve, and one of the largest such areas in the state. It contains many examples of endangered or rare plants, animals and ecosystems. The avifauna of the entire park, which consists of these two districts, is the subject of this paper.

No recent studies have focused intensively on the distribution and abundance of birds in Haleakala National Park. Dunmire (1961) listed and described the bird species present in Haleakala and Hawaii Volcanoes national parks, but gave little detailed information on distribution and abundance. The unpublished report (Warner 1967) of an expedition to Kipahulu Valley (now partly included in the Kipahulu District of Haleakala National Park) described the rediscovery of two endemic species of Hawaiian forest birds, but no other avifaunal surveys of Kipahulu took place until we began the work described here. Since our work was completed, the U.S. Fish and Wildlife Service has also completed its surveys of forest birds on the island of Maui (Scott et al. ms.), but their coverage of the park was less comprehensive than ours, and they were unable to survey areas repeatedly or at different seasons of the year. In 1975 the Cooperative National Parks Resources Studies Unit (CPSU) funded researchers at the University of Hawaii to conduct inventories of the biota in Hawaii's two national parks. The results of the avifaunal surveys of the Crater and Kipahulu districts of Haleakala National Park provided the basis for this checklist.



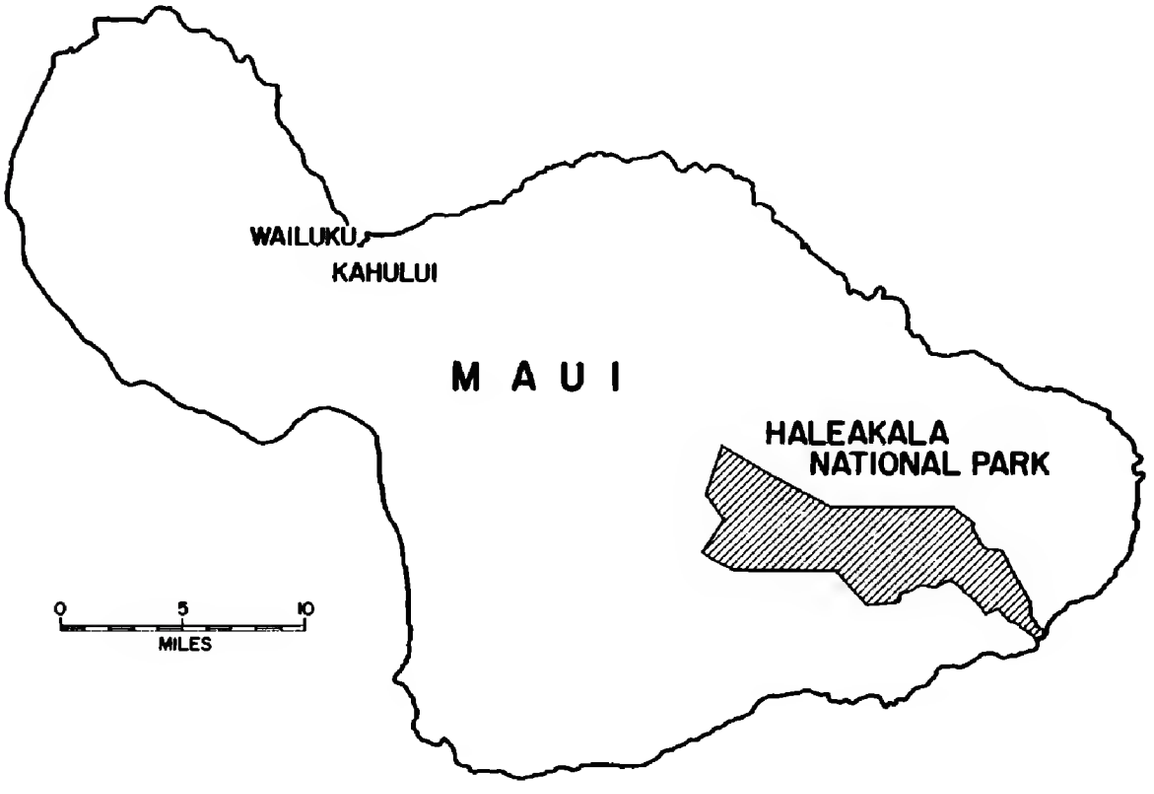


Figure 1. Location of the main Hawaiian Islands, the island of Maui, and Haleakala National Park.

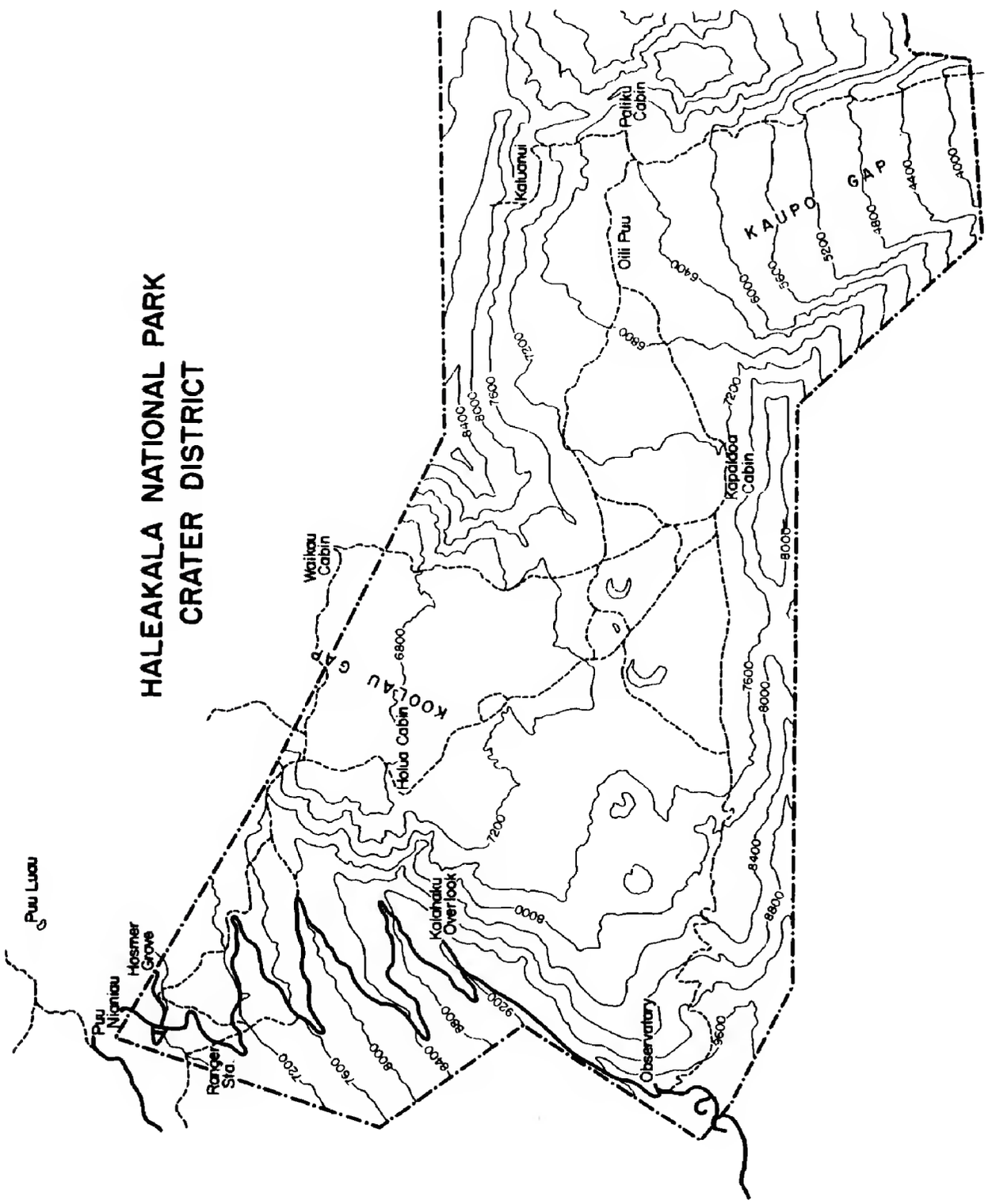


Figure 2. Crater District of Haleakala National Park, with elevation contours (in feet), trails, roads and place names.

METHODS

The checklist is based primarily on field work conducted in Haleakala National Park (Figure 1) from 1976 to 1980. During that period of time we spent 184 days in the field: 79 days in the Crater District and 105 days in the Kipahulu District. We have included the time spent by several biologists who assisted us in our surveys (see Acknowledgments). We also included information from the published literature, as cited in the text.

Nomenclature follows the AOU Checklist (AOU 1983), except as noted. Some Hawaiian names for species follow Pyle (1983). The biogeographic status (i.e., endemic, indigenous, exotic) is given for each species, and was determined from the literature. In this paper an endemic species or subspecies is one whose natural (i.e., deliberate or accidental human influence not involved) distribution is limited to the Hawaiian Archipelago or to a single island or group of islands in the archipelago. An indigenous species is

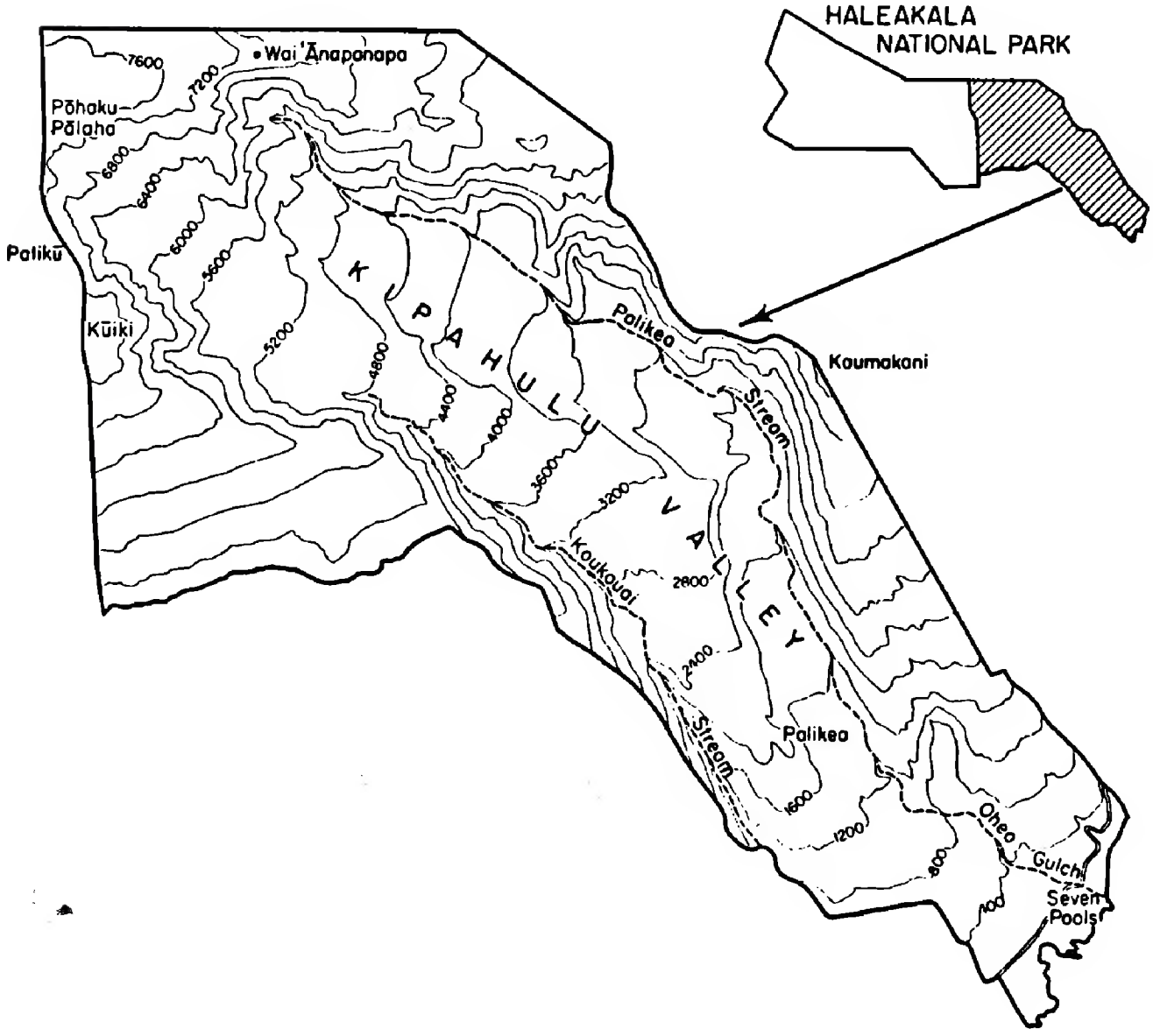


Figure 3. Kipahulu District of Haleakala National Park, with elevation contours (in feet) and place names.

one whose natural distribution includes Hawaii and elsewhere in the world. An exotic species is one that has been deliberately or accidentally introduced to the Hawaiian Archipelago by human actions. Figures 2 and 3 show details of the two districts, including the place names used throughout the text.

We identified five habitat types in the Crater District by using Whiteaker's (1983) vegetation map for the area. Whiteaker identified 53 plant community types, but we combined these into five habitat types that were adequate for describing bird distributions. Figure 4 shows the distribution of the five vegetation types we will be using in this paper. Because no similar map of vegetation types for the Kipahulu District has been produced, our discussion of bird distribution in that district is more general.

For detailed discussions of avian distribution and abundance, the reader is referred to two additional reports. The first of these contains detailed distribution and abundance maps for the bird species found in the Crater District (Conant and Stemmermann 1979). The second is a brief report on the birds of the Kipahulu District, with maps of endangered species' distributions (Conant and Stemmermann 1980). These reports may be obtained from the authors.

ANNOTATED CHECKLIST

Family Procellariidae — Shearwaters and Petrels

DARK-RUMPED PETREL *Pterodroma phaeopygia* (Hawaiian Petrel, Uau)

Endangered species; Hawaiian subspecies, *P. p. sandwichensis*, endemic. Recent studies by Simons (1983) indicate that nesting burrows within the park are found on the west rim from Red Hill to above Holua Cabin, on the eastern part of the south rim, and near the summit of Hanakauhi. Although Simons also found nesting colonies outside the park itself, most of the breeding population of this endangered bird is within the Crater District. Our observations include sightings on the south rim above Kapalaoa Cabin, although a one-night search during the breeding season revealed no burrows. We heard this bird at Puu Mamane about one hour after sunset in June 1976 and June 1977. G. Teves (pers. comm.) heard this species at Paliku 2-3 hours after sunset in June, July and August 1977. Simons estimated the total breeding population of this species on East Maui to be 575 pairs.

Family Phaethontidae — Tropicbirds

WHITE-TAILED TROPICBIRD, *Phaethon lepturus* (Koa e kea)

Indigenous. Breeds on Maui (Berger 1982:50), but no nests reported from Haleakala National Park. One to four birds observed frequently in Kaupo Gap, especially west wall, during this study. Birds landed on cliff face of west Kaupo Gap on two different occasions (June 1976, January 1977). In July 1977 three birds were observed at Paliku and one near Namana o ke Akua. Infrequently observed near waterfalls in Kipahulu Valley (T. Lind pers. comm.).

Family Fregatidae — Frigatebirds

GREAT FRIGATEBIRD, *Fregata minor* (Iwa)

Indigenous. Individuals observed flying over lower parts of Kipahulu Valley or just offshore of the mouth of the valley.

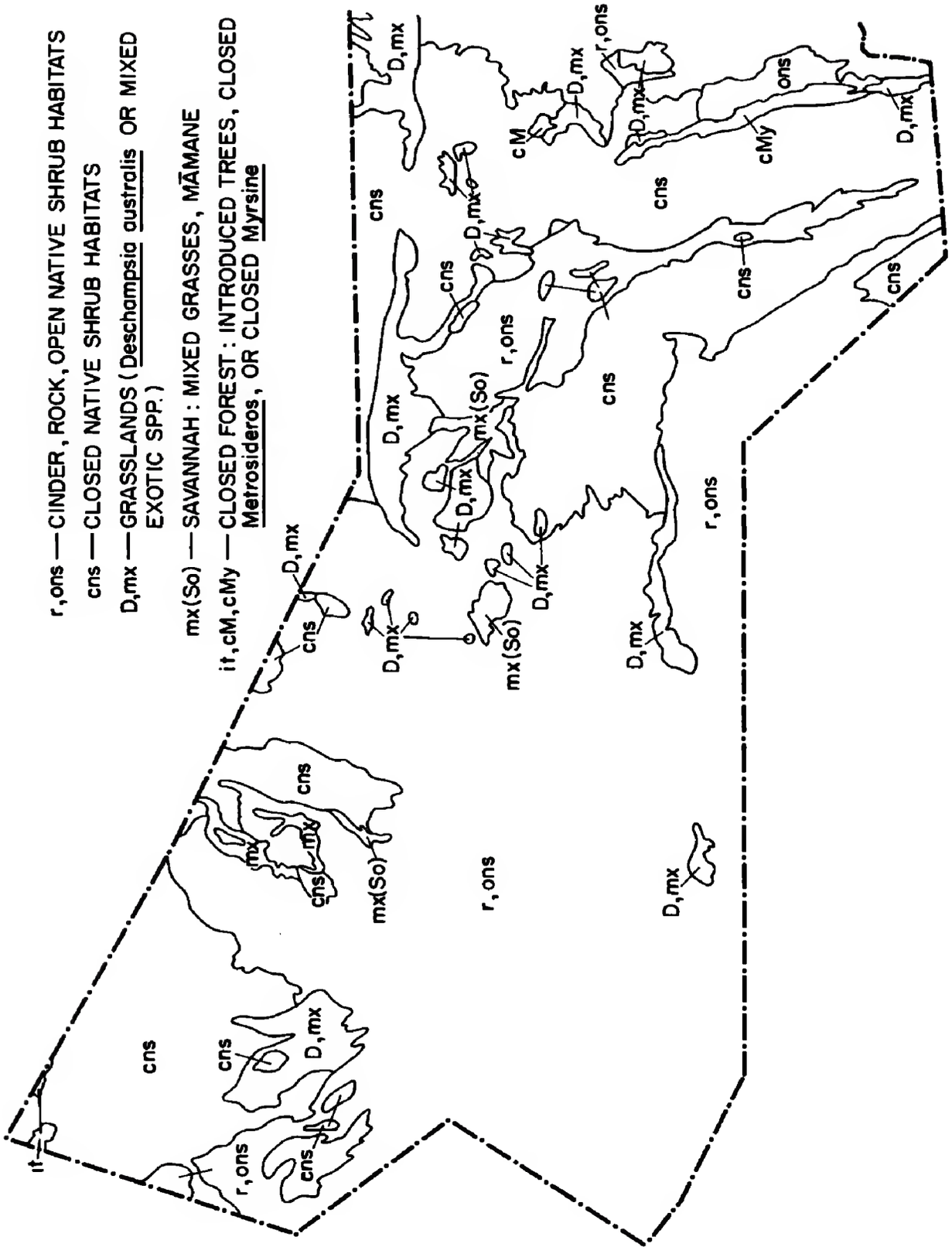


Figure 4. Distribution of five major vegetation types in the Crater District of Haleakala National Park (modified from Whiteaker 1983).

Family Anatidae — Ducks and Geese

HAWAIIAN GOOSE, *Nesochen sandvicensis* (Nene)
Endemic; endangered. May be seen flying throughout the areas of open vegetation in the park (i.e., all but closed forest). Particularly common in eastern half of Crater, especially the Paliku area. Frequently observed in alpine grasslands on Kalapawili Ridge and Kuiki. Total population estimated at 80-100 birds in the Crater District.

Family Phasianidae — Quails, Pheasants and Francolins

GRAY FRANCOLIN, *Francolinus pondicerianus*
Exotic. Rare in Crater District although probably expanding its range into the xeric shrublands from the Kaupo Gap area. Observed in west Kaupo Gap twice during this study: once at about 1520 m elevation (C.W. Smith pers. comm.), and later at 1770 m (J.I. Kjargaard pers. comm.). Frequently observed on Kaupo Ranch (ranch hand pers. comm.).

CHUKAR, *Alectoris chukar*
Exotic. Frequently observed and widely distributed throughout closed native shrub habitats, grasslands and savannah. Particularly abundant in the closed native shrub on the northwest border of the Crater District (Kalapawili Ridge).

RING-NECKED PHEASANT, *Phasianus colchicus*
Exotic. Widely dispersed in all open vegetated areas in the Park and at edges of forested regions.

Family Charadriidae — Plovers

LESSER GOLDEN-PLOVER, *Pluvialis fulva*. (Kolea)
Regular migrant. Nomenclature follows Connors (1983). Widely distributed in shrublands and grasslands of the Park, including alpine grasslands and boggy areas. Present August through April; some birds may oversummer.

Family Scolopacidae — Sandpipers

WANDERING TATTLER, *Heteroscelus incanus* (Ulili)
Regular migrant. Observed in streams in Kipahulu Valley, usually near stream mouth, but once as high as 800 m.

Family Columbidae — Doves and Pigeons

ROCK DOVE, *Columba livia* (Pigeon)
Exotic. Five birds observed roosting in a lava tube near Holua Cabin (F.G. Howarth pers. comm.).

SPOTTED DOVE, *Streptopelia chinensis* (Chinese Dove, Lace-necked Dove)
Exotic. Observed in lowlands of Kipahulu Valley, especially wet exotic forest.

ZEBRA DOVE, *Geopelia striata* (Barred Dove)
Exotic. Like the Spotted Dove, observed in lowlands of Kipahulu Valley. This species is more often observed in open fields and along roadsides than in the wet exotic forests.

Family Tytonidae — Barn-Owls

COMMON BARN-OWL, *Tyto alba*
Exotic. Uncommon in shrublands and grasslands (including alpine grasslands on Kalapawili Ridge and Kuiki). Most frequently observed near southeast end of Crater District and near Hosmer Grove.

Family Strigidae — Typical Owls

SHORT-EARED OWL, *Asio flammeus* (Pueo, Hawaiian Owl)
Hawaiian subspecies, *A.f. sandwichensis*, endemic. Uncommon in shrublands and grasslands, at forest edges and in forests, especially in the eastern part of the Crater District, along Halemauu Trail and Hosmer Grove. Also observed in alpine grassland on Kalapawili Ridge and Kuiki during this study.

Family Alaudidae — Larks

EURASIAN SKYLARK, *Alauda arvensis*
Exotic. Found throughout grasslands and open shrublands, including alpine regions, in the park. Less common within Crater itself than on the northwest slope (Kalapawili Ridge).

Family Muscicapidae — Thrushes, Babblers, etc.

MELODIOUS LAUGHING-THRUSH, *Garrulax canorus* (Hwa-mei, Chinese Thrush)
Exotic. Uncommon; several birds observed on Kaupo Trail at about 1200 m during this study; reported from Halemauu Trail head by Smith (1975). Common below 1000 m in Kipahulu Valley, rare in the upper portions.

RED-BILLED LEIOTHRIX, *Leiothrix lutea* (Leiothrix, Pekin Hill Robin, Japanese Hill Robin)
Exotic. Seasonally abundant (i.e., present in June 1976 and March 1977, absent January 1977) in Paliku area. Also observed in and adjacent to Hosmer Grove in this study. Reported from Halemauu Trail head, Hosmer Grove and east of Puu Nianiau by Smith (1975). Probably present though not common in most wet forests. Relatively common throughout Kipahulu Valley.

Family Mimidae — Mockingbirds

NORTHERN MOCKINGBIRD, *Mimus polyglottos*
Exotic. Occurs in dry forest, grasslands and shrublands, including cliff faces, throughout Crater District. Reported from Halemauu Trail head, Hosmer Grove, Puu Nianiau by Smith (1975).

Family Sturnidae — Mynas and Starlings

COMMON MYNA, *Acridotheres tristis*
Exotic. A few birds present at occupied buildings in the Park outside the Crater itself (e.g., Park Headquarters), Hosmer Grove and Halemauu Trail head. Relatively common in cattle pastures and campgrounds of lower Kipahulu District.

Family Zosteropidae — White-eyes

JAPANESE WHITE-EYE, *Zosterops japonicus* (Mejiro)
Exotic. Common (in sparsely vegetated areas) to abundant (in forested areas) throughout most of the Park, absent from grasslands and aeolian habitats (e.g., cinder and rock at Puu o Pele). Probably the most abundant bird in the Park.

Family Emberizidae — Cardinals, Blackbirds, etc.

NORTHERN CARDINAL, *Cardinalis cardinalis*
Exotic. Uncommon; observed in Kaupo Gap during July 1977. Also reported from Hosmer Grove and Puu Nianiau by Smith (1975). Somewhat more common below about 1000 m in Kipahulu District.

Family Fringillidae — Finches, Hawaiian Honeycreepers

Subfamily Fringillinae — Fringilline Finches

HOUSE FINCH, *Carpodacus mexicanus* (Linnet, Papayabird)
Exotic. Common to abundant throughout the Crater District except in wet forests. By far the most abundant bird in shrublands, grasslands and dry forests in the Crater. Occasionally observed in very large flocks (500 or more birds). Uncommon in lower Kipahulu Valley.

Subfamily Drepanidinae — Hawaiian Honeycreepers

MAUI PARROTBILL, *Pseudonestor xanthophrys*
Endemic. Observed at Lake Waianapanapa, in Kipahulu Valley at about 1700 m, and on Kuiki at about 2040 m. Other recent sightings have been made in the Koolau Forest Reserve just outside park boundaries (Conant 1981, Carothers et al. 1983, Scott et al. ms.).

COMMON AMAKIHI, *Hemignathus virens*
Endemic species; *H.v. wilsoni* (Maui Amakihi) endemic to Maui, Molokai and Lanai. Uncommon in shrublands on northwest slope (i.e., from Park Headquarters to Puu Nianiau, including Hosmer Grove).

NUKUPUU, *Hemignathus lucidus*
Endemic; *H.l. affinis* (Maui Nukupuu) endemic to Maui. Two sightings in Kipahulu Valley: one (by Conant) at 1460 m in August of 1978, one (by M.S. Kjargaard) at 1470 m in March 1979. These and other sightings reported by Conant (1981).

AKEPA, *Loxops coccineus*
Endemic; *L.c. ochraceus* (Maui Akepa) endemic to Maui. Recent sightings outside of Haleakala National Park were reported by Scott and Sincock (1977). We saw one bird at about 1900 m in Kipahulu Valley in August 1979.

MAUI CREEPER, *Paroreomyza montana* (Alauwahio)
Endemic to Maui Island. Uncommon but widespread in wet forests of the Park, including Paliku region and Hosmer Grove. Somewhat more common above 1000 m to tree line in Kipahulu District.

CRESTED HONEYCREEPER, *Palmeria dolei* (Akohekohe)
Endemic to Maui and Molokai. Molokai population extirpated since late 1800s. Found in Kipahulu District and the Kuiki region of the Crater District from tree line to as low as 1100 m in Kipahulu Valley, but usually above 1680 m in the winter months.

APAPANE, *Himatione sanguinea*
Endemic; *H.s. sanguinea* endemic to main Hawaiian Islands. Present in shrublands and dry forests; abundant in wet forest. Probably the most abundant native bird in the park.

IIWI, *Vestiaria coccinea*
Endemic. Uncommon in wet forests. Observed at Hosmer Grove, Paliku, Kuiki, Kaluanui and Kalapawili Ridge in the Crater District, and throughout the upper portions (above 1000 m) of Kipahulu Valley.

Family Estrildidae — Waxbills and Mannikins

NUTMEG MANNIKIN, *Lonchura punctulata* (Spotted Munia, Ricebird)
Exotic. Uncommon; observed in July 1977 at Paliku and in Kaupo Gap. Also reported from Hosmer Grove and Puu Nianiau (Smith 1975). Common but not abundant in cattle pastures in lower (below 500 m) part of Kipahulu Valley.

WARBLING SILVERBILL, *Lonchura malabarica*

Exotic. Observed in lower Kipahulu Valley in 1978 (Conant 1983). No observations made during this study.

STRUCTURE AND ECOLOGY OF THE AVIFAUNA

Native Birds

During our surveys we found 11 (34%) endemic (including endemic subspecies), 4 (13%) indigenous, and 17 (53%) exotic birds in Haleakala National Park. In the Crater District there were 7 endemic, 2 indigenous and 13 exotic species, whereas the Kipahulu District had 9 endemic, 4 indigenous and 13 exotic species. Table 1 lists the species and their presence or absence in the two districts. Kipahulu District, with its extensive, nearly undisturbed rain forests, is clearly a more important area for the endangered and rare forest birds, whereas the Crater District is an important area for Dark-rumped Petrel and Nene.

Since the arrival of Europeans, three endemic Hawaiian birds formerly found on Maui have apparently been extirpated (Hawaii Audubon Society 1981). The Ou (*Psittirostra psittacea*) is likely to have been found in Haleakala National Park. Dramatic changes in vegetation within the Crater District caused by feral pigs (*Sus scrofa*) and especially feral goats (*Capra hircus*) have probably been responsible for eliminating suitable habitat for several forest birds from the Crater District (e.g., Akepa, Nukupuu, Maui Parrotbill and Crested Honeycreeper). Although these birds may still be

Table 1. Birds found in Haleakala National Park, Crater and Kipahulu districts, 1976-1980 (* = endangered, C = Crater District, K = Kipahulu District).

EXOTIC (17; 53%)	ENDEMIC[1] (11; 34%)	INDIGENOUS (4; 13%)
Chukar C, K	*Dark-rumped Petrel C	White-tailed Tropicbird C, K
Gray Francolin C	*Nene C, K	Great Frigatebird K
Common Barn-Owl C, K	Short-eared Owl C, K	Lesser Golden-Plover C, K
Rock Dove C	*Maui Parrotbill K	Wandering Tattler K
Spotted Dove K	Common Amakihi C, K	
Barred Dove K	*Nukupuu K	
Eurasian Skylark C, K	*Akepa K	
Melodious Laughing-thrush C, K	Maui Creeper C, K	
Red-billed Leiothrix C, K	*Crested Honeycreeper C,K	
Northern Mockingbird C	Apapane C, K	
Japanese White-eye C, K	Iiwi, C, K	
Common Myna C, K		
House Finch C, K		
Northern Cardinal C, K		
Nutmeg Mannikin C, K		
Warbling Silverbill K		

TOTALS: 17 families, 32 species, 15 native species

[1]Includes endemic subspecies

found within the Kipahulu District, they cannot be seen in the areas where interested hikers are usually permitted to go. Native passerines in the Kipahulu District occur from tree line (usually about 2000 m) to as low as 500 m in Kipahulu Valley. The low elevation limit is considerably below the 850 m lower limit noted by the Kipahulu Valley Expedition (Warner 1967). It may be that this apparent range increase represents a seasonal difference which was not apparent in 1967.

Of the four common native passerines in the Kipahulu District, two, the Apapane and the Amakihi, are found in virtually all forested areas above approximately 500 m. The Iiwi and the Hawaiian Creeper were not found below about 1000 m. The Crested Honeycreeper was somewhat more limited in its distribution (see discussion below), and the remaining native passerines were very rare. Detailed descriptions including maps of other sightings of the rare species were reported by Conant (1981).

The Crater District provides relatively little suitable habitat for native forest passerines. Wet forest near Hosmer Grove and the Paliku Cabin area have the heaviest concentrations of these birds. However, habitat for nonpasserine native species, especially the endangered Dark-rumped Petrel and Nene, is considerable in extent.

Seasonal Variation

Seasonal variation was observed in some species. Two species are absent during their non-breeding months, the Dark-rumped Petrel from November to February, and the Lesser Golden-Plover from late April to early August, although some first-year plovers may oversummer. Chukar chicks are common during late spring and summer, whereas the more secretive Ring-necked Pheasant and its offspring are less obvious during breeding months, January through July. Only two introduced passerines show much seasonal variation. House Finches are more obvious in spring and summer because they travel in large flocks (500 birds) during this time. Perhaps this behavior is related to the fruiting times of grasses, important food sources for this species. The second such species, Red-billed Leiothrix, is much more abundant in the Paliku area in late spring and early summer, undoubtedly in response to fruiting of Akala (*Rubus macraei*) shrubs and exotic plum trees (*Prunus cerasifera*).

Among the endemic forest birds, the Crested Honeycreeper showed an interesting seasonal variation in its distribution pattern. The upper elevation limits of this bird occur at the upper tree line, about 2070 m. In spring months, Crested Honeycreepers are found down to about 1680 m. In the summer, however, they may be found at lower elevations: sightings which occurred in August included several at 1430 m and one as low as 1100 m in Kipahulu Valley. At all times of the year, this species is decidedly more common above 1680 m, and at times seems to be particularly common in a band from the tree line to about 150 m lower elevation.

While nearly half the species in the Kipahulu District are exotic, only two (the Japanese White-eye and the Red-billed Leiothrix) are common throughout the region. The remaining exotics are most abundant either in the alpine grasslands or below about 1000 m in Kipahulu Valley, especially in cattle pastures at the bottom of the valley.

Impacts of Exotic Birds

Long-established introduced species form the the largest contingent of the Crater District avifauna, in terms of both species composition and abundance. Changes in the structure and plant species composition of the various communities in the Crater District have undoubtedly facilitated the successful establishment of many of the exotic birds. Granivorous birds (Eurasian Skylark, Nutmeg Mannikin, Northern Cardinal, House Finch) and frugivorous or browsing birds (Red-billed Leiothrix, Chukar, Ring-necked Pheasant) are successful in dry forest or savannah communities. Some species appear to be using resources not used by native forms on Maui (e.g., seeds), whereas others may compete with native species.

A few of the exotic species are rare (e.g., Gray Francolin, Melodious Laughing-thrush, Common Barn-Owl) and, at present, may have minimal impact on native forms, unless they are important as reservoirs of disease. However, several species (e.g., Chukar, Ring-necked Pheasant, Common Barn-Owl, Melodious Laughing-thrush, Northern Cardinal, Nutmeg Mannikin) may continue to expand their ranges, changing the situation.

Very little is known of the impact of the exotic bird species on native ecosystems, particularly the avifauna. The possibility of competition exists among at least three groups of native and exotic birds. Ground-nesting herbivores, the Chukar and the Ring-necked Pheasant, may exploit some of the same resources as the Nene. The Common Barn-Owl and the Short-eared Owl undoubtedly prey on some of the same mammal and bird species and may compete for food. Two common passerines, the Japanese White-eye and the Red-billed Leiothrix, and possibly the Melodious Laughing-thrush, may impact native forest bird populations via competition for food or as disease reservoirs.

Given continued impact of exotic biota, avifaunal structure and interspecies relationships will remain in a state of flux. Reduction of exotic species is desirable for the welfare of native birds, but impractical for many species. Native avifauna stands the best chance of survival if pristine, relatively intact native ecological communities are restored.

ENDANGERED SPECIES MANAGEMENT

Simons (1983) has provided an excellent discussion of the various factors that must be considered in managing the habitat of the Dark-rumped Petrel. Major problems include predation and alteration of habitat by exotic organisms such as feral goats and various game birds. Predators—both natural (e.g., Short-eared Owl) and exotic (e.g., cats, mongoose) — appear to be an important problem for the species. However, it is not clear how these problems can best be solved. Certainly if resources are available an active predator control program within the important nesting areas should be a high priority.

The Nene, which apparently disappeared from Maui in the early 1900s (Berger 1982), is being reintroduced to Haleakala via the release of captive-raised birds. However, our census data do not indicate that these birds have established successfully self-maintaining populations. This conclusion is based on the fact that over 460 captive-raised birds have been released since

1962, and our estimates indicate that the present population is less than 100 birds total. Similarly, recent research (Banko and Manuwal 1982) on the status, distribution and life history of this species indicates that the species will be able to establish self-maintaining populations only if appropriate management programs are implemented. Their results indicate that the primary aim of management should be to reduce predation by the introduced small Indian Mongoose (*Herpestes auropunctatus*). Reduction of populations of exotic game birds which may compete with the Nene for food and reduction of negative impact to ecosystems by feral ungulates are two other priorities discussed by Banko and Manuwal (1982). Careful and continuous monitoring of Nene populations will be essential to allow managers to keep abreast of the status of this bird. Clearly this is a species which has not been saved from extinction yet, and one for which intensive management will be required for some time, perhaps on a permanent basis.

While direct management (e.g., predator and feral mammal control) for endangered species should have a high priority, management of ecosystems to enhance habitat quality for native birds in general is also of great importance. We suggest that management efforts be concentrated on the elimination of feral ungulates and exotic plants. Another important priority for National Park Service management programs is their continued support and encouragement of basic research on the biology of native bird species, particularly endangered species, with emphasis on habitat requirements and factors affecting breeding success. Since we began this research there have been two excellent intensive studies of endangered species that have begun to meet management planners' needs, Simons (1983) on the Dark-rumped Petrel and Banko and Manuwal (1982) on the Nene. Research is also needed on the more successful exotic species, with the objectives of determining their effects on other ecosystem components. For example, Jacobi (1980) suggested that exotic game birds may have negative impacts on vegetation.

SUMMARY

During field surveys of Haleakala National Park, we recorded 32 species in 17 families. Eleven species are endemic, and contain subspecies endemic to Maui Nui (i.e., Maui, Molokai and Lanai). Of four indigenous species present, two contain subspecies endemic to the Hawaiian archipelago. Among the 11 endemic species and subspecies, 6 (Nene, Dark-Rumped Petrel, Maui Parrotbill, Nukupuu, Akepa and Crested Honeycreeper) are on the Federal list of endangered species. Seventeen introduced species were observed in the park. Two of these, the Japanese White-eye and the House Finch, were widespread and abundant, but their impact on native bird populations is unknown. Ecological relationships of the avifauna and management programs for the endangered species are discussed.

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THE BIRDS OF SAN CLEMENTE ISLAND

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Presented here is the first compilation of published and unpublished information on the birds of San Clemente Island since Howell's 1917 account of the birds of the California Channel Islands. The absence of any published synthesis of records since that time clearly invites this update. The majority of observations have been made over the past 10 years by numerous researchers who visited the Island.

The classic reasons for listing island bird faunas have been amply explained by Jehl (1977) and DeSante and Ainley (1980). But, San Clemente Island presents a special case because the status of many bird species is expected to change rapidly as feral animals are removed. The Navy's current attempts to remove all goats, pigs, cats and deer, if successful, will assuredly bring about drastic changes to the Island by reversing more than a century long trend of habitat devastation. The information presented here will be helpful in measuring the changes in the avifaunal and ecological conditions of the Island. We only wish there were more data on conditions prior to the arrival of exotic animals.

ISLAND DESCRIPTION

San Clemente Island (SCI) is the southernmost of the California Channel Islands, its center lying at about 32°50'N latitude, 118°30'W longitude (Figure 1). It is 103 km west-northwest of San Diego and 80 km south-southwest of San Pedro, the nearest mainland point. Santa Catalina Island, the closest land, is 34 km to the north.

San Clemente Island is 34 km long, ranging from 2.4 km wide near the north end, to 6.4 km wide near the south end; its long axis runs approximately northwest. The total land area of the Island is approximately 150 km^2 and its high point, called Mount Thirst, reaches 599 m and lies near the center of the Island. For convenience the steep northeast side of the Island is herein referred to as the "east" side and the gentler sloping southwest side as the "west" side.

Most of the San Clemente Island coastline is rugged and precipitous, especially on the east side and at Seal Cove on the west side. Sandy beaches are few, the largest occurring at the southern end of the Island at China Cove, Horse Beach Cove, and Pyramid Cove. Two large offshore rocks at the northern end of the Island are also of significance to birds. Other smaller rock islets are located along the western shore of the Island particularly between Eel Point and Lost Point.

Geologically, San Clemente Island is described as the upper part of a tilted and gently arched block with a steep east slope and a more gentle west slope (Olmstead 1958). It is principally composed of volcanic rocks of Miocene

age. The 20 distinct wavecut terraces on the west side extend up to a level of 450 m. The Island is everywhere dissected by deep, geologically young canyons, those on the east side dropping precipitously over 500 m to the sea. Apparently, the Island has never been connected to the mainland.

San Clemente Island has a distinct maritime climate with cool summers and mild winters. Based on weather records since the 1940s, the mean annual temperature is 16° C, with mean summer temperatures of 18° C, and mean winter temperatures of 14° C. The average daily temperature range is approximately 5° C. Freezing temperatures are very rare. Occasionally, when Santa Ana conditions prevail in August through October, temperatures exceeding 38° C have been recorded. Gale force winds are frequent in the higher regions of the Island, whereas at the northern airfield, the average wind speed for all months is under 10 knots. The predominant wind direction is from the west with short periods of northerly to easterly winds associated with Santa Ana conditions. Annual precipitation ranges between 13 and 20 cm. The wettest months are November through March and the driest months from June through September.

CURRENT VEGETATION

Vegetation and floral accounts of San Clemente Island and other California Channel Islands have been reviewed and discussed in several publications (Dunkle 1950, Raven 1963, Axelrod 1967, Philbrick 1967, Thorne 1969, Philbrick and Haller 1977, Ferguson 1979, Brumbaugh 1980, Power 1980, Sward and Cohen 1980). All authors mention the substantial deleterious effects that feral animals, particularly sheep or goats, have had on the distribution, abundance, and condition of the native plants. Virtually no reproduction of woody species has occurred in this century because of feral animal depredation upon their fruit and seeds.

Bunchgrass, prickly-pear, cholla, and the less common velvet-cactus are dominant native species. In addition, much of the Island is densely covered by introduced Mediterranean annual grasses, e.g., *Avena, Bromus, Hordeum, Vulpia.* Native shrubs and trees are essentially restricted to the precipitous eastern canyons and cliffs, but may also be found less frequently in most of the large western canyons. When compared to the shrub communities found on the northern Channel Islands, San Clemente's shrub communities are relatively depauperate.

San Clemente Island is unique among the California Channel Islands because it harbors the highest number of endemic plants—a total of 15 distinctive taxa. In addition, 41 Channel Island endemics are found there and the total known flora for San Clemente Island is 331 taxa (Ferguson unpubl. ms.). At least three species have been extirpated either by man or introduced herbivores.

Seven plant communities are found on San Clemente Island. Dominant species occurring in each community are *Avena barbata, Bromus* sp., *Stipa pulchra* (Grasslands); *Lycium californicum, Bergerocactus emoryii, Opuntia* sp. (Maritime Desert Scrub); *Quercus tomentella, Lyonothamnus floribundus* (Island Woodland); *Malva leprosa, Salsola iberica* (Disturbed); *Abronia sp., Ambrosia chamissonis, Astragalus miguelensis* (Coastal Strand/Dunes);

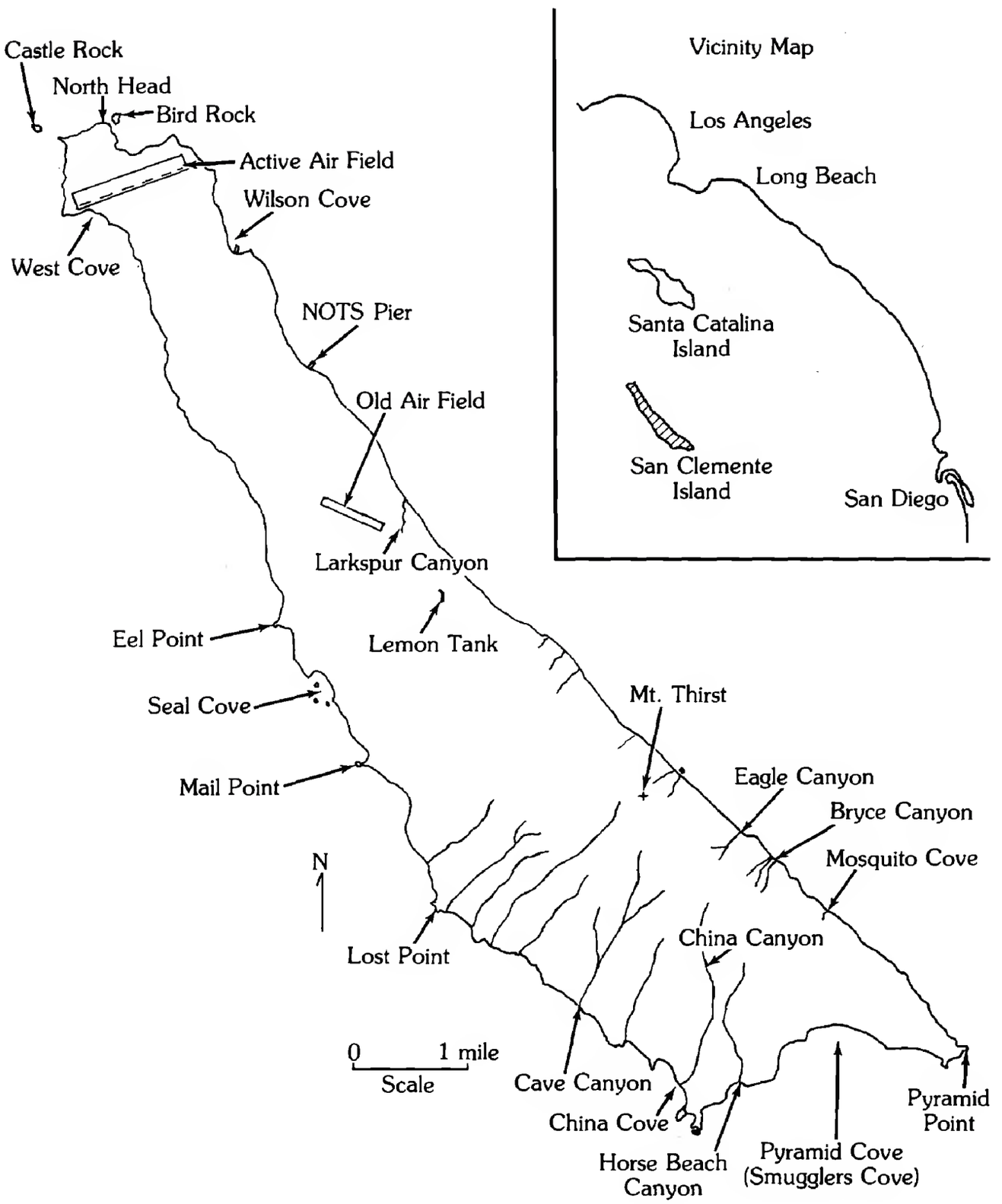

Figure 1. Map of San Clemente Island showing place names and the location of the Island on the California coast.

Artemisia nesiotica, A. californica, Opuntia sp. (Maritime Sage Scrub); *Salicornia subterminalis, Frankenia grandifolia, Distichlis spicata* (Salt Marsh). The Grassland community, being the largest, covers approximately 45% of the Island. Maritime Desert Scrub, Island Woodland and "Disturbed" areas are next in size covering approximately 35%, 7% and 5% of the Island, respectively. Coastal Strand/Dunes, Maritime Sage Scrub, and Salt Marsh cover 4%, 3%, and 0.2% of the Island (Ferguson unpubl. notes).

MAN AND HIS IMPACT ON SCI VEGETATION

Man modified the Island vegetation before botanists had visited the Island. We can therefore only speculate on the historical or pristine condition of the Island flora. Unfortunately, goats were introduced to San Clemente Island in the 1800s (Johnson 1975). By 1883, there were 10,000 sheep on the Island (Doran 1980). Britton; in 1897, also noted the presence of cattle on the Island (Doran 1980). Sheep grazing continued until 1934 when the San Clemente Island Sheep and Wool Company lost its lease and the Island was transferred to the Navy. Apparently all of the sheep were removed at that time, but the goats remained on the Island, their population unchecked. Their numbers increased to a peak of 12,000 in the early 1970s. In 1972, the Navy initiated a feral animal removal program. By 1983 there were fewer than 1000 goats left and it is hoped that they will be removed soon. Deer and feral pigs were introduced onto the Island in the early 1950s for the sake of sport hunting. Most, if not all, of these animals have also been removed.

Naval use has had various environmental effects on the Island. Numerous roads and rifle ranges have been constructed, a new airfield was built on the northern end of the Island in the early 1950s, and ship to shore gunnery practice directly impacts about 2% of the Island.

Some idea of the Island's vegetation prior to the introduction of feral animals may be gained from the notes of early botanists. William Lyon, who visited the south end of San Clemente Island in 1885, noted great dead masses of *Dudleya* (*virens*) which had formerly covered the ground throughout the entire Island (Raven 1963). Today *Dudleya virens* is restricted to steep canyon walls and the lowest western terrace near Eel Point. Another report from about 1883 states that *Lavatera assurgentiflora* (California Tree-Mallow) "constituted an unbroken forest, extending for miles upon the high plateaus" (Raven 1963). Today there are only a few *Lavatera* remaining. The drastic reduction of these two species serves as a powerful reminder of what the Island once looked like. The reduction of *Lavatera* probably parallels that of many other plants, particularly woody species favored by goats, that were not adapted to life on the cliffs—the one area out of reach of the exotic animals. At least three Island endemic plants have already become extinct.

HISTORICAL REVIEW OF SAN CLEMENTE ISLAND AVIFAUNA

Early accounts of the birds of San Clemente Island began when Cooper (1870) collected several species in 1863. Major contributions since include annotated lists by Grinnell (1897a), Linton (1908, 1909), and Howell (1917). Howell gathered all available records up to 1917 and reported a total

of 114 species. There followed brief visits by several investigators up to 1941, but during a crucial period from 1941 to 1968, when several species were apparently extirpated, there are very few records from the Island. Recent work began with Cody and Diamond documenting the presence of breeding species (unpubl. notes 1968). Johnson (1972) examined the origin and differentiation of resident land birds on all the Channel Islands. His analysis of San Clemente birds was based on existing information. Later, Jones (1975) and Jones and Diamond (1976) reported on avifaunal turnover rates for breeding species on all of the California Channel Islands. Their work was based on extensive field work, including 11 visits to San Clemente Island by Jones from 1972 to 1975. Jones was the first person to make a special effort to record migrant and transient species. Since 1972, the Navy has hosted several hundred visits by more than 25 different bird observers.

SCOPE AND METHODS

The current list includes all birds for which there are adequate records, including several tentative records as well. Although San Clemente Island has been a favorite location for pelagic birdwatching trips since the 1950s, the numerous reports of seabirds (particularly in *Audubon Field Notes* and *American Birds*) are generally not included in this present account unless they were reported within 1 km of the Island. Thus, pelagic species recorded as "off" or "near" San Clemente Island are omitted.

All records are sight records unless noted. Generally, each record for a species is listed when there are five or fewer records. Otherwise, records are summarized. Unpublished records are cited with the initials of the observer. Site locations are used sparingly and only when useful. Nomenclature follows the AOU Check-list (1983).

In cases where the existence of a specimen is known and where it may be important in documenting information on that species, the initials of the museum holding the specimen are given in the annotation: California Academy of Sciences (CAS), Los Angeles County Museum of Natural History (LACMNH), Chicago Field Museum of Natural History (FMNH), San Diego Natural History Museum (SDNHM), Western Foundation of Vertebrate Zoology (WFVZ), University of California at Los Angeles (UCLA).

The authors' work began in 1972 and has included over 150 days of field work during all seasons, with the majority of visits occurring since 1977. Most recent records are by the authors and were obtained during visits of 1 to 10 days, at which time the survey of birds was usually the primary task.

Abundance categories are assigned according to a species' occurrence on San Clemente Island and are not intended to reflect regional status.

Abundant	200 + per day in appropriate habitat and season
Very Common	50-200 per day in appropriate habitat and season
Common	20-50 per day in appropriate habitat and season
Fairly Common	7-20 per day in appropriate habitat and season
Uncommon	1-6 per day in appropriate habitat and season
Rare	1-6 per season in appropriate habitat

CONTRIBUTORS

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*GM et al. = GM, EC, HF, PJ, DP, RW

SPECIES ACCOUNTS

ARCTIC LOON (*Gavia arctica*). Three records: Linton (1909) noted "a few" during winter months of 1908; about 15 on 3 Jun 1972 (LJ); one 25 Jul 1979 (PJ).

COMMON LOON (*G. immer*). Four records: one 2 May 1974 (RS, WC); one 4 Nov 1976 (PJ); two 10 Dec 1976 (LJ); one 13 May 1979 (HF, PJ).

PIED-BILLED GREBE (*Podilymbus podiceps*). Two records: Howell (1917) reported that H. Wright shot a female on 26 Aug 1908; one 12 Jul 1915 (CAS).

EARED GREBE (*Podiceps nigricollis*). Rare to uncommon winter visitor: recorded from 19 Sep to 13 May. Linton (1908) noted large flocks Dec 1907 to Mar 1908.

WESTERN GREBE (*Aechmophorus occidentalis*). Rare winter visitor: seven modern records from 8 Oct to 21 Apr. Howell (1917) reported that C.B. Linton had seen this species at different times in the winter, although Linton (1909) does not mention them.

NORTHERN FULMAR (*Fulmarus glacialis*). Three records: one 2 Dec 1972 no details (LJ); one found dead on beach at Mosquito Cove 5 May 1974 (WC, RS); one off NOTS Pier 5 Apr 1981 (HF, BJ).

SOOTY SHEARWATER (*Puffinus griseus*). Three records: Miller (1936) reported a raft of 200 just west of the Island on 31 Jul 1935; one 0.4 km offshore near Pyramid Point 10 Jul 1974 (LJ); one viewed from several meters in Seal Cove 17 May 1980 (HF, PJ).

ASHY STORM-PETREL (*Oceanodroma homochroa*). One record: Miller (1936) reported this species attracted to his ship at Pyramid Cove on 30 Aug 1935.

BLACK STORM-PETREL (*O. melania*). Two possible records: Grinnell (1897a) reported hearing storm-petrels at night in Mosquito Cove sometime between 28 Mar and 7 Jun 1897 (he listed this observation under *O. melania*); Miller (1936) reported them about the ship at night while at Pyramid Cove in Jul or Aug 1935.

RED-BILLED TROPICBIRD (*Phaethon aethereus*). Rare regular summer and fall visitor: there are at least 11 records from 27 Jul to 21 Oct, with four being the highest number observed at one time. Most sightings are from Pyramid Cove which is regularly visited by pelagic bird watchers.

BROWN PELICAN (*Pelecanus occidentalis*). Very common to abundant from Jul to Mar, common Mar to Jul. No breeding records. Highest count is roughly 1800 reported by Briggs et al. (1981) in Oct 1977 during a circumnavigational count.

DOUBLE-CRESTED CORMORANT (*Phalacrocorax auritus*). Fairly common year-round but no breeding records: 12 modern records from 17 Nov to 30 Jul. Linton (1908) reported a flock of 200 or more 5 Feb 1907 and listed them as fairly common. Possibly overlooked in large flocks of Brandt's Cormorants. Eggs collected by Babcock 3 May 1914 (WFVZ) and labeled as Double-crested cannot be positively identified (Kiff pers. coum.).

BRANDT'S CORMORANT (*P. penicillatus*). Abundant year-round, breeds in small numbers. Most numerous Jan to Apr when large feeding flocks of up to 4550 have been recorded. Nesting records: NW coast, small numbers, 1907 (Linton 1908); Seal Cove, nest with young, 9 Apr 1972 (Leatherwood and Coulombe 1972); Bird Rock, 15 nests; Castle Rock, 1 nest; Seal Cove 6 nests, all 10 Jul 1974 (LJ); Castle Rock, 1 nest 8 May 1975 (LJ); Seal Cove, 2 nests; south of Mail Pt., 4 nests; east end of the active airfield, 3 nests, all 15 May 1976 (RC); and Seal Cove, 12 nests 18 Jul 1975 (LJ).

PELAGIC CORMORANT (*P. pelagicus*). Uncommon year-round, no breeding records. Breninger (1904) said "they were reported to have nested," but he furnished no evidence.

GREAT BLUE HERON (*Ardea herodias*). Uncommon year-round visitor. No breeding records.

GREAT EGRET (*Casmerodius albus*). Two records: one 27 Dec 1972 (JLa); one 4 Nov 1976 (PJ).

SNOWY EGRET (*Egretta thula*). One record: three 9 Sep 1972 (LJ); two the next day (JL) at the opposite end of the Island.

TRICOLORED HERON (*E. tricolor*). One record: one 20 May 1981 (WE).

CATTLE EGRET (*Bubulcus ibis*). Regular fall-winter visitor: recorded from 13 Oct to 19 Mar. First recorded 2 Nov 1973 (PJ). Highest single count, 21 on 13 Oct 1976 (LJ).

GREEN-BACKED HERON (*Butorides striatus*). One record: one 12 Sep 1974 (LJ).

BLACK-CROWNED NIGHT-HERON (*Nycticorax nycticorax*). Three records: 11 on 24 Aug 1894 (Mearns unpubl. notes); one adult 17 Jul 1972 at Wilson Cove Pier (PJ); one subadult 16 Sep 1981 (KH).

[FLAMINGO (*Phoenicopturus?*)]. One tentative record: one near Mosquito Cove 17 Nov 1976 (DG). No other details but no doubt an escapee.

BRANT (*Branta bernicla*). One record: two 13 Apr 1973 (PJ).

GREEN-WINGED TEAL (*A. crecca*). Two records: one collected 13 Feb 1903 by Breninger (FMNH); one 24 Aug 1979 (HF, PJ).

MALLARD (*A. platyrhynchos*). Two records: one male 15 Nov. 1978 (LJo); one male 21 and 23 April 1981 (WE).

NORTHERN PINTAIL (*A. acuta*). Ten fall records from 5 Sep to 1 Nov and one spring record on 4 Apr 1915 (Howell 1917). Highest count 32 on 21 Oct 1978 (PJ).

BLUE-WINGED TEAL (*A. discors*). One record: one male 19 Mar 1979 (PJ).

CINNAMON TEAL (*A. cyanoptera*). Rare to uncommon migrant: recorded in the fall from 8 Aug to 22 Sep and in the spring from 14 Feb to 3 May.

NORTHERN SHOVELER (*A. clypeata*). One record: two females 13 and 21 Oct 1978 (PJ).

AMERICAN WIGEON (*A. americana*). Eight fall records from 22 Sep to 15 Nov. First recorded 22 Sep 1976 (LJ).

REDHEAD (*Aythya americana*). One record: one 1-4 Jun 1981 (HF, BJ). This is the second Channel Islands record.

RINGED-NECKED DUCK (*A. collaris*). One record: one 8 Oct 1980 (GM et al.).

LESSER SCAUP (*A. affinis*). One record: one female 21 Oct 1978 (PJ).

SURF SCOTER (*Melanitta perspicillata*). Irregularly recorded winter-spring visitor: recorded from 2 Nov to 30 Apr. Recorded by Linton (1909) in 1908 (no date).

WHITE-WINGED SCOTER (*M. fusca*). One record: four on 16 Sep 1979 near shore (PJ).

RED-BREASTED MERGANSER (*Mergus serrator*). Rare winter-spring visitor: six records from 25 Nov to 11 Apr.

RUDDY DUCK (*Oxyura jamaicensis*). Four records: three 12 Oct 1978 (PJ); one 24 Aug 1979 (HF); one 8 Oct 1980 (GM et al.); one 17 Sep 1981 (KH).

TURKEY VULTURE (*Cathartes aura*). Uncommon visitor: 18 records from 27 Feb to 3 Nov but never more than 1 individual seen at once. First recorded 25 May 1968 (MC, JD). Not recorded on the other Channel Islands.

OSPREY (*Pandion haliaetus*). Formerly a common breeder (Grinnell 1897a; Breninger 1904; Linton 1908; Howell 1917; Willett 1912, 1933), now a rare visitor. Two modern records: one 13-20 Oct 1975 (RC); one 13 Jun 1978 remained 3 weeks (JLa). SCI had the largest breeding population off the coast of California with 20 active nests found in 1907 (Linton 1908). Kiff (1980) reported that the last nest record was for 26 Mar 1927 and that the species was declining and may have ceased to breed by 1930. Persecution by humans, particularly shooting by fishermen, appears to have led to their decline, although Kiff (1980) speculated that "some deleterious change in food supply" could also have contributed to the Osprey's extirpation as a nester on the Channel Islands.

BLACK-SHOULDERED KITE (*Elanus caeruleus*). Two records: two 9 Sep 1981 (JL); the original two were apparently still present on 5 Nov 1981 when a total of four were seen (KH).

BALD EAGLE (*Haliaeetus leucocephalus*). Once a fairly common resident but now extirpated (Grinnell 1897, Linton 1908, Howell 1917). The last record was for 26 Mar 1927 when three or more pairs were reported to be on the Island (Kiff 1980). The species certainly did not survive through the 1950s on the Channel Islands, but the date of its demise on SCI is not documented. Between 1 Nov 1976 and 24 Aug 1978 one adult male, two adult females and one immature were released on the Island by Dave Garcelon in an attempt to reestablish them on SCI. The adult male and one of the adult females were recaptured and removed because they did not forage on their own. The other two birds left the Island soon after release and were not seen again.

NORTHERN HARRIER (*Circus cyaneus*). Rare fall-winter visitor: recorded from 21 Oct to 14 Apr. First recorded 3 Nov 1973 (LJ). Highest count was four on 31 Oct 1981 (KH).

SHARP-SHINNED HAWK (*Accipiter striatus*). Four records: several in canyons near Mosquito Cove Dec 1908 (Linton 1909); one collected by Sefton 13 Dec 1925 (SDNHM 10183); one 9 May 1974 (WC, RS); one 17 Jan 1979 (PJ, JLa).

COOPER'S HAWK (*A. cooperii*). One record: one 8 Apr 1979 (PJ).

RED-TAILED HAWK (*Buteo jamaicensis*). Rare throughout the year, two breeding occurrences: Linton (1908) noted that several pairs were nesting on the Island in 1907, but gave no details; an adult was observed feeding a recently fledged immature bird (determined by plumage) in Cave Canyon 28 Jun 1980 (HF).

[GOLDEN EAGLE (*Aquila chrysaetos*)]. Two tentative records: Mearns (unpubl. notes 1894) lists this species in his SCI notes for 23-28 Aug 1894, but did not include it in his published account of 1907 or give any details; a Navy research team, working with falcons, reported seeing a subadult on 6 Nov 1974 but gave no conclusive description.

AMERICAN KESTREL (*Falco sparverius*). Common resident. Apparently much more numerous at present since they were not recorded by Grinnell (1897a) or Mearns (unpubl. notes) and were reported as occasional by Linton (1908). Fledglings seen as early as 29 Apr (PJ). An index of the current population was obtained on 2 Jan 1980 when 70 were counted during a census along all maintained roads from Mt. Thirst to the north end of the Island.

MERLIN (*F. columbarius*). Three records: two seen together 30 Mar to 11 Apr 1915 (Howell 1917); one 19 Sep 1978 (PJ); one 4 Dec 1979 (KH).

PEREGRINE FALCON (*F. peregrinus*). Formerly a rare resident (Grinnell 1897, Breninger 1904, Mearns 1907, Linton 1908, Howell 1917), now a rare migrant. Five modern records: one 13 Nov 1979 (PJ); one 4 Dec 1979 (KH); one adult 17 Oct 1980 (KH); one 22 Apr 1981 (WE, HF, PJ); a different individual 23 Apr 1981, (EC, WE). There are no specific nest records, however, reports indicate that one or two pairs were nesting prior to 1915 when the last known observation of resident peregrines was recorded (Kiff 1980). Kiff attributes the decline to pesticide DDE.

CHUKAR (*Alectoris chukar*). Fairly common introduced resident since 22 Aug 1960 when the California Department of Fish and Game released 176.

GAMBEL'S QUAIL (*Callipepla gambelii*). Common introduced resident. Probably brought to the Island from Banning, California, about 1912, when 10 dozen were released (Huey 1932).

CALIFORNIA QUAIL (*C. californica*). Introduced, but no longer present. Grinnell (1897a) saw 20 and took 6 specimens. He was told that 12 dozen were released 10 years prior to his visit. No other records.

VIRGINIA RAIL (*Rallus limicola*). One record: one 19 Sep 1975 at Wilson Cove Canyon (LJ).

SORA (*Porzana carolina*). Four records: one partially eaten remains 1908 (Linton 1908); one immature 21 Sep 1975 (LJ, JLa); one adult 24 Jan 1979 (PJ); one immature 22 Sep 1981 (WE, HF, BJ).

AMERICAN COOT (*Fulica americana*). Rare fall, spring visitor: four fall records from 19 Sep to 16 Nov and two spring records 20 Mar 1979 and 8 May 1981. First recorded 20 Sep 1975 (LJ).

BLACK-BELLIED PLOVER (*Pluvialis squatarola*). Fairly common to common migrant and winter visitor. Numbers reduced in May and June, but a few are present all year.

LESSER GOLDEN-PLOVER (*P. dominica*). Nine records: recorded from 21 Sep to 4 Mar. First recorded 21 Sep 1975 when 11 were seen (LJ). Highest count 18 on 18 Feb 1981 (HF, BJ).

SNOWY PLOVER (*Charadrius alexandrinus*). Fairly common: recorded from 10 Jul to 8 Apr. No breeding records. Highest count 23 on 6 Dec 1980 at West Cove (PJ).

SEMIPALMATED PLOVER (*C. semipalmatus*). Uncommon migrant: two spring records 4 May 1974 and 16 Apr 1981 and eight fall records from 24 Jul to 20 Sep.

KILLDEER (*C. vociferus*). Rare visitor: recorded from 9 Sep to 25 Mar. Highest count eight on 5 Dec 1978 (PJ).

MOUNTAIN PLOVER (*C. montanus*). Status unclear: Breninger (1904) took the only specimen he saw (FMNH) and said a member of the SCI Wool Co. told him that they wintered in "incredible numbers." No other records.

AMERICAN BLACK OYSTERCATCHER (*Haematopus bachmani*). Rare year-round resident. Apparently breeds near Seal Cove where a pair was seen repeatedly entering and leaving a crevice on the rocky shore on 27 Apr 1975 (RC, JLa). Highest count five on 10 Apr 1981 at Eel Point (HF).

BLACK-NECKED STILT (*Himantopus mexicanus*). One record: one 6 Apr 1979, photo on file (PJ). The second record for the Channel Islands.

AMERICAN AVOCET (*Recurvirostra americana*). Three records: one 19 Sep 1975 (LJ); one 11 Sep 1980 (EC, HF, PJ); six 23 Oct 1981 (WE).

GREATER YELLOWLEGS (*Tringa melanoleuca*). Four records: apparently the same bird 12, 17, 18 Oct 1979 (HF); two 1 Oct 1980 (EC, HF, PJ); one 21 Apr 1981 (WE, HF); one 13 May 1981 (HF, BJ).

LESSER YELLOWLEGS (*T. flavipes*). Two records: apparently the same individual 19, 22, 26 Sep 1978 (PJ); one 16 Aug 1980 (PJ).

SOLITARY SANDPIPER (*T. solitaria*). Four records: one collected 22-29 Aug 1894 (Mearns 1907); one 10-12 Sep 1975 (PO); two 5 Sep 1979 (HF); two 12 Aug 1981 (HF).

WILLET (*Catoptrophorus semipalmatus*). Uncommon visitor: recorded from 23 Jul to 18 May.

WANDERING TATTLER (*Heteroscelus incanus*). Fairly common most of the year, numbers reduced in Jun and Jul.

SPOTTED SANDPIPER (*Actitis macularia*). Uncommon visitor: recorded from 28 Jul to 14 May. Also a specimen (LACMNH) collected 6 Jul 1939 by J. Von Bloeker.

WHIMBREL (*Numenius phaeopus*). Fairly common from Jul to Apr and rare in May and Jun.

LONG-BILLED CURLEW (*N. americanus*). Rare migrant: six fall records from 24 Jul to 28 Sep and three spring records 18 Feb to 30 Mar. First recorded 9 Sep 1972 (LJ). Highest count, 14 on 18 Feb 1981 (HF, BJ).

MARBLED GODWIT (*Limosa fedoa*). Rare visitor: 12 records from 11 Sep to 8 Oct.

RUDDY TURNSTONE (*Arenaria interpres*). Fairly common visitor: recorded from 23 Jul through 20 Jun.

BLACK TURNSTONE (*A. melanocephala*). Common visitor: recorded from 14 Jul through 17 Apr.

RED KNOT (*Calidris canutus*). Two records: one 28 Jul 1973 (LJ); one 4 May 1974 (WC, RS).

SANDERLING (*C. alba*). Common to very common visitor: recorded from 26 Jul to 15 Apr.

WESTERN SANDPIPER (*C. mauri*). Rare to uncommon migrant: eight fall records 14 Jul to 19 Sep; one spring record 15 Apr 1973 (LJ); and one winter record Dec. 1908 (Linton 1909).

LEAST SANDPIPER (*C. minutilla*). Rare to uncommon migrant: ten fall records from 19 Jul to 20 Oct and one winter record in Dec 1908 (Linton 1909).

BAIRD'S SANDPIPER (*C. bairdii*). Rare fall migrant: recorded from 4 Aug to 11 Sep.

PECTORAL SANDPIPER (*C. melanotos*). Rare fall migrant: eight records from 11 Sep to 8 Oct.

DUNLIN (*C. alpina*). Four records: two 29 Dec 1975 (RC); seven 20 Oct 1976 (LJ); seven 8 Dec 1976 (PJ); one 28 Nov 1980 (PJ).

SHORT-BILLED DOWITCHER (*Limnodromus griseus*). Seven fall records from 24 Aug to 20 Oct.

LONG-BILLED DOWITCHER (*L. scolopaceus*). Five records: one flock seen and one collected by Mearns 27 Aug 1894 (unpubl. notes); feather remains found 2 Nov 1975 (LJ); one 5 Dec 1978 (PJ); one 8 Oct 1980 (GM et al.); one 21 Oct 1981 (HF, PJ).

COMMON SNIPE (*Gallinago gallinago*). Four records: one 26 May 1979 (PJ); three 27 Aug 1980 (EC, HF); one 11 Sep 1980 (EC, HF, PJ); one 8 Oct 1980 (GM et al.).

WILSON'S PHALAROPE (*Phalaropus tricolor*). Two records: one 28 Jul 1973 (LJ); one 11 Sep 1980 (EC, HF, PJ).

RED PHALAROPE (*P. fulicarius*). One or two records: collected 22-29 Aug 1894 (Mearns 1907); two phalaropes seen at a distance 8 Dec 1976 were thought to most likely be *P. fulicarius* because of the date (LJ).

POMARINE JAEGER (*Stercorarius pomarinus*). Two records: one adult 18 Feb 1981 (EC, WE); one 24 Sep 1981 (WE).

PARASITIC JAEGER (*S. parasiticus*). Three records: one 9 Sep 1976 (LJ); one adult light phase 13 Oct 1976 (LJ); one imm. 20 Oct 1976 (LJ).

[LAUGHING GULL (*Larus atricilla*)]. Two tentative records: one 31 Jul 1980 and one 16 Aug 1980 (PJ). Both appeared to be adults with solid dark wing tips, solid black head and all white tail. The possibility exists that they were Franklin's Gulls as bill and body size were not noted and Franklin's are more numerous off the southern California coast.

BONAPARTE'S GULL (*L. philadelphia*). Five records: a wing was found 5 May 1974 (WC, RS); one adult 19 Dec 1976 (LJ); one adult 20 Apr 1981 (BJ); four 4 Dec 1981 (BJ); another wing found 19 Feb 1982 (HF).

HEERMANN'S GULL (*L. heermanni*). Very common visitor Jul through Feb. Numbers reduced Mar through May. No Jun records.

MEW GULL (*L. canus*). One record: nine 10 Dec 1976 including four subadults (LJ).

RING-BILLED GULL (*L. delawarensis*). Three records: one immature 26 Mar 1915 (Howell unpubl. notes); five 1 Nov 1975 including adults and subadults (LJ); one 8 Oct 1980 (RW).

CALIFORNIA GULL (*L. californicus*). Abundant in winter: recorded from 27 Nov to 1 Apr. Highest count was an estimated 7000 along 3 km of east shore 2 Mar 1979 (PJ).

HERRING GULL (*L. argentatus*). Six records: two 5 Apr 1915 (Howell 1917); one 10-12 Sep 1975 (PO); 40 on 9 Nov 1975 (PJ); five 30 Dec 1975 (RC); one 4 Nov 1976 (PJ); two 15 Nov 1978 (PJ).

THAYER'S GULL (*L. thayeri*). One record: one first-year plumaged bird 10 Dec 1976 (LJ).

WESTERN GULL (*L. occidentalis*). Very common to abundant resident. Nests at: Mail Point (23 nests on 13 Jun 1979, PJ); Seal Cove (estimate 20 nests 14 Jun 1980, PJ); Coast NW of Cave Canyon (1 nest 9 Jun 1973, LJ); Bird Rock (38 nests 17 May 1980, HF, PJ). Highest single day count was 350 birds during circumnavigation 18 Jul 1975 (LJ).

GLAUCOUS-WINGED GULL (*L. glaucescens*). Rare winter-spring visitor: six records from 18 Feb to 11 Apr.

BLACK-LEGGED KITTIWAKE (*Rissa tridactyla*). Five records: one 4 May 1974 found oiled and dead on the beach at China Canyon (WC, RS); three immature 28 May 1975 (LJ); one immature 1 Apr 1977 (GK, LS); one immature 17 Apr 1977 (GK, LS); one 14 Feb 1978 (PK).

CASPIAN TERN (*Sterna caspia*). Three records: possibly the same individual on 9 Aug 1980 and 27 Aug 1980 at same location (HF); two 20 Jun 1981 (KH, BJ); two 28 Jul 1981 (HF).

ROYAL TERN (*S. maxima*). Fairly common visitor: recorded from 25 Jul to 28 Mar. Most numerous in fall.

ELEGANT TERN (*S. elegans*). Three records: three 16 Aug 1969 (LJ); one 9 Sep 1972 (LJ); nineteen 12 Aug 1981 (HF).

COMMON TERN (*S. hirundo*). One record: one 13 Sep 1975 (Garrett and Dunn 1981).

FORSTER'S TERN (*S. forsteri*). One record: one 28 Mar 1975 (LJ).

COMMON MURRE (*Uria aalge*). One found beached 5 Aug 1981 which had died much earlier (PJ).

XANTUS' MURRELET (*Synthliboramphus hypoleucus*). Rare breeder. Six records: one specimen secured in Dec 1908 by Linton (1909); seen in the summer 1912 by H. Wright (Willett 1912); two adults with two downy young just off China Point 27 Jul 1968 (GM); two adults with one chick north of Wilson Cove (LJ); twitter calls, possibly of this species, heard at Seal Cove on 2 and 15 April 1977 and unsuccessful nest search made of China Point and Seal Cove (GK, LS). One found dead on beach at Pyramid Cove 17 May 1980 (HF, PJ). The only definite breeding record is by Hunt, Pitman and Jones (1980: 462) who reported finding an egg shell of a Xantus' Murrelet on 11 Jun 1977 that had hatched earlier in the season. The egg was in a crevice in Seal Cove. They further stated that "the almost insignificant Murrelet population on SCI is probably held in check by the abundant terrestrial predators and the lack of offshore rocks."

ANCIENT MURRELET (*S. antiquus*). One record: several seen and two collected Nov and Dec 1908 (Linton 1909).

CASSIN'S AUKLET (*Ptychoramphus aleuticus*). Four historical records: one or more specimens taken (Cooper 1870); one specimen taken 25 Jan 1889 (Townsend 1890); Breninger (1904) reports that "along the shores and on the water, dead Auklets were everywhere" (he could not account for the mortality among *P. aleuticus*); seen frequently in 1907 near shore, especially common that year on the West Coast (Linton 1908).

RHINOCEROS AUKLET (*Cerorhinca monocerata*). One record: Linton (1909) collected two specimens and found several skeletons on beach in 1908.

ROCK DOVE (*Columba livia*). Rare throughout the year. First recorded 28 Jul 1973 (PJ).

BAND-TAILED PIGEON (*C. fasciata*). Rare spring migrant, casual in fall: eight spring records 9 Apr to 8 Jun and three fall records 9 Sep to 18 Oct. First recorded May 1968 (MC, JD).

WHITE-WINGED DOVE (*Zenaida asiatica*). Rare migrant: 10 fall records from 28 Aug to 8 Nov; two seen 17 May 1980 (TO). First recorded 9 Sep 1972 (LJ).

MOURNING DOVE (*Z. macroura*). Common breeding resident.

COMMON BARN-OWL (*Tyto alba*). Uncommon year-round, probably breeds. Cody and Diamond (unpubl. notes) reported that "Bob Delong found them nesting in a barn at the old air strip" but gave no other details.

BURROWING OWL (*Athene cunicularia*). Uncommon fall-winter resident, one breeding record. Recorded from 28 Sep to 10 Mar and several young reported in a burrow in Larkspur Canyon during summer, 1975 (RB).

LONG-EARED OWL (*Asio otus*). In Dec 1908, Linton (1909) secured one specimen and saw three more in wooded canyons.

SHORT-EARED OWL (*A. flammeus*). Two records: one 3 Mar 1979 (PJ, JLa); one 28 Nov 1980 (PJ).

COMMON POORWILL (*Phalaenoptilus nuttallii*). Three records: Grinnell (1897) reported hearing poorwills each evening 30 Mar to 2 Apr at Pyramid Cove, with one female specimen secured on 31 Mar; one 14 Mar 1974 (JL); one 24 Mar 1981 (PJ).

VAUX'S SWIFT (*Chaetura vauxi*). Two records: three 22 Sep 1978 (PJ, JLa); one 21 Oct 1981 (HF, PJ).

WHITE-THROATED SWIFT (*Aeronautes saxatalis*). Fairly common: recorded from 19 Feb to 29 Nov, probably breeds. Grinnell (1897a) observed swifts entering crevices west of Pyramid Cove, and said they probably nested there. Linton (1908) observed birds entering crevices in the cliffs near Wilson Cove on 7 Mar 1907. More recent indications of breeding are: 2 May 1974, mating activity observed near Eagle Canyon (WC, JLa, RS); two seen copulating near Seal Cove 30 Apr 1980 (PJ).

ANNA'S HUMMINGBIRD (*Calypte anna*). Ten records from 15 Mar to 12 Feb. No breeding records, but Howell (1917) observed one at his skinning table collecting bits of cotton on 15 Mar 1915.

COSTA'S HUMMINGBIRD (*C. costae*). Four spring records: one adult male 30 Mar 1897 (Grinnell 1897); one 24-27 May 1968 (MC, JD); one male mist netted 3 May 1974 (WC, RS); one adult male 29 Apr 1981 (PJ).

CALLIOPE HUMMINGBIRD (*Stellula calliope*). One record: one adult male 3 May 1974, netted and released 5 May 1974, photo on file (WC, RS).

RUFOUS HUMMINGBIRD (*Selasphorus rufus*). Two records: one adult male 1 May 1974 (WC, RS); one male 12 Feb 1981 (EC, WE).

ALLEN'S HUMMINGBIRD (*S. sasin*). Fairly common resident. Nesting records range from 28 Mar to 10 May. The race *sedentarius* is reportedly present year-round but only one winter record is known: five 10 Dec 1976 (LJ). Either it is very inconspicuous in winter and/or a portion of the population departs.

BELTED KINGFISHER (*Ceryle alcyon*). Uncommon fall, winter resident: recorded from 25 Jul to 21 Apr.

LEWIS' WOODPECKER (*Melanerpes lewis*). One record: one 8 Apr 1972 (Leatherwood and Coulombe 1972).

ACORN WOODPECKER (*M. formicivorus*). Three records: two 19 Sep 1978 (PJ); four 21 Oct 1978 (PJ); one 24 Oct 1981 (WE).

RED-BREASTED SAPSUCKER (*Sphyrapicus ruber*). One record: two imm. apparently collected above Mosquito Cove 11 Oct 1907 (Linton 1908). The numerous drilling holes currently found on oak and cherry trees indicate that sapsuckers may visit the Island more regularly than records reflect.

NORTHERN FLICKER (*Colaptes auratus*). Uncommon visitor: red-shafted type recorded regularly from 20 Sep to 22 Apr; one yellow-shafted seen 18 Oct to 3 Nov 1976 (RM).

OLIVE-SIDED FLYCATCHER (*Contopus borealis*). Three records: one 2 May 1974 (WC, RS); four 10-12 Sep 1975 (PO); one 14 Sep 1980 (KH).

WESTERN WOOD-PEWEE (*C. sordidulus*). Uncommon migrant: recorded from 9 Apr to 4 Jun in spring and 15 Jul to 22 Sep in fall.

WILLOW FLYCATCHER (*Empidonax traillii*). Six records: three fall records 8 to 19 Sep and three spring records 2 to 13 May. First recorded 2 May 1975 (WC, RS).

HAMMOND'S FLYCATCHER (*E. hammondii*). Five records: one collected 9 Apr 1915 by L. Huey (specimen UCLA); one 14 Apr 1973 (LJ); one each on 11 and 12 Sep 1974 (LJ); one 1 Oct 1980 (EC, HF, PJ).

DUSKY FLYCATCHER (*E. oberholseri*). One record: one 23 Apr 1981 (EC, WE).

GRAY FLYCATCHER (*E. wrightii*). Eight spring records from 19 Apr to 12 May. First recorded 8 May 1974 (WC, RS).

WESTERN FLYCATCHER (*E. difficilis*). Fairly common migrant and summer resident: recorded from 1 Apr to 1 Oct. Most numerous in eastern wooded canyons where up to 20 have been counted in Eagle Canyon in one day (10 Jun 1973, LJ). Breeding behavior has been reported by Grinnell (1897a), Linton (1908) and Jones (1975) but no nests or young have been reported. Once thought to be a separate species (*E. insulicola*) on the California Channel Islands (Oberholser 1897), it was soon rejected (Grinnell 1905) and relegated to the subspecific status *E. d. insulicola* (Brodkorb 1949).

BLACK PHOEBE (*Sayornis nigricans*). Uncommon in fall, rare in spring and winter: recorded from 11 Sep to 28 Apr. Breeding status uncertain. The only evidence of nesting was an unfinished nest fastened to the side of a cave on 20 Mar 1907 (Linton 1908).

SAY'S PHOEBE (*S. saya*). Fairly common Oct through Nov, uncommon in winter and spring: recorded from 14 Sep to 11 Apr and collected 6 Jul 1939 by G. Willett (LACMNH).

ASH-THROATED FLYCATCHER (*Myiarchus cinerascens*). Uncommon in fall from 9 Jul to 12 Sep; rare in spring from 29 Apr to 9 May. One *Myiarchus* flycatcher, thought to be an Ash-throated, was seen 3 Jan 1980 (PJ).

TROPICAL KINGBIRD (*Tyrannus melancholicus*). One record: one imm. 13 Oct 1976 (LJ).

CASSIN'S KINGBIRD (*T. vociferans*). Five records: two 27 Jul 1973 (LJ); one 10 Aug 1973 (PJ); two 12 May 1979 (PJ); one 13 May 1979 25 km from preceding record (HF); one 29 Jul 1981 (HF).

WESTERN KINGBIRD (*T. verticalis*). Uncommon fall, spring migrant: four records 27 Jul to 9 Sep and seven records 3 Apr to 14 May.

EASTERN KINGBIRD (*T. tyrannus*). Three records: one 22 Sep 1976 (LJ); one 13 May 1979 (PJ); one 24-26 May 1980 (JLa).

HORNED LARK (*Eremophila alpestris*). Abundant resident. The resident race, *insularis*, is endemic to the Channel Islands. It is probably the most numerous breeding bird on SCI. The status of migrant races on the Island is not clear.

TREE SWALLOW (*Tachycineta bicolor*). Three records: three 30 Aug 1978 (PJ); 35 on 26 Sep 1978 (PJ); one 12 Mar 1981 (HF).

VIOLET-GREEN SWALLOW (*T. thalassina*). Rare migrant: six records from 25 Feb to 9 Apr.

NORTHERN ROUGH-WINGED SWALLOW (*Stelgidopteryx serripennis*). One record: One 20 Sep 1976 (LJ).

BANK SWALLOW (*Riparia riparia*). One record: one 2 May 1974 (WC, RS).

CLIFF SWALLOW (*Hirundo pyrrhonota*). Two records: two 10 Jun 1973 (LJ); ten 25 Sep 1978 (PJ).

BARN SWALLOW (*H. rustica*). Fairly common summer resident: recorded from 26 Mar to 8 Nov. Apparently breeds but the only nesting records have been one unattended nest found in 1974

(Jones 1975) and one empty, recently-active nest found 24 Mar 1981 (BJ). Six fledglings were seen being fed by adults 9 Jun 1981 (PJ).

COMMON RAVEN (*Corvus corax*). Very common resident. Nests are frequently found in rock crevices along the coast and in canyons. Highest single count to date was 193 on 8 Sep 1976 along a 4 km stretch of road (LJ).

RED-BREASTED NUTHATCH (*Sitta canadensis*). Four records: one 22 Sep 1975 (LJ); one 7 Sep 1979 (HF, PJ); one 17 Oct 1979 (HF); one 31 May 1980 (JLa).

[CACTUS WREN (*Campylorhynchus brunneicapillus*)]. One tentative record: Mailliard (1918) reported that a Dr. Everman was positive that he saw several near Wilson Cove. No specimen was obtained.

ROCK WREN (*Salpinctes obsoletus*). Very common resident. There has been an apparent increase in the population since the early 1900s. Early observers (Grinnell 1897, Linton 1908, Howell 1917) all reported the Rock Wren as fairly common. Since 1972, all reports list them as common or abundant.

BEWICK'S WREN (*Thryomanes bewickii leucophrys*). Formerly very common, now extinct. Reported as a "very common" or "abundant" resident by Grinnell (1897), Linton (1908) and Howell (1917). Pacific Coast races were described by Swarth (1916). There is no record of the endemic race since George Willett collected a male at Middle Ranch on 17 Feb 1941 (LACMNH). Cody (unpubl. notes) searched and found none in 1968. A Bewick's Wren was found in Horse Beach Canyon 15 Apr 1973 (LJ). A singing male, assumed to be the same individual, was found 4 May 1974 in the same location and was mist netted, measured and photographed by R. Stewart (Stewart et al. 1974). He concluded that the bird was not the endemic race, but possibly *T. b.catalinae* from neighboring Santa Catalina Island.

HOUSE WREN (*Troglodytes aedon*). Uncommon fall-winter visitor: recorded from 15 Jul to 3 Jan. First recorded 15 Jul 1972 (PJ).

MARSH WREN (*Cistothorus palustris*). Three records: one collected 13 Nov 1939 by G. Willett (LACMNH); one 23 Sep 1976 (LJ); one 28 Sep 1978 (PJ).

GOLDEN-CROWNED KINGLET (*Regulus satrapa*). Two records: one 2 Nov 1975 (LJ); one 11 Sep 1980 (EC, HF).

RUBY-CROWNED KINGLET (*R. calendula*). Uncommon visitor: recorded from 23 Aug to 9 May; only one winter record 10 Dec 1976 (LJ). First recorded 14 Apr 1973 (LJ).

BLUE-GRAY GNATCATCHER (*Polioptila caerulea*). Five records: one 10-12 Sep 1975 (PO); single birds on 14 Apr 1973, 23 Sep 1976, 13 Oct 1976 (LJ), and 27 Aug 1980 (EC, HF).

WESTERN BLUEBIRD (*Sialia mexicana*). One record: adult male collected Dec 1908 (Linton 1909). Unfortunately, we cannot locate this specimen.

MOUNTAIN BLUEBIRD (*S. currucoides*). Irregular winter visitor: recorded from 19 Nov to 2 Mar. Flocks of up to 50 individuals have been reported.

TOWNSEND'S SOLITAIRE (*Myadestes townsendi*). Two records: one 2 May 1974 (WC, RS); one 24 Oct 1981 (WE).

SWAINSON'S THRUSH (*Catharus ustulatus*). Rare fall, spring migrant: four spring records 9 May to 10 Jun and six fall records 9 Sep to 21 Oct.

HERMIT THRUSH (*C. guttatus*). Uncommon visitor: recorded from 8 Oct to 15 May.

AMERICAN ROBIN (*Turdus migratorius*). Rare to uncommon migrant: recorded from 21 Oct to 16 May.

VARIED THRUSH (*Ixoreus naevius*). One record: several were collected in Jan-Apr 1907 (Linton 1908).

NORTHERN MOCKINGBIRD (*Mimus polyglottos*). Fairly common resident.

SAGE THRASHER (*Oreoscoptes montanus*). Uncommon migrant: seen regularly in the fall since 1974, occasionally overwinters; one spring record 3 May 1974 (WC, RS). First recorded 9 Sep 1972 (JL, JLa).

BENDIRE'S THRASHER (*Toxostoma bendirei*). Two records: one 15 Sep 1979 (HF); one 17 Aug 1980 (PJ).

WATER PIPIT (*Anthus spinoletta*). Uncommon visitor: recorded from 6 Oct to 16 Apr.

CEDAR WAXWING (*Bombycilla cedrorum*). Rare irregular visitor: eleven records scattered throughout the seasons.

PHAINOPEPLA (*Phainopepla nitens*). Six records: one 15 Apr 1973 (PJ); one 10-12 Sep 1975 (PO); one 13 Oct 1976 (LJ); two 25-27 Sep 1978 (PJ); one 20 Oct 1978 (PJ); two 19 Aug 1981 (BJ).

LOGGERHEAD SHRIKE (*Lanius ludovicianus mearnsi*). Uncommon resident and SCI endemic race. The Secretary of the Interior has listed this subspecies as endangered because of its low numbers and continued destruction of habitat by feral herbivores. Early nesting accounts are found in Grinnell (1897a), Linton (1908) and Howell (1917). Howell reported "young strong on the wing" by 23 Mar 1915. The population levels prior to 1973 are not well documented but have apparently declined. Howell (1917) commented that "no matter which birds we shot there always seemed to be others that came in to take their places." The current estimate of the population is 12-15 pairs (Hyde 1981).

EUROPEAN STARLING (*Sturnus vulgaris*). Abundant resident: reported as common by 1968 (MC, JC) and abundant thereafter. First sighted 5 Jun 1966 (HC).

GRAY VIREO (*Vireo vicinior*). One record: one 23 Sep 1976 (LJ).

SOLITARY VIREO (*V. solitarius*). Rare fall, spring migrant: recorded from 5 to 16 Sep and 21 Apr to 5 May. First recorded 1 May 1974 (WC, RS).

WARBLING VIREO (*V. gilvus*). Fairly common fall, spring migrant: recorded from 31 Aug to 8 Oct and 9 Apr to 15 May. First recorded 9 Sep 1972 (LJ).

TENNESSEE WARBLER (*Vermivora peregrina*). Three records: one each 12 Sep 1974, 22 Sep 1976, and 13 Oct 1976 (LJ).

ORANGE-CROWNED WARBLER (*V. celata*). Fairly common to common resident. The race *sordida* is found on the Channel Islands, Palos Verdes Peninsula and Point Loma, California, while other races are thought to reach the islands in migration. There are several reports of breeding activity but the only records of nests from SCI are by Howard (1906) who found six in 1905.

NASHVILLE WARBLER (V. ruficapilla). Rare fall, spring migrant: recorded from 16 Jul to 2 Nov and 14 Apr to 16 May.

VIRGINIA'S WARBLER (*V. virginiae*). Two records: four 11-13 Sep 1974 (LJ); one 16 Sep 1979 (PJ).

NORTHERN PARULA (*Parula americana*). One record: one 2 Nov 1983 (SW).

YELLOW WARBLER (*Dendroica petechia*). Uncommon fall, spring migrant: recorded from 27 Aug to 6 Oct and 28 Apr to 12 May. First recorded 29 Sep 1972 (LJ).

MAGNOLIA WARBLER (*D. magnolia*). Two records: one 11 Sep 1980 (EC, HF, PJ); one 8 Oct 1980 (GM et al.).

YELLOW-RUMPED WARBLER (*D. coronata*). The "Audubon's" type is a fairly common migrant and uncommon winter resident: recorded from 11 Sep to 2 May but most numerous in the fall. The "Myrtle" type was reported as fairly common in the winter of 1908 (Linton 1909).

BLACK-THROATED GRAY WARBLER (*D. nigrescens*). Ten fall records 9 Sep to 8 Oct and three spring records 11 to 16 Apr. First recorded 9 Sep 1972 (JL, JLa).

TOWNSEND'S WARBLER (*D. townsendi*). Uncommon fall, spring migrant: recorded from 23 Aug to 10 Nov and 14 Apr to 15 May. One winter record, Dec 1908 (Linton 1909).

HERMIT WARBLER (*D. occidentalis*). Uncommon fall, spring migrant: recorded from 7 to 22 Sep and 16 Apr to 14 May. First recorded 10 Sep 1972 (JL, JLa).

BLACKBURNIAN WARBLER (*D. fusca*). One record: one 21 Sep 1981 (HF, BJ).

PRAIRIE WARBLER (*D. discolor*). One record: one 22 Sep 1981 (WE, HF, BJ). No other Channel Island record.

PALM WARBLER (*D. palmarum*). Three records: one 26 Mar 1975 (LJ); one 31 Oct to 3 Nov 1975 (LJ); one 8 Oct 1980 (GM et al.).

BAY-BREASTED WARBLER (*D. castanea*). One record: one 9-11 Jul 1975 (KG).

BLACKPOLL WARBLER (*D. striata*). Four records: one 22 and one 23 Sep 1976 (LJ); two 22 Sep 1981 (WE, HF, BJ); one 6 Oct 1981 (HF, BJ).

BLACK-AND-WHITE WARBLER (*Mniotilta varia*). Four records: one 10-12 Sep 1975 (PO); one female 22 Apr 1981 (WE, PJ); one male 1 Jun 1981 (BJ); one male 31 Oct 1981 (KH).

AMERICAN REDSTART (*Setophaga ruticilla*). Five records: two 11, 12 Sep 1974 (LJ); six 10-12 Sep 1975 (PO); two 19-22 Sep 1975 (LJ); two 22 Sep 1976 (LJ); one 11 Sep 1980 (EC, HF, PJ).

NORTHERN WATERTHRUSH (*Seiurus noveboracensis*). Rare fall, spring migrant: recorded six times in the fall from 11 Sep to 8 Oct and once in the spring, 1 Apr 1977.

MACGILLIVRAY'S WARBLER (*Oporornis tolmiei*). Rare fall, spring migrant: recorded from 22 Apr to 24 May and 12 to 27 Sep. First recorded sometime during 24-27 May 1968 (MC, JD).

COMMON YELLOWTHROAT (*Geothlypis trichas*). Five records: one 23 Mar 1915 (Howell 1917); one 11-13 Sep 1974 (LJ); two 22 Sep 1976 (LJ); one 8 Oct 1980 (GM et al.); three 22 Sep 1981 (WE, HF, BJ).

WILSON'S WARBLER (*Wilsonia pusilla*). Fairly common fall, spring migrant: recorded from 20 Aug to 22 Sep and 14 Apr to 20 May. The first record was 20 May 1972 (PJ).

CANADA WARBLER (*W. canadensis*). Two records: one male 20 Oct 1974 (JLa); one male 3 Nov 1976 (PJ).

YELLOW-BREASTED CHAT (*Icteria virens*). Three records: one 10-12 Sep 1975 (PO); one 19 Sep 1975 (LJ); one 21 Apr 1981 (WE, HF, BJ).

SUMMER TANAGER (*Piranga rubra*). One record: one female collected 11 Oct 1907 (Linton 1908).

WESTERN TANAGER (*P. ludoviciana*). Fairly common fall, spring migrant: modern records range from 29 Jul to 20 Oct and 21 Apr to 9 Jun. Also recorded 23 Mar 1915 (Howell 1917).

ROSE-BREASTED GROSBEAK (*Pheucticus ludovicianus*). Two records: one singing male 9 Jun 1973 (LJ); one imm. 27 Aug 1980 (EC, HF).

BLACK-HEADED GROSBEAK (*P. melanocephalus*). Uncommon fall, spring migrant: recorded from 29 Jul to 27 Sep and 21 Apr to 11 Jun. First recorded 9 Sep 1972 (JL).

BLUE GROSBEAK (*Guiraca caerulea*). Four records: two 21 Apr 1914 (Kimball 1922); one 13 Sep 1974 (LJ); and two 23 Sep 1976 (LJ); one female 8 Oct 1980 (GM et al.).

LAZULI BUNTING (*Passerina amoena*). Rare to uncommon fall, spring migrant: recorded from 6 Sep to 13 Oct and 14 Apr to 9 Jun. First recorded 14 Apr 1973 (LJ).

INDIGO BUNTING (*P. cyanea*). Four records: one 3, 5 May 1974 (WC, RS); one 15 May 1976 (PU); two 16 Sep 1979 (HF); one 8 Oct 1980 (GM et al.).

[DICKCISSEL (*Spiza americana*)]. Two tentative records: one seen at a distance and heard 19 Sep 1975 and three heard 23 Sep 1976 "but no positive I.D." (LJ).

GREEN-TAILED TOWHEE (*Pipilo chlorurus*). Rare migrant: eight fall records from 8 Sep to 9 Nov and one spring record 23 Apr 1981 (EC, WE). First recorded 30 Sep 1973 (JLa).

RUFOUS-SIDED TOWHEE (*P. erythrophthalmus*). The Channel Islands endemic race, *clementae*, was formerly a resident but apparently is now extirpated from SCI. Grinnell (1897a) collected 16 specimens from 28 Mar to 7 Jun 1897 and considered it "not uncommon." He later reported on their taxonomic status (Grinnell 1897b). Others collected specimens but no nests or young were reported. Documentation of the demise of the resident race is unavailable because of the lack of observers from 1915 to 1968 and because of the occurrence of migrant subspecies on SCI. One bird collected by Linton in 1908 was of the race *P. e. oregonus*; presumably most of the 12 modern records, observed mainly in the fall, are also of this migrant race. Possible modern sightings of the endemic race are: 2 males in Bryce Canyon 9 Apr 1972 (Leatherwood and Coulombe 1972); one singing male 15 Apr 1973 in Horse Beach Canyon (LJ); and one 9-11 Jul 1975 (KG, no details). As with the Bewick's Wren and Song Sparrow, the most likely reason for the towhee's absence is the widespread destruction of the island's shrub habitat by feral herbivores.

AMERICAN TREE SPARROW (*Spizella arborea*). One record: one 2 Nov 1975 (LJ).

CHIPPING SPARROW (*S. passerina*). Uncommon summer resident: recorded from 27 Mar to 29 Nov. One winter record: two specimens taken 2 Dec 1908 (Linton 1909). Most numerous in wooded canyons where breeding behavior and fledglings have been observed but no nests found.

CLAY-COLORED SPARROW (*S. pallida*). One record: one 12 Sep 1974 (LJ).

BREWER'S SPARROW (*S. breweri*). Three records: two 11 Sep 1974 (LJ); fifteen 10-12 Sep 1975 (PO); four imm. 1 Oct 1980 (EC, HF).

BLACK-CHINNED SPARROW (*S. atrogularis*). Four records: one female collected 5 Dec 1908 (Linton 1909); one heard 2 May 1974 (RS, WC); one 23 Sep 1976 (LJ); one 23 Aug 1979 (PJ).

VESPER SPARROW (*Pooecetes gramineus*). Rare to fairly common visitor: recorded from 1 Oct to 9 Apr. First recorded 26 Mar 1975 (LJ).

LARK SPARROW (*Chondestes grammacus*). Rare fall, spring migrant: recorded from 11 to 25 Nov and 21 Apr to 13 May. First recorded 11 Sep 1972 (JL).

BLACK-THROATED SPARROW (*Amphispiza bilineata*). One record: one 9 Nov 1980 (BJ).

SAGE SPARROW (*A. belli*). The endemic race, *clementae*, is an uncommon Island resident, restricted primarily to the boxthorn-cactus covered lower western terraces of SCI. The Secretary of the Interior has listed it as threatened because of habitat destruction by feral herbivores. Early accounts (Grinnell 1897, Howell 1917) describe them as common. Hyde (1981) estimated the population at 250-300 individuals. One female of the Great Basin race, *A. b. nevadensis*, was collected by G. Willett on 25 Nov 1939 (LACMNH).

LARK BUNTING (*Calamospiza melanocorys*). Two records: one male 10 Jun 1973; one 8 Sep 1976 (LJ).

SAVANNAH SPARROW (*Passerculus sandwichensis*). Fairly common migrant and winter visitor: recorded from 13 Aug to 23 Apr.

FOX SPARROW (*Passerella ilica*). Uncommon visitor: recorded from 23 Sep to 18 Apr.

SONG SPARROW (*Melospiza melodia*). The race *clementae*, endemic to the Channel Islands, is now extirpated from SCI, apparently due to the loss of shrub vegetation. This race was once reported as a common or even abundant resident (Mearns unpubl. notes, Grinnell 1897, Howell 1917). Several modern records which may or may not be of the endemic race: 9-10 Jun 1962 no details (HK); two 24-27 May 1968 (MC, JD); one 9 Apr 1972 (GC); one singing male 14 Apr 1972 (LJ); one 9 Nov 1975, one 5 Nov 1976, one Sep 1978, one 19 Mar 1979, one 12 Mar 1980 (PJ); one 27 Aug 1980 (EC, HF). Two birds observed singing, one by Cody and Diamond in 1968 and the other by Lee Jones in 1973, could be individuals of the resident *clementae* race. However, Stewart and Clow, during their May 1974 visit, conducted a fairly extensive search and failed to detect any Song Sparrows. The last definite record of the resident race is a breeding female collected on 17 Feb 1941 by George Willett (LACMNH).

LINCOLN'S SPARROW (*M. lincolnii*). Rare fall and spring migrant: recorded from 13 Sep to 9 Nov and 23 Mar to 4 May. Two winter records: one collected by J. C. Von Bloeker 19 Feb 1941 (LACMNH) and one 9 Dec 1976 (LJ).

GOLDEN-CROWNED SPARROW (*Zonotrichia atricapilla*). Uncommon winter visitor: recorded from 5 Oct to 9 May.

WHITE-CROWNED SPARROW (*Z. leucophrys*). Common to very common visitor: recorded from 22 Sep to 16 May.

HARRIS' SPARROW (*Z. querula*). Two records: one collected 15 Oct 1907 (Linton 1908) and one 9 Dec 1976 (LJ).

DARK-EYED JUNCO (*Junco hyemalis*). Uncommon visitor: "Oregon" Junco (subspecies group *oreganus*) recorded from 11 Sep to 14 Apr; subspecies *caniceps* recorded once on 27 Mar 1975 (LJ).

CHESTNUT-COLLARED LONGSPUR (*Calcarius ornatus*). Two records: one 16 Dec 1980 (HF); one 15, 22 Apr 1981 (EC, WE).

BOBOLINK (*Dolichonyx oryzivorus*). Six records: one 12 Sep 1974 (LJ); one 10-12 Sep 1975 (PO); one 19 Sep 1975 perhaps the same one (LJ); one 13 Oct and 20 Oct 1976 (LJ); one male 22 Jul 1979 (HF, PJ); one 11 Sep 1980 (EC).

RED-WINGED BLACKBIRD (*Agelaius phoeniceus*). Six records: one male 10 Jun 1973; one 26 Mar 1975; 65 on 2 Nov 1975 and one 22 Sep 1976 (LJ); one 11 Sep 1980 (EC, HF, PJ); one male 30 Nov 1980 (PJ).

WESTERN MEADOWLARK (*Sturnella neglecta*). Very common resident.

YELLOW-HEADED BLACKBIRD (*Xanthocephalus xanthocephalus*). Rare migrant: recorded from 14 Jul to 2 Nov. One spring record, 28, 29 Apr 1981 (HF, PJ). First recorded 14 Jul 1972 (LJ).

RUSTY BLACKBIRD (*Euphagus carolinus*). Two records: one collected 20 Nov 1908 (Linton 1909); two 1-2 Nov 1975 (LJ).

BREWER'S BLACKBIRD (*E. cyanocephalus*). Rare to common: recorded from 10 Sep to 2 May. Recorded annually in fluctuating numbers since first being reported on 15 Dec 1972 (PJ).

BROWN-HEADED COWBIRD (*Molothrus ater*). Fairly common to common in fall especially when livestock are present, numbers reduced the rest of the year. Breeding status unknown. First recorded 17 Jul 1972 (LJ).

HOODED ORIOLE (*Icterus cucullatus*). Rare migrant: recorded from 11 Sep to 20 Oct and from 16 to 28 Apr. First recorded 11 Sep 1974 (LJ).

NORTHERN ORIOLE (*I. galbula*). Rare to uncommon migrant: recorded from 9 Aug to 19 Sep and 24 Mar to 13 May. First recorded 31 Mar 1907 (Linton 1908).

PURPLE FINCH (*Carpodacus purpureus*). Three records: one 15 Apr 1973 (LJ); one 3 May 1974 (WC, RS); one 8 Nov 1975 (PJ).

HOUSE FINCH (*C. mexicanus*). Common resident. California Channel Island birds were classified as a separate race (*clementis*) by Mearns (1898) and have been examined in some detail (Power 1979). Nevertheless, their taxonomic status remains unclear.

PINE SISKIN (*Carduelis pinus*). Two records: 22 on 8-9 Nov 1975 (PJ); eight 31 Oct to 1 Nov 1975 (LJ).

LESSER GOLDFINCH (*C. psaltria*). Uncommon migrant: ten fall records from 5 Sep to 9 Nov and two spring records 27 Mar 1975 and 11 Apr 1980. First recorded 11 Sep 1974 (LJ).

LAWRENCE'S GOLDFINCH (*C. lawrencei*). Three records: one 9-11 Jul 1975 (KG); two 14 May 1976 (PU); three 23 Sep 1976 (LJ).

AMERICAN GOLDFINCH (*C. tristis*). Two records: one 12 May 1980 and two 10 km away 13 May 1980 (HF).

HOUSE SPARROW (*Passer domesticus*). Fairly common resident of inhabited areas. First recorded 30 Mar 1915 (Howell 1917).

DISCUSSION

On San Clemente Island 248 species have been recorded, including five tentative records. There is substantial evidence to show that 31 species have bred on the island; however six of these—Bald Eagle, Peregrine Falcon, Osprey, Bewick's Wren, Rufous-sided Towhee and Song Sparrow—no longer nest on San Clemente Island. Three additional species—Barn Owl, Anna's Hummingbird and Black Phoebe—may have bred or do breed, but direct evidence is lacking. There are no major seabird colonies (see Xantus' Murrelet account for a possible explanation), but there are small numbers of nesting Brandt's Cormorant, Western Gull and Xantus' Murrelet. The only nesting shorebird is the American Black Oystercatcher.

Of the 248 taxa recorded, seven are California endemics while three others, Bewick's Wren, Loggerhead Shrike and Sage Sparrow, are endemic to San Clemente Island. The once common Island race of Bewick's Wren (*T.b. leucophrys*) is now extinct, whereas the Rufous-sided Towhee (*P.e. clementae*) and Song Sparrow (*M.m. clementae*) are still present on other California Channel Islands, but have been extirpated from San Clemente Island.

The most compelling explanation for the loss of these terrestrial species is the reduction of brushy vegetation by introduced herbivores. One only needs

to read Grinnell's or Mearns' unpublished accounts of how abundant the Loggerhead Shrike, Rufous-sided Towhee and Song Sparrow were during their early island visits in order to appreciate how much more common woody vegetation was at that time. Mearns reported that the Song Sparrow was "the most abundant land bird of Clemente."

In addition to the loss of six resident species, significant changes in status have apparently occurred for several other species since Howell's 1917 list. The arrival of Cattle Egret, European Starling and House Sparrow is consistent with regional trends, but increases in American Kestrel and Rock Wren may be attributable to Island habitat changes. Mountain Plover, if as abundant as once reported (Breninger 1904), may have been attracted to the Island during the brief time prior to 1920 when cultivated fields were present. The arrival and dramatic rise in the starling population will assuredly affect the Island avifauna. Within an hour's time it is common to see flocks of a hundred or more starlings in the grasslands, along the rocky shore and in inhabited areas.

The proliferation of records of migrant and vagrant species beginning in 1972 is a direct result of the dramatic increase in observers and the recent attention focused on non-resident birds. This new information is particularly enlightening because over 220 of the recorded species are migratory or wintering birds, including subspecies of several resident species. Even with the increased coverage of the Island, many water birds and vagrant land birds are probably more common than this report reflects.

The Navy has undertaken measures aimed at protecting plant and animal species at San Clemente Island since the first Natural Resources Management Plan was written in 1975. The principal effort has been a continuing program to remove feral animals.

Preservation of bird species and their habitats has focused on SCI's federally-listed endangered Loggerhead Shrike and threatened Sage Sparrow. Efforts to protect and stabilize the populations of these two species have recently been formalized by R.M. Beauchamp, K. Hyde and W. Mautz in a U.S. Fish and Wildlife Service draft recovery plan for San Clemente Island endangered, threatened and candidate species. The plan calls for the following: continue research and monitoring programs to delineate critical habitat, establish distribution information, determine habitat requirements and establish baseline population level counts for both listed bird species. The plan also emphasizes the need for removal of all feral herbivores, a goal which the Navy is actively pursuing.

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NOTES

OBSERVATIONS ON THE DIVING BEHAVIOR OF THE NORTHERN FULMAR

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Northern Fulmars are relatively light weight, aerial seabirds, and are not anatomically well-adapted for diving or underwater swimming. However, Fisher (1952) stated, "the literature is full of controversy about the diving of fulmars." He listed eight observers reporting diving; presumably their reports represented most of the detailed descriptions of this behavior discovered during an extensive literature search conducted on the species (see Fisher 1952). Subsequent published reports are few if any. Descriptions in more recent references (e.g. Palmer 1962, Cramp 1977) apparently are derived from Fisher's synthesis. Ashmole (1971) listed the fulmar's feeding methods as surface seizing, surface filtering, scavenging and pursuit diving (which is classified as "of minor importance"). Cramp (1977) stated pursuit-plunging is "infrequently" employed. There is disagreement on the depth to which fulmars dive, with estimates of depths ranging from 18" to 2 fathoms (0.5 to 4 m) or more.

On 4 July 1983 I was aboard the *T.V. Oshoro Maru* which was leaving a salmon gill-net sampling station at 55°00'N 147°30'W in the northern Gulf of Alaska. About 25 Northern Fulmars (*Fulmarus glacialis*), 4 Black-footed Albatrosses (*Diomedea nigripes*), 6 Fork-tailed Storm-Petrels (*Oceanodroma furcata*) and 1 Short-tailed Shearwater (*Puffinus tenuirostris*) were gathered at the offal slick which was apparent even on the relatively calm sea surface. This group was typical of the relatively small assemblages noted during my 2-week cruise. As the ship got under way, a dark-phase fulmar flew in and landed within 1 m of another dark-phase fulmar already present. The newcomer lunged aggressively with opened beak and half-opened wings to drive the other bird back 1-2 m, and then abruptly reared-up on the surface and dove almost vertically with wings partially opened. It popped to the surface 6 seconds later, swallowed something, waited perhaps 4 seconds, and dove again for 6 seconds. I then lost track of the bird as the ship moved off station.

After I recovered from the surprise of actually seeing a fulmar dive, questions came to mind. How frequently do fulmars dive? Under what conditions are fulmars likely to dive? I contacted other observers who have watched numbers of fulmars feeding at sea and found two who recall seeing fulmars dive. R.G.B. Brown (pers. comm.) reported seeing fulmars dive on three occasions in the Greenland Sea and Baffin Bay. Single birds on two occasions and two birds on another submerged for 3 to 5 seconds while feeding apparently on planktonic items. In all cases birds dove from the surface. A bird submerged for 3 seconds was feeding where Black-legged Kittiwakes (*Rissa tridactyla*) were plunging and submerging to tails and wingtips—a depth of about 40-50 cm.

In the North Pacific, H. Ogi (pers. comm.) experimented with baits suspended from a floating wooden bar at seven depths, ranging from 20-200 cm. Many fulmars were unwilling to approach the floating bar and birds were frightened away after one became hooked on the line. Some fulmars dove for bait during three "sets," but they did not try for bait at a depth greater than 80 cm.

Fisher (1952) thought that fulmars will dive, "with enough stimulus, e.g. for light-coloured fatty stuff." I have seen frenzied fulmars rush to choice, just-jettisoned fish entrails only to watch the food sink, just out of reach, with no more effort employed by

the birds than submerging head and neck before giving up. The bird I saw dive for 6 seconds was probably well below the surface and could have retrieved large amounts of food other fulmars missed. Is food normally so plentiful that individual fulmars become sufficiently motivated to dive only when desperately hungry? The aggressive feeding behavior displayed by fulmars on many occasions may make it hard to distinguish extremely hungry birds. And of course certain choice food items might "turn-on" any fulmar to diving. This possibility should be investigated. "Natural" foods taken by fulmars (see Fisher 1952) apparently come from the surface layer. The relative importance of nocturnal feeding by fulmars and other seabirds, particularly pelagic species, is almost unknown. Possibly fisheries discards are less important in the fulmar's diet under many circumstances than is often believed. Perhaps enough of this offal is available at the surface so that what sinks is usually unimportant and not worth the effort of underwater retrieval.

Do fulmars dive only when more agile underwater retrievers (e.g. shearwaters) are not present? Fulmars feeding at vessels in areas where aggressive surface-feeders like gulls and underwater feeders like shearwaters are present can be seen to be at an obvious competitive disadvantage because they neither feed by "dipping" from flight nor fly as adeptly in close quarters as gulls, nor do they (normally) catch or retrieve items underwater like shearwaters. Fulmars often appear to compensate for this disadvantage by crowding closer than other species and aggressively contending for whatever comes within reach. Even where there was no subsurface avian competition for sinking food, however, I have seen thousands of fulmars feeding at pelagic sources of discards and have witnessed just this one incident of diving. And when this incident took place there was much less competition for discards than on many other occasions. Several times I have observed adult Glaucous-winged Gulls (*Larus glaucescens*) diving from about 1 m above the surface and (barely) submerge while attempting to retrieve sinking food. However, I observed this behavior only when very few other birds were competing for the food. To gulls and fulmars, diving is likely only marginally worthwhile energetically. Are these birds more inclined to dive when competition is minimal or lacking?

Have fulmars learned to dive only recently, with the advent of "industrial fishing?" While this presumably could have been the case in the Atlantic (see Fisher 1952), observations by Anthony (1895) and Linton (1908) would seem to predate intense, large scale effort in the Pacific. It is clear that this aggressive, successful species, with its long-documented association with man, has long included at least some individuals that could and did dive. Fulmars have been known to dive for many generations, and diving is not restricted to one population or another.

Have only certain individuals adopted the diving technique? Due to the apparent infrequency of encounters with diving fulmars, this question is likely unanswerable. The value of diving behavior may be marginal enough for fulmars so as not to reflect in its spread throughout a population.

The reports given here indicate fulmars may dive at natural feeds and also for fishing discards, and to relatively shallow depths. Further experiments would be of great interest. Descriptions of prey taken during diving are needed to document the type of "pursuit diving" employed. Do fulmars actually "pursue" or do they simply extend their reach toward relatively inactive plankton? In the case of discards, perhaps "retrieval diving" is what fulmars actually perform.

Perhaps, though it seems unlikely, other observers are seeing lots of fulmars diving. Response to this note may document and explain the extent of this "controversial" behavior in a species otherwise well-known.

Thanks are due the Faculty of Fisheries, Hokkaido University, Dr. H. Ogi, and Capt. T. Fujii of the *T.V. Oshoro Maru* for my attendance on several research cruises in the North Pacific. J.R. Jehl, Jr., and S.M. Speich very helpfully reviewed an early version of this note. R.G.B. Brown and H. Ogi also kindly furnished field notations.

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Northern Fulmar

Sketch by Tim Manolis

NOTABLE RECORDS OF BIRDS FROM EASTERN SONORA, MEXICO

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A literature survey of bird distribution in Sonora, Mexico, indicates a conspicuous lack of information from east-central portions of the state. Most ornithologists travel via Hermosillo to Guaymas, thence southeast along the coast to more tropically vegetated southern states (as outlined by Alden 1969). Exploring many areas of east Sonora requires a four-wheel drive vehicle because of rough mountainous dirt roads. This inaccessibility enhanced by poor maps, is a major reason for avoidance by ornithologists.

From 27 April to 8 May 1978, Dean Hendrickson and I observed birds in Sonora while on a trip to collect fish in the Río Yaqui drainage (itinerary and detailed maps in Hendrickson et al. 1980). Historical records are from van Rossem (1945), Friedmann et al. (1950), and Miller et al. (1957), unless noted otherwise. We found 102 species; accounts of the most noteworthy records follow.

On 29 April we observed an adult White-tailed Hawk (*Buteo albicaudatus*) for several minutes as it flew over oak (*Quercus* spp.) woodlands 20 km north of Nacozari de Garcia (30°29'N, 109°38'W, elev. 1500 m [Figure 1]). The white underparts and contrasting thin black terminal tail band of an adult were apparent as the bird soared in early morning thermal air currents. Although the White-tailed Hawk has been recorded farther north, sightings have been scarce, warranting its inclusion in this note.

The northernmost previous record of Military Macaws (*Ara militaris*) in Sonora is a 1931 sighting near Soyopa (van Rossem 1945). Don Ducote of the Arizona Sonora Desert Museum saw two Military Macaws in a Kapok tree (*Ceiba acuminata*) 11 km from El Novillo on the Bacanora-Sahuaripa road on 27 April 1977 (Gale Monson pers. comm.). On 7 May we observed and photographed two Military Macaws in a side canyon of the Río Yaqui (29°25'N, 109°15'W, elev. 500 m). We were first attracted by a flash of color and raucous calls when the birds flew over our vehicle. As we walked up the canyon, we saw two birds perched in an *Acacia*. The birds became alarmed at our approach, dove at us, and flew down the canyon. The sighting was approximately 5 km from the Río Yaqui along the Sahuaripa-Diviaderos road as it climbs west from the river. The side canyon contained a lush growth of vegetation consisting of Fremont Cottonwood (*Populus fremontii*), *Acacias*, fan palms (*Erythea aculeata*), Common Mesquite (*Prosopis juliflora*), seep-willow (*Baccharis salicifolia*) and numerous unidentified shrubs and forbs. We searched for a nest to determine if the birds were a breeding pair but found none. These recent sightings indicate that Military Macaws' northern range may follow the Río Yaqui canyon, and quite possibly the Río Moctezuma canyon between San Pedro and Moctezuma. Five other Military Macaws were seen farther south, near Nuri.

Blue Mockingbirds (*Melanotis caerulescens*) are fairly common in thick vegetation in the extreme southeast corner of Sonora. We observed a Blue Mockingbird on 6 May near Santo Tomás (28°57'N, 109°12'W, elev. 460 m). It was perched low on a branch in a mesquite thicket with a dense forb undergrowth along the Río Sahuaripa 10 km south of Sahuaripa. This species probably reaches its northern limits somewhere in the dense thorn forest between Nuri and Alamos. The bird sighted at Santo Tomás may have wandered down the south-to-north flowing Río Sahuaripa.

Tropical Parulas (*Parula pitiayumi*) have been recorded in Sonora from the southeast corner and as an isolated population near La Chumata mine on 26 May 1905 55 km north of Ures (Thayer and Bangs 1906, van Rossem 1945). On 6 May we observed a group of 10-15 Tropical Parulas in early morning, foraging among mesquite along Río Sahuaripa 5 km south of Guisamopa (28°38'N, 109°07'W, elev. 690 m). This sighting, which may

have been of late migrants going north, was within the large void between La Chumata and Alamos.

A Flame-colored Tanager (*Piranga bidentata*) collected at Alamos on 30 March 1888 and two other southeastern sightings are the only Sonoran records for the species (van Rossem 1945). On 4 May we observed a single Flame-colored Tanager near Movas 40 km northwest of Nuri along a side canyon of the Río Chico (28°12'N, 109°28'W, elev. 300 m). The brilliant red individual was first seen 15 m away perched on a thorny tree. White wing bars and tail edges became evident as it flew 10 m to another tree. The habitat was thorn forest on volcanic ridges leading down to lush cottonwood (*Populus monticola*) and willow (*Salix* spp.) riparian woodland along Río Chico. Although there is one breeding record for Sonora (Miller et al. 1957), Flame-colored Tanagers are still rare in the state and sightings are probably of vagrants.

In the same canyon where we sighted the Military Macaws, we observed a solitary fully adult male Orchard Oriole (*Icterus spurius*). Orchard Orioles were unrecorded in Sonora (Miller et al. 1957) until specimens were taken from the southeast in late 1950s (Hubbard and Crossin 1974). During spring 1979 and 1980, Scott Terrill and Kenneth Rosenberg (pers. comm.) saw several Orchard Orioles in riparian vegetation along the Río Sonora near Ures. These sightings indicate this species may be expanding its range northwesterly from Chichuahua and Sinaloa, where nesting has been recorded.

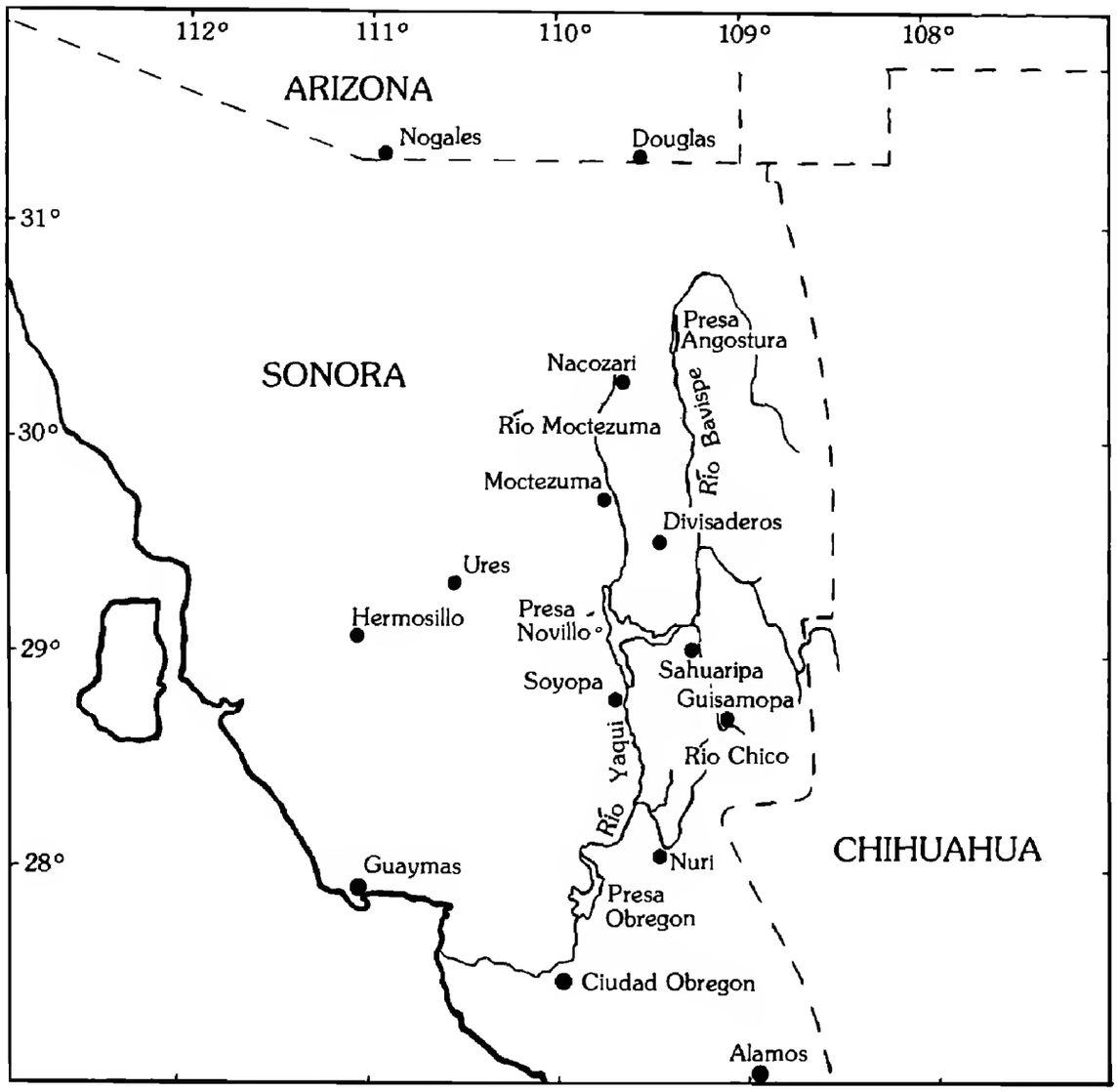

Figure 1. Map of Sonora, Mexico, showing place names mentioned in text.

The east central portion of Sonora is very poorly known biologically; as evidence, several undescribed species and subspecies of fish were collected from the area during 1978 (Hendrickson et al. 1980). No undescribed species of birds are likely but many species reach their northwestern range limit in Sonora. Owing to the lack of information, evaluation of sightings of uncommon birds is difficult and based primarily on conjecture. Some species may be dependent on thorn forest and associated vegetation types but occasionally wander, whereas others could be in the process of expanding their ranges.

I wish to thank Gale Monson and Dale Zimmerman for their informative comments and review, and Kenneth Rosenberg for his initial encouragement to write this note. This trip was sponsored by Arizona State University from a U.S. Fish and Wildlife Service contract.

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Blue Mockingbird *Sketch by Narca Moore-Craig*

BOOK REVIEW

Island Biogeography in the Sea of Cortez. Case, Ted J. and Martin L. Cody, eds. 1983. University of California Press, 2120 Berkeley Way, Berkeley, CA 94720. xii + 508 pp., 72 line drawings, 11 halftones, 33 tables. $55.00.

The birth of this volume was a symposium on the same subject at the University of California, Los Angeles, in 1977. That this title has come along so many years later is a blessing, presumably to be attributed to the editors. For once the papers from a symposium have been rewritten, reviewed and assembled with the idea that a collaboration can be coherent and cohesive. One would not expect 15 writers to agree on everything; they certainly do not. But at least they are discussing the same region and addressing some of the same issues.

Individual writers were given the choice between using "Sea of Cortez" and "Gulf of California" (so the reviewer gets his choice, too). Whichever name is used, the body of water is the 1070 km-long, 100 to 200 km-wide division between the peninsula of Baja California and mainland Mexico. The specific focus was the islands, of which there are about 25 major ones, including 67 km-long Angel de la Guarda (elevation 1315 m) and Tiburón with an area of 1,000 km², and about 10 very small islets.

These desert islands are, on relative terms, some of the most pristine in the world. The species of plants and vertebrates present on the various islands are now reasonably well known, partly through the efforts of the authors. Many gaps remain (and are freely admitted), and with basic inventories only just completed, one can imagine the potential for the study of the biology of individual species and of community ecology. Discussions of invertebrates are not included.

Two chapters deal with birds. Chapter 8 (pp. 210-245) by Martin L. Cody is on the land birds. Cody begins the chapter with a discussion of the potential sources of the island avifaunas, especially the Sonoran desert which borders the Gulf of California. The Sonoran desert as a whole does not have a particularly distinct avifauna; most species occur widely in other deserts or other habitats. The "Gilded" Flicker is the closest to being typical of the region and endemic. Because the islands are low and dry, montane colonists need not apply, and the nearby montane regions come in for only limited discussions. Also included is a brief but adequate discussion of patterns of (primarily) subspecific differentiation along Baja, as well as other oddities of the peninsular avifauna.

To provide comparative data for his investigations of the islands, Cody did some basic census work on the mainland (the species lists are in the appendices). Seven sites are in the typical desert habitats around the northern and central Gulf, and four in the thorn scrub of the summer rain region on both sides of the mouth of the Gulf.

Not surprisingly, the birds of the islands are drawn from the surrounding deserts. No species are endemic to the islands, and only a few weakly differentiated races are unique to the islands. It is always interesting to see which species are absent: Greater Roadrunner is not a surprise, but the absence of Cactus Wren from all but one of the cactus-rich islands is startling. Perusal of the species lists reveals other interesting occurrences — for instance, Great Horned Owl, which has not colonized the Channel Islands of California, is present on 10 of the large islands.

Much of the purpose of this volume is to discuss island biogeography, and Cody devotes most of his chapter to a discussion of the observed patterns. While I am not facile with the mathematical models of this discipline, most of Cody's conclusions seemed reasonable. A latitudinal change in the species composition is related to the brushier thorn scrub habitats of the southern islands and adjacent source areas. The richest island, Tiburón, is the largest, lies only 2 km from the mainland, and was formerly connected by a landbridge (current channel depth: 3 fathoms).

Cody found that 79% of the variability in bird species could be attributed to the area of the island. Distance from shore (never too far in the Gulf anyway) and the former

presence of a landbridge were relatively unimportant. For a given size of island, the species present are quite predictable. As island size increases, there are changes in hydrology and thereby floristic diversity, which is in turn related to an increased number of bird species present; Cody attempts, with mixed success, to develop a stadial model for this relationship. Species present on small islands are also present on large islands; the presence of a habitat is more important than the presence (or absence) of other species. Undoubtedly extinctions occur from time to time, but in most cases there is probably rapid replacement by the same species. It is also important to realize that in this desert avifauna, few taxonomically closely related species act as substitutes; there are few "either/or" situations, although obviously some reductions occur in groups such as wrens and thrashers from mainland to island sites.

A couple pages of discussion of migrant landbirds contribute little. Appendix 8.8 gives a number of records island by island for migrants and wintering species. Although the records increase substantially the meager amount published previously, Cody does not indicate which were recorded in spring or fall, a fact of considerable importance, given the different routes some species take coming and going. Black-lored and white-lored White-crowned Sparrows can be easily separated as adults; such information would provide preliminary sorting of the populations of that species. The presence of wintering Savannah Sparrows in the intertidal zone is nice, but are they small-billed or large-billed salt marsh forms, or pale interior birds? Migration was not the main focus of the author, nor has he had the chance to do extensive field work on all the islands; the subject of trans-gulf migration (both directions in both seasons) of landbirds is an exciting field deserving much study.

There are other quibbles. I am uncomfortable with statements such as the one that Xantus' Hummingbird complements "Costa's hummingbird in a role comparable to that of the black-chinned hummingbird elsewhere." Some of the range maps (e.g. Xantus' Hummingbird and Bendire's Thrasher) seem a bit generous. However, the factual basis is sufficiently solid, and most of the conclusions have been erected on firm scaffolding. This interesting and thought provoking article should leave most readers much better informed about the biogeography of the entire region.

Chapter 9 (pp. 246-264) by Daniel Anderson is about the seabirds. To some extent it does not fit into the rest of the book. Seabirds are extremely mobile animals which seek oceanic islands for refuge and often to avoid the dangers of the mainland. Thus, many of the central concerns of island biogeographers expressed in other chapters simply do not apply. However, the seabirds are a conspicuous and well publicized part of the gulf biota, and the chapter is a welcome one.

Anderson briefly considers biogeography. Considering the Gulf of California as a region, only 1 of the 14 breeding seabirds is endemic: the Yellow-footed Gull. If the region on the western side of Baja is included, the figure becomes 4 of 14: Heermann's Gull, Elegant Tern and Craveri's Murrelet are added to the total. Even so, the percentage of endemism is substantially less than that of the San Diego province/California region. In terms of origin, Anderson calculates that 73% of the breeding birds of the Gulf of California have a southern, warm water origin, whereas 27% are of northerly, cold water affinities. Many of the breeding species largely leave the Gulf after breeding, including post-breeding dispersal north along the Pacific Coast and migration south to wintering grounds.

Anderson reviews methods of feeding, the typically estuarine species which breed on island shorelines, and the characters that make islands suitable breeding sites. He also points toward some basic subjects still in need of study, such as the degree of competition between Black and Least storm-petrels, or Royal and Elegant terns, and the adaptations of some nesting species to desert conditions. Three appendices summarize characteristic feeding areas and methods, food, nesting substrate, general range in the Gulf and the number of islands used for breeding, and general population estimates, and present an assessment of the importance of the Gulf as a breeding

ground for a given species and/or race. I found the estimates of population size particularly interesting, and some of Anderson's information on these topics will prove useful to conservationists wishing to extend the limited protection now received by the islands in the Gulf.

Anderson's chapter is mostly a review, although his field work has added to what was known. Clearly much remains to be learned about seabirds in this region. I was somewhat frustrated by this chapter, partly because a number of topics were only mentioned in passing. The statement that "In fact, I have studied at least six seabird species that freely migrate across the peninsula (Anderson, field notes)" leaves me climbing up the wall — which ones? Elegant Tern has not been conclusively recorded in the interior of the southwestern U.S., and yet is common in the northern Gulf; I have always wondered if the birds breeding on Isla Rasa reached California via Cabo San Lucas or by hopping Baja California. Also, the importance of the Gulf as a wintering ground for many waterbirds and as a corridor for migration deserved more attention. Although some of these topics are only distantly related to island biogeography, they are related to the Gulf as a whole, and I suspect that the author knows a great deal about these subjects, subjects which arouse the curiosity of many.

In addition to the two chapters on birds, there are ten other chapters on which I shall comment briefly. I wish to stress that the subject of the title, the islands of the Gulf, may seem limiting because few people will actually visit the islands. However, biogeography must deal with the source areas, which principally include Baja California, Sonora, Sinaloa and the Sonoran desert portions of the United States. Many of the chapters serve to introduce these vast and fascinating areas in as much detail as the islands themselves.

Chapter 1 by George E. Lindsay is a brief history of the scientific exploration of the region and introduces the reader to some of the major figures and important institutions. A "recommended reading" section might have been a nice touch and a good way to pick the most important titles from the extensive bibliographies presented later.

Chapter 2 is on the geology of the islands. By Gordon Gastil, John Minch and Richard P. Phillips, this chapter is not too technical and provides an overview of the formation of the entire Gulf. Two tables give the principal rocks, probable ages and origins, areas, distances to the nearest land, and depths of the intervening channels for all the islands.

Linda Yvonne Maluf wrote the chapter on physical oceanography. A number of figures help present a clear picture of the bottom of the Gulf, tides, salinity, water temperature, currents and dispersal of sediments. I particularly enjoyed this chapter; for instance, I was intrigued by the fact that the evaporation from the Gulf is greater than the inflow of fresh water.

Plants are the subject of Chapter 4 by Martin Cody, Reid Moran and Henry Thompson. A long chapter, the first parts add to the preceding chapter by giving valuable information on the physical setting, including temperature and rainfall. Other topics include the phytogeographic regions around the Gulf, the paleohistory of those regions, plant communities on the islands, and all the subjects of concern to an island biogeographer in relation to those communities. A final section considers in detail the ecology of a few major families (e.g. cacti). For this very poor botanist, the chapter was still readable and interesting.

Chapter 5 is on the rocky-shore fishes. I hadn't thought about the island biogeography of salt-water, inshore fishes before, so I cooked up a few quick theories. Donald Thomson and Matthew R. Gilligan wrecked them in the course of an educational chapter on fish.

Reptiles are the subject of Chapter 6 (Robert W. Murphy: Origins and Evolution) and Chapter 7 (Ted J. Case: Ecology). Chapter 10 by Timothy E. Lawlor is on the mammals. The result of their work is 103 pages of information on the distribution and ecology of these vertebrates, obviously more than can be easily summarized. I will

confine myself to saying that it is interesting to consider the many differences between birds and other groups of organisms in relation to island biogeography. For instance, the former presence of a landbridge often has much greater lingering effects on a reptile or mammal fauna than it has on the more vagile bird and plant communities.

In Chapter 11 Conrad Bahre discusses the human impact on the Midriff islands. I felt that the author, by sticking closely to a thoroughly collected assortment of facts, leaned too far backward from making even some tentative conclusions about the effect humans have had. Still, Bahre presents much of interest on the diet of the Seri Indians, mining of guano, and hunting of sea turtles, and provides a good reminder that this region, particularly its fisheries, will come under increasing pressure as the population of northwestern Mexico continues to grow rapidly.

Chapter 12 by Case and Cody concludes and summarizes the preceding chapters; it also might be the best chapter to read first. For those with little knowledge of the principles of island biogeography, there is an extended introduction. I don't think any punch lines would be spoiled by reading the conclusions first, and the conclusions might make the individual chapters more instructive by providing a framework on which to hang the more isolated facts and inferences. If you are looking for some real conclusions, well, "there is no unanimous support for the equilibrium theory." Still, this volume conveys the usefulness and excitement of island biogeography, and suggests that although no laws are carved in stone, there is much order in a seemingly random world.

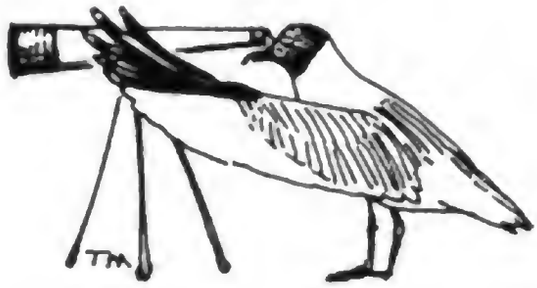
The 157 pages of appendices present two basic types of information: details to support statements by the authors and detailed lists of the flora and fauna of the islands. These lists are very dry, but will undoubtedly be an essential reference for those visiting the islands or starting research projects.

Although this book was easy to read and attractive, I feel that the technical editing was a bit lax. In the bird chapters I found a number of lapses, such as "Gilded Woodpecker" and "black-throated hummingbird;" in another case, a more serious error was "black-chinned sparrow" (p. 239) where "black-throated" was meant. I was particularly struck by the number of maps, figures and tables which had errors (misspelled names of islands, switched captions) or omissions (unexplained symbols). While not of epidemic proportion, and generally detectable and correctable, the errors do leave me hoping that the appendices were very carefully checked.

The book has one serious problem: a 500-page, hardcover volume without color art or photographs seems very expensive at $55. This volume is an absolute must for regional libraries and institutions in the Southwest and for serious research libraries around the world. It will be valued by people studying this region, planning extensive visits, or studying the biology of islands. But for the less affluent who wish, as the dust cover suggests, to vicariously explore this region, I would suggest visiting the first refuge of the vicarious explorer: the library.

RICHARD WEBSTER, P.O. Box 6318, San Diego, California 92106

IDENTIFICATION QUIZ



The key to making a correct identification of this bird is to pay close attention to its *environment* as well as its *appearance*. At first glance it appears we have little to go on. However, if we focus our attention on the bird's face, we note a broad, flat bill; large, dark eyes; faint, light eyerings; and pale lores. These features can belong to only a few North American birds, specifically *Empidonax* flycatchers and female or immature male American Redstarts (*Setophaga ruticilla*). A redstart would not show pale edges to the tertials or a long tail no darker than the back. At this point, some of us might think of vireos, e.g., Hutton's (*Vireo huttoni*) or Solitary (*V. solitarius*), but these have narrower bills and

build pendant nests suspended by the rim from the arms of a forked branch. The bird, what can be seen of it, has the overall look of an *Empidonax* sp., which in fact it is.

Now most *Empidonax* flycatchers are difficult to identify even when the entire bird is in view. What makes us think this bird can be identified to species? Here's where a shift in focus, from bird to environment, is in order. The bird is obviously on a nest, and *Empidonax* spp. are quite distinctive in their nesting habits (consider the choices confined to those species nesting in western North America). There are really *two* taxonomic identifications to be made in this photo: the bird and the shrub in which it is nesting. Careful examination of the leaves around the nest reveals the characteristic size and shape of leaves of many species of manzanita (*Arctostaphylos*), the preeminent plants of western montane chaparral. The characteristic *Empidonax* of this habitat is the Dusky Flycatcher (*E. oberholseri*), which often nests in manzanita bushes.

Is there any reason to suspect another species? Gray (*E. wrightii*) and Hammond's (*E. hammondii*) flycatchers are the only other reasonable candidates, but neither fits the picture. Gray Flycatcher should show a bright pale base to the lower mandible and usually builds a less-tidy nest in Big Sagebrush (*Artemisia tridentata*) or other plants of the Great Basin deserts. A Hammond's Flycatcher would show a shorter tail and longer wings, and would usually build its nest on a high, horizontal branch of a conifer. All aspects of this bird's appearance and nest environment best fit Dusky Flycatcher — the correct conclusion.

The bird was photographed in August 1974 at Castle Crags State Park, Siskiyou County, California, by Bruce Webb.

TIM MANOLIS, 3532 Winston Way, Carmichael, California 95608

Dusky Flycatcher *Sketch by Keith Hansen*

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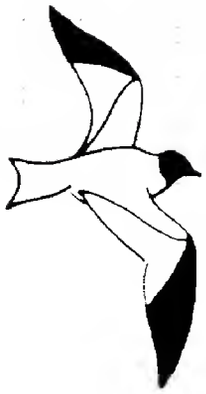
Cover Photo by Kenneth W. Fink: Sharp-tailed Grouse (*Tympanuchus phasianellus*) displaying about 4 km SE of Highwood, Chouteau Co., Montana, 0530 approximately 20 May 1979. ASA 64, 560 mm lens, overcast.

Manuscripts should be sent to Alan M. Craig, P.O. Box 254, Lakeview, CA 92353. For matters of style consult *Suggestions to Contributors to Western Birds* (6 pp. mimeo available at no cost from the Editor) and *Council of Biology Editors Style Manual* 4th edition, 1978 (available from the American Institute of Biological Sciences, 1401 Wilson Boulevard, Arlington, VA 22209 for $12.00).

Papers are desired that are based upon field studies of birds, that are both understandable and useful to amateurs, and that make a significant contribution to scientific literature. Appropriate topics include distribution, migration, status, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, the techniques for identifying, 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 papers dealing with studies accomplished in or bearing on Rocky Mountain states and provinces westward, including Alaska and Hawaii, adjacent portions of the Pacific Ocean and Mexico, and western Texas.

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.



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BREEDING PHENOLOGY AND MID-SEASONAL SOCIAL BEHAVIOR OF THE SOOTY GUILLEMOT ON TEURI ISLAND, JAPAN

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The breeding biology of the genus *Cepphus* (Alcidae) is represented in literature for two of the three species: *Cepphus grylle*, the Black Guillemot and *Cepphus columba*, the Pigeon Guillemot (Asbirk 1978, 1979a and b; Cairns 1978, 1979, 1980, 1981; Drent 1965; Hyde 1936, 1937; Preston 1968; Storer 1952; Thoresen and Booth 1958; Winn 1950). Notations within larger compilations (Dement'ev and Gladkov 1951, Kozlova 1957) and a short paper by Nazarov and Labzyuk (1972) have been the only reports published on the habits of *Cepphus carbo*, the Sooty (or Spectacled) Guillemot. Austin and Kuroda (1953) recorded a population of at least 7000 Sooty Guillemots on Teuri Island, Japan, in 1949, which was at that time the largest known aggregation of the genus anywhere in the world. Unfortunately, this figure is difficult to substantiate and the present number on Teuri Island does not exceed 400 birds, including non-breeders (Environmental Agency 1973). Colonies twice the size inhabit Soviet islands to the north (Nazarov and Labzyuk 1972). I camped on Teuri Island in June and July 1981, to observe the breeding habits of this little studied species.

All three species of *Cepphus* nest as individual pairs, in small groups, or in larger groups — up to 10,000 pairs for the Black Guillemot (Nettleship 1974) — according to the availability of nesting cavities and abundance of food supply. The Sooty Guillemot ranges from the coasts of northern Japan, Korea, and southern Kuriles to the shores of the Okhotsk Sea (Dement'ev and Gladkov 1951). The bird differs from the other two species in being slightly larger, lacking white wing patches, and possessing white eyelids which merge with white facial plumage. As in the other two species, the Sooty has conspicuously red feet and legs. The interior lining of the mouth is flesh pink as opposed to the bright coral red of the Black and Pigeon guillemots.

STUDY AREA AND METHODS

Teuri Island (lat. 44°4'N, long. 141°3'E), is one of two islands located approximately 38 km off the northwest coast of Haboro, Hokkaido, Japan. Teuri is famous in Japan as a National Monument for seabirds and is a well-known tourist attraction (Environmental Agency 1973).

Teuri Island is approximately 5.5 km² and has almost 12 km of coastline, one third of which is suitable for breeding seabirds. The island rises gently at the north end from east to west and more abruptly at the south end to high points of approximately 100 m. The rock is composed of volcanic breccia overlain with ash conglomerates. Several rocky stacks along the western shoreline also provide nesting places for birds. A village of just over 1000 persons is located at the sheltered northeastern end of the island.

The sea was remarkably calm during June and July although a few wet, foggy and windy days impeded observations. Air temperatures varied between 16 and 20° C, and the sea temperatures at shore were just a degree or two below air temperature. Tidal effect was practically nil, with a difference of less than 1 m between high and low tides throughout June and July.

Teuri Island is the site of the largest known colony of Rhinoceros Auklets (*Cerorhinca monocerata*) where a minimum of 500,000 and a maximum estimation of 785,000 individuals breed (Environmental Agency 1973). Other breeding species include Black-tailed Gull, *Larus crassirostris*, 40,000; Slaty-backed Gull, *Larus schistisagus*, 400; Common Murre, *Uria aalge*, 700 to 800; Sooty Guillemot, *Cepphus carbo*, 380 to 400; and a few scattered Ancient Murrelets, *Synthliboramphus antiquus*. (All figures represent individuals.)

I camped on Teuri from 3 June to 31 July 1981, observing for more than 700 hours. From within 25 to 50 m of the campsite 20 or more Sooty Guillemots could be observed. An additional group of birds could be seen

Figure 1. Part of the study area on Teuri Island, Japan.

easily with binoculars to the south. To the north, beyond rock piles, the remaining 300 plus birds were counted each day shortly after dawn and at intervals throughout the day. Attendance counts were made by counting every hour all birds within view of the campsite area on the sea and on land near nesting sites. Locations of nest cavities were determined by observing the movements of the birds to and from the cliffs. Sightings of birds carrying fish were used to determine locations of nest sites in which chicks were present.

A rock blind was constructed from which the entrance to eight nests known to contain chicks could be seen. Among the boulder piles at the base of the cliff 20 nests were located but only 7 of these were shallow enough to permit access to their contents.

Binoculars, notebook, tape recorder, a 16 mm motion picture camera and a 35 mm motor-driven camera were used for recording behavior. The early mating behavior was entirely missed, nevertheless social activities continued throughout June and July. Figure 1 pictures the campsite and part of the observation area on Teuri. Figure 2 shows four adult birds.

RESULTS AND DISCUSSION

Breeding Chronology and Development of Young

Storer (1952) indicated that the prenuptial (prealternate) molt of the Sooty Guillemot appeared to occur in January and February in northern Japan. This observation fits in well with the early onset of breeding activities which take place on Teuri Island.

Eggs were already hatching on 2 June 1981. On 5 June, five of seven accessible nests contained eggs: three contained two eggs and two only one. Matutoshi Aotsuka, warden of birds on Teuri Island, informed me that the

Figure 2. Adult Sooty Guillemots perched near a nesting area. One bird utters the alarm Scream from a resting position.

eggs usually hatched at about the same time every year and that, in 17 years of banding birds on Teuri, he had never found more than one Sooty Guillemot chick being fledged from a nest. Nazarov and Labzyuk (1972) also could find only one chick in each nest they examined. My observations showed that although two chicks may hatch, only one fledges. In one nest the second chick to hatch was found dead on the second day with its head severely pecked.

On 4 July 1981 the first fledgling was seen on the bay, where it was observed daily until 20 July. Allowing 40 plus days for the nestling stage (based on records from three nests) and assuming that the incubation period averaged 30 days, the first eggs of the Sooty Guillemot on Teuri probably were laid about 26 April and hatched 26 May. To the north Nazarov and Labzyuk (1972) found the earliest eggs on 8 May with the greatest number being laid after 20 May.

Of a maximum population of about 400 individuals, no more than 200 were breeders in 1981. In other words, there may have been a maximum of 100 nests with a lesser number of pairs rearing young. Nests were located under rock piles, in crevices, and under rocks higher on the slopes. Sixty percent of the nest sites, as determined by observing birds flying to them, were more than 20 m above sea level (see Figure 3). Nest sites were often defended late in the season by adults without eggs or young being raised in them. Preston (1968) noted this behavior also in the Black Guillemot on Kent Island in all five years of his study.

Throughout June and July, I observed daily 5 to 10 non-breeders which were still in mottled-grey belly plumage. These immature birds displayed with the other members of the colony. Kozlova (1957) and Nazarov and Labzyuk (1972) have also noted that young birds frequently retain white feathers late into June.

The eggs of the Sooty Guillemots resemble in appearance those of the other two species. The two eggs of a single clutch are not always marked alike, a feature also noted in the Pigeon Guillemot (Thoresen and Booth 1958). However, Asbirk (1979b) commented that the two eggs from the same clutch of Danish Black Guillemots always have the same ground color and the same pattern of spots. Ten eggs on Teuri averaged 60.37 x 41.70 mm with a range of 57.60 - 63.80 x 40.3 - 43.8 mm. These were smaller than 14 eggs measured by Nazarov and Labzyuk (1972) who on more northerly islands found a range of 61.1 - 66.8 x 41.1 - 45.2 mm. Nine eggs at late stages of incubation had an average weight of 55.57 g with a range of 50.0 - 60.1 g.

Chicks were fed at varying periods during the day. Early morning and late evening feedings were more frequent than midday feedings in 20 nests observed. Three to eight feedings per day, with an average of five, were observed on four different days, from dawn until sunset. Small chicks were usually fed fish 4-6 cm long. Occasionally a fish, too large for a chick to swallow, was either left at the nest site or carried away again by the parent. The most common fish seen being brought to the nest were sand lance (*Ammodytes* sp.), rock blennies (*Pholis* sp.) and small sculpins. Three 20 cm sand lance weighing between 28 and 29 were dropped at one nest. (A single 4.0 cm sand lance weighed only 2.0 g). As is well known, *Cepphus* feed

upon practically any small fish they are capable of catching. For example, Follett and Ainley (1976), in a study of the Pigeon Guillemot in central California found representatives of 10 families of fish including 19 genera and 24 species to form the prey of that species. The Sooty Guillemot is probably just as adaptable in its diet.

The chicks of Sooty Guillemots, upon hatching, look just like the young chicks of the other two species. They have a full covering of sooty-black down. The legs and feet are pink, turning black in a day or two. The bill is also black with a prominent white egg-tooth on the top mandible, while at the tip of the lower mandible a smaller egg tooth is also present. These features match those of the other species of *Cepphus* (Sealy 1970). Both egg teeth gradually wear off, but in the three chicks observed to fledging, a remnant of the upper one remained up to the 40th day. A single chick hatched with a body weight of less than 40.0 g, reached a peak of 605 g by Day 38, and declined to 545 g the day before fledging.

Body feathers and remiges began to show on Days 12 and 15 after which the belly feathers developed a mixture of white and sooty black. The head, neck and dorsum including the wings and tail were a uniform sooty-black by fledging time. The eyelids were white and an area around the eyes, destined in maturity to become white, remained naked until close to fledging when it filled in thinly with fine grey feathers. The feet and legs upon fledging were black or dark grey. Figure 4 pictures a juvenile in the nest cavity the day before it fledged.

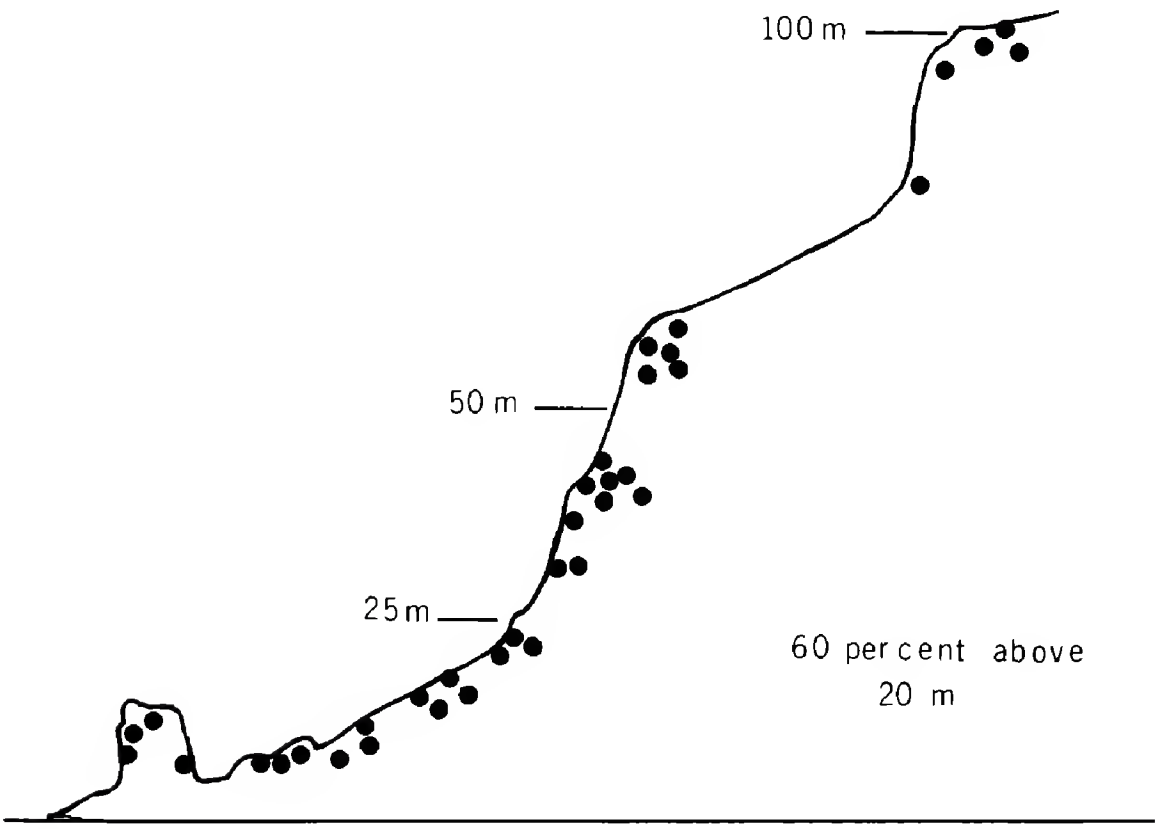

Figure 3. Profile of Teuri Island cliffs showing distribution of Sooty Guillemot nests above sea level.

One fledgling was observed for 16 days from 4 July through 19 July, feeding alone very close to shore. It was a remarkably tame bird often allowing my approach to within a few meters. When first sighted it was midway out in the bay among adult-plumaged birds which kept threatening it and driving it away from the group. One adult dived repeatedly after the young one until both were out of sight behind rocks at the bay entrance. At that time the feet and legs of the fledgling were noticeably as dark in color as a nestling's. After 12 days its plumage had changed from slaty to brown. Dement'ev and Gladkov (1951) also described the brownish color of the juvenal plumage in *Cepphus carbo*. Nazarov and Labzyuk (1972) noted that in August the juveniles become brown. Also by 12 days the feet and legs had become a brownish-red and by 19 July they were almost as bright red as an adult's. The bird never attempted to fly in the 16 days it was observed. The fledgling, unlike the mature birds, always swam with its neck withdrawn. It also boldly defended itself. On one occasion I saw the fledgling attack a bathing Black-tailed Gull so vigorously that it ploughed up onto the gull's back, causing the gull to fly away. Fledging of three birds in observed nests occurred on 20 July (Day 45), 21 July (Day 44) and 29 July (Day 40).

As evidenced by missing wing feathers in five adults, and the greying of the back of the head and neck plumage in four birds, the annual prebasic molt began at the beginning of July. All four birds seen to be in molt were still feeding young.

Colony Attendance

Toward the end of the first week of July a noticeable switch in the pattern of attendance occurred. Figure 5 shows a gradual shift in attendance to later in the day. This unexplained change of pattern in colony attendance by the

Figure 4. A 44-day-old Sooty Guillemot nestling in its nest cavity the day before it fledged.

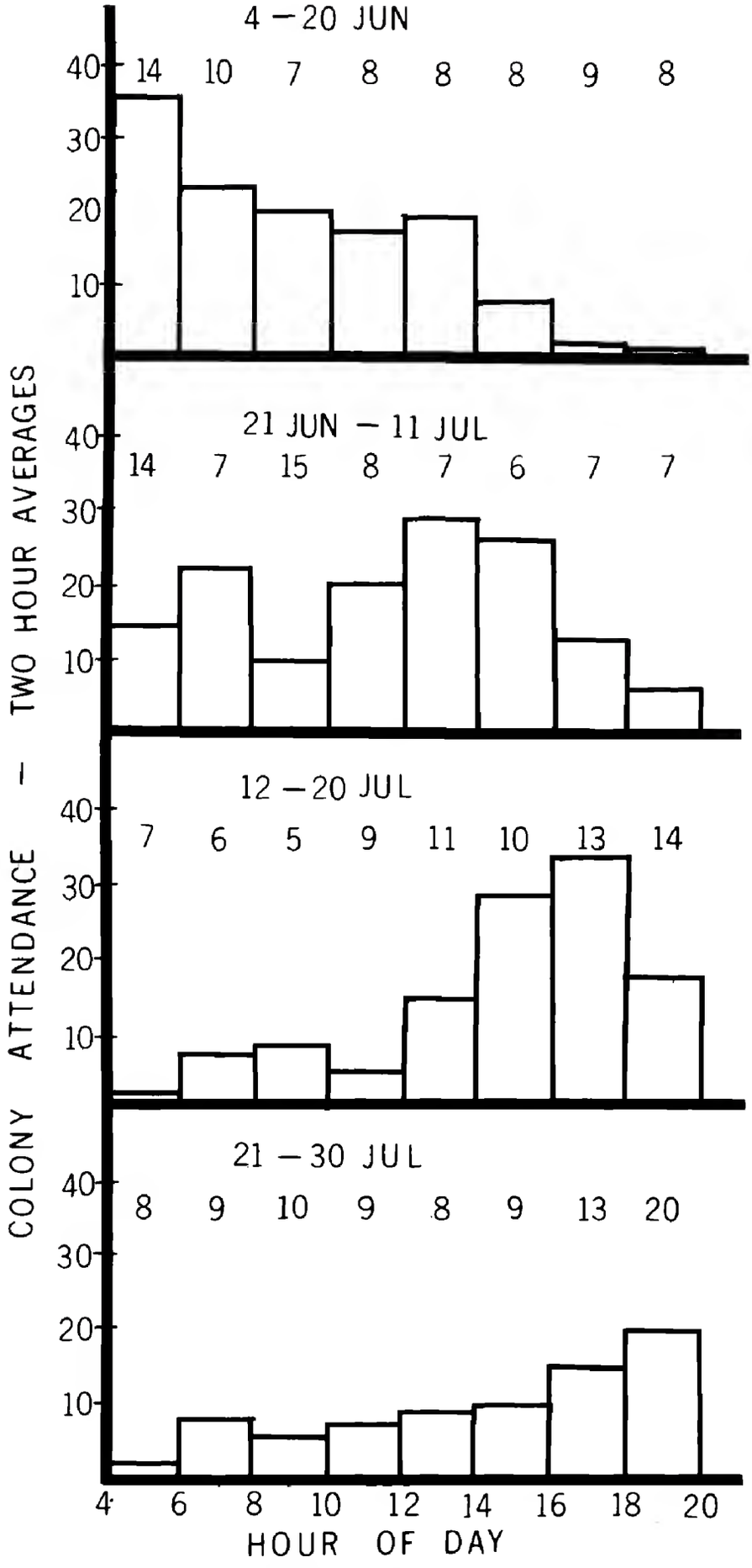

Figure 5. Colony attendance of Sooty Guillemots at intervals during June, July and August 1981. Figures at the top of each graph represent number of counts averaged for each 2-hour period. Colony attendance includes birds on land and on the water close to shore.

Sooty Guillemots was unlike the uniform attendance patterns throughout the breeding season demonstrated by the Pigeon Guillemot (Drent 1965), and the data presented by Asbirk (1976b) and Cairns (1979) for the Black Guillemot. In June, birds arrived in large numbers at dawn and were active on the sea and at the breeding sites until 1500 to 1600 after which time only a few scattered individuals were observable within 0.5 km of shore. By 20 June, a detectable lowering of numbers occurred between 0900 and 1100 each day. By noon a large percentage of the population returned to the rocks and cavity entrances to defend either empty or occupied nest cavities. By 12 July, only the few birds feeding young were ever close to land before 1000. Most other birds returned at about 1300 and stayed until 1900. Sunset at this period was between 1915 and 1930. A few were still at their perches near their nests until 2000. Slight variations occurred with the weather but in general the weather appeared to have little effect on activity. The low numbers of birds carrying fish during the latter half of July indicated that the change in colony attendance had nothing to do with growing demands for food by young.

Behavior

The habits of the Sooty Guillemot closely resemble those of the other two species of the genus. Sooty Guillemots on Teuri were very sensitive and suspicious birds. Kozlova (1957) also noted their shyness. I partially attributed their caution to the alarm calls and frequent panic flights of the Black-tailed Gulls. Incubating birds would flush at the slightest sound such as a falling rock within 10 m. However, in an area immediately below a tourist observation platform near the top of the cliffs on Teuri, one pair showed little concern for the presence of man. There they seemed to be conditioned to people.

Sooty Guillemots when not disturbed almost always made a direct flight into the nest when carrying fish to their young. If a fish-carrying bird did hesitate it was chased by a gull (six out of seven observations) attempting to snatch the fish.

Discussion of Behaviors

The sounds produced by the Sooty Guillemot were found to be less intense than those of the Pigeon Guillemot. For example, the strong "seeeooo" of the alarm or warning scream of the Pigeon Guillemot is reduced to a thinner sounding "seeee" in the Sooty Guillemot (Figure 6c). The "tsit" or "chip" sound (Figure 6d) is similar in all three species of *Cepphus* and is given at varying intervals, even in flight. The contexts and interpretations of behaviors observed are summarized in Table 1.

The trilled call (Figure 6a and b) lacked the "seeeooo" addition in the middle of the call usually heard in Pigeon Guillemots and in this respect more closely resembled the descriptions given for the Black Guillemot (Preston 1968, Storer 1952, Thoresen and Booth 1958, Drent 1965). Asbirk (1979a) refers to this call in the Black Guillemot as the "Nest song," which I believe rightly identifies it with nest territory ownership.

Squat-peeping or Hunch-whistle is one of the most common social displays seen in all three species of guillemots (Figure 7a). Some observers

have interpreted it as an aggressive display (Asbirk 1979b, Drent 1965, Preston 1968). However, my observations on the Sooty Guillemot did not always reveal an aggressive action. Squat-peeping was sometimes demonstrated by a single bird in a group or at the nest site when an intruder landed nearby. In all of my hundreds of observations of Squat-peeping, Strut-circling by a second bird accompanied it. Strut-circling was characterized by frequent Head-dipping while swimming around the squat-peeper. Squat-peeping may be a sign of being mated both in the Sooty and the Pigeon Guillemot. Numerous observations on both species indicated that when a mated bird, sitting near its nest entrance or on the water below the nest site, was approached by an intruder the former began to Squat-peep. This attracted the mate if it was within calling distance. When the mate arrived it responded by circling the squat-peeping bird. This demonstration usually encouraged the intruder to leave without attack. Otherwise the arriving mated bird displaced the intruder by Strutting, Hunching or attack.

Twitter-waggle (see Figure 7b) is an aggressive display common to all three species of the genus although Drent (1965) interpreted Twitter-waggle in the Pigeon Guillemot to be an appeasement action. In the Sooty Guillemot, the action was strongly aggressive and frequently performed by individuals among groups on the water or on land. Birds jostling for the highest position on the rocks displayed Twitter-waggle constantly. It was also a major part of aquatic displays and was always a mechanism for increasing distance between birds. On one occasion I watched, for 15 minutes, a single Sooty Guillemot continuously Twitter-waggle towards a group of communally

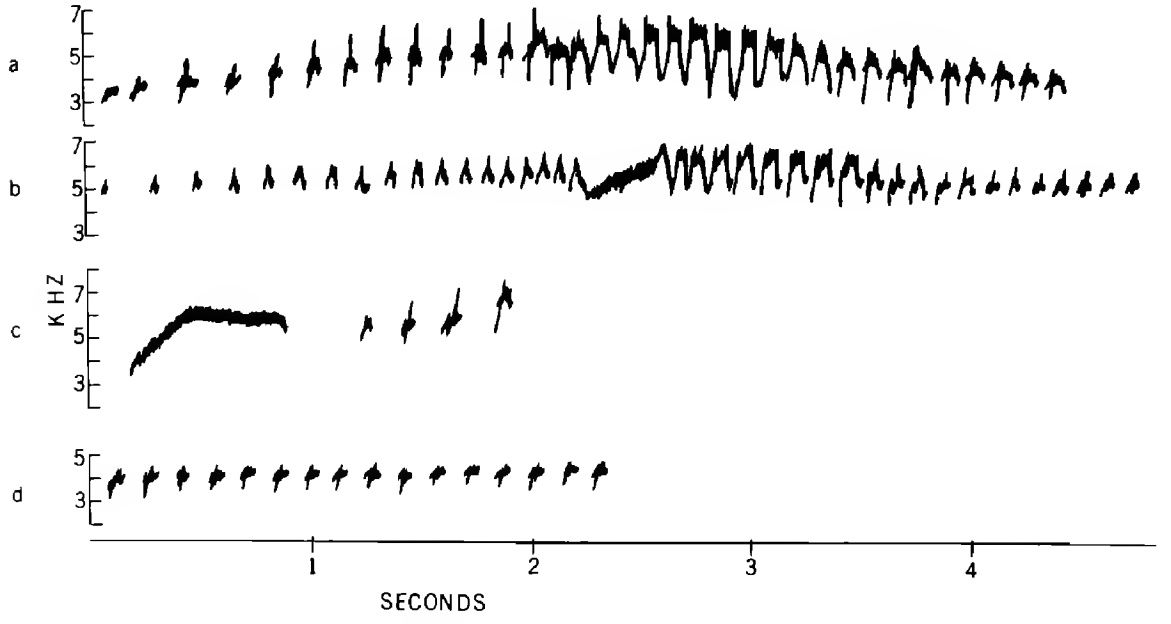

Figure 6. Sonographs of (a) the Trilled song of *Cepphus carbo* (song varies from 4 to 5 seconds in duration and always lacks the central upslur most often included by *C. columba*). (b) the Trilled song of *C. columba*. (c) the Scream ("seeeee") of *C. carbo*, followed by four "tsits" or "chips," and (d) the "tsit" or "chip," the most frequent call heard in *C. carbo*. These "chips" are portrayed here as a series lasting more than 2 seconds. Most often "chips" are given well spaced and are heard in varying situations — even in flight.

bathing Black-tailed Gulls. This bird was obviously attempting to drive the gulls away, although the gulls appeared to ignore it.

Frequently, Twitter-waggle began by a bird distantly removed from a group which would swim quickly toward the group, picking on, it seemed, any individual that would turn and Twitter-waggle back towards it. An attacking lunge and fight often followed with the two birds splashing — "Leap-frogging" (Asbirk 1979a, Preston 1968) — and diving just below the surface. The rest of the group joined the subsurface twisting and turning as individuals, ending with skittering over the surface in all directions. This action dispersed the groups temporarily. The fighters may continue to duel or they may fly from the scene in aerial chase. In the Pigeon Guillemot, Drent (1965) called the water phase of this action the "Water Dance", and the aerial chase the "Duet Flight". However, the terms "Water Duel" and "Duel Flight" are preferred because they describe the activities more accurately. Milling around on and under the water is not a dance, nor is an aggressive aerial chase a duet, since the term "duet" implies song. Duel Flight in guillemots results from an initial flight encounter started with Twitter-waggle. It should not be confused with a pair of birds merely flying together which is a common phenomenon among water birds in general. Duel Flight is an active duel between two birds in which the birds fly high and low frequently crossing each other's flight paths. In the Sooty Guillemot this duel sometimes ended by fighting in the water among groups of other guillemots as much as 0.5 km away from the initial encounter. The fight usually triggered communal subsurface Water Duelling by the new group: a confusion which tended to break up the fight.

While in the air a bird being chased may turn its head and open its beak towards the chaser, but in most encounters observed, Duel Flight was merely a contest to outfly the other. Most frequently the duel ended when considerable space developed between the two birds. In more than 100 sightings of Duel Flight among Sooty Guillemots I never witnessed actual contact in the air, such as tail twigging, or sudden 180° turns with falls into the sea as are commonly displayed by the Pigeon Guillemot.

Erect Display as seen in the Sooty Guillemot is apparently the same as "Neck Stretch," as Nelson (1982) calls it, in *Cepphus columba*. I have also observed a similar stance in Tufted Puffins (*Lunda cirrhata*) and Rhinoceros Auklets, which occasionally stand for a minute or more with their bills pointed upward. According to D. Nelson (pers. comm.) *Lunda, Fratercula, Cerorhinca* and *Cepphus columba* all vocalize during Erect Display. No vocalizations were noted in *Cepphus carbo* although I may have missed the sounds. In the Atlantic Puffin (*Fratercula arctica*) the attitude is accompanied by frequent Head-flicking, but in the Sooty Guillemot Head-flicking is rare and is much less pronounced (Figure 7d).

A strutter waddled on land or when on water swam excitedly, toward the bird to which it displayed. Strutting accompanied by holding the wings stiffly over the body (Wing-flagging) indicated a stronger aggressive action. This posture has also been described in the Black Guillemot which when on land embellishes the action with a distinctive high stepping gait (Preston 1968). Wing-flagging display may be more meaningful in the Black Guillemot which flashes white underwings. The Sooty Guillemot lacks white underwings but

does occasionally flag its wings when strutting and momentarily as a flight-intention signal. In a nonsocial context the Sooty Guillemot may hold its wings over the body for balance when walking over rocks.

Hunching is also an aggressive approach toward an intruder and is demonstrated by all three species of *Cepphus* (Figure 7c). The intruder usually moves away; otherwise a lunging attack occurs.

Headbobbing, a rare display, I interpreted as a threat in the Sooty Guillemot. Headshaking, a side to side motion, as described by Preston (1968) in the Black Guillemot, was not seen in the Sooty Guillemot.

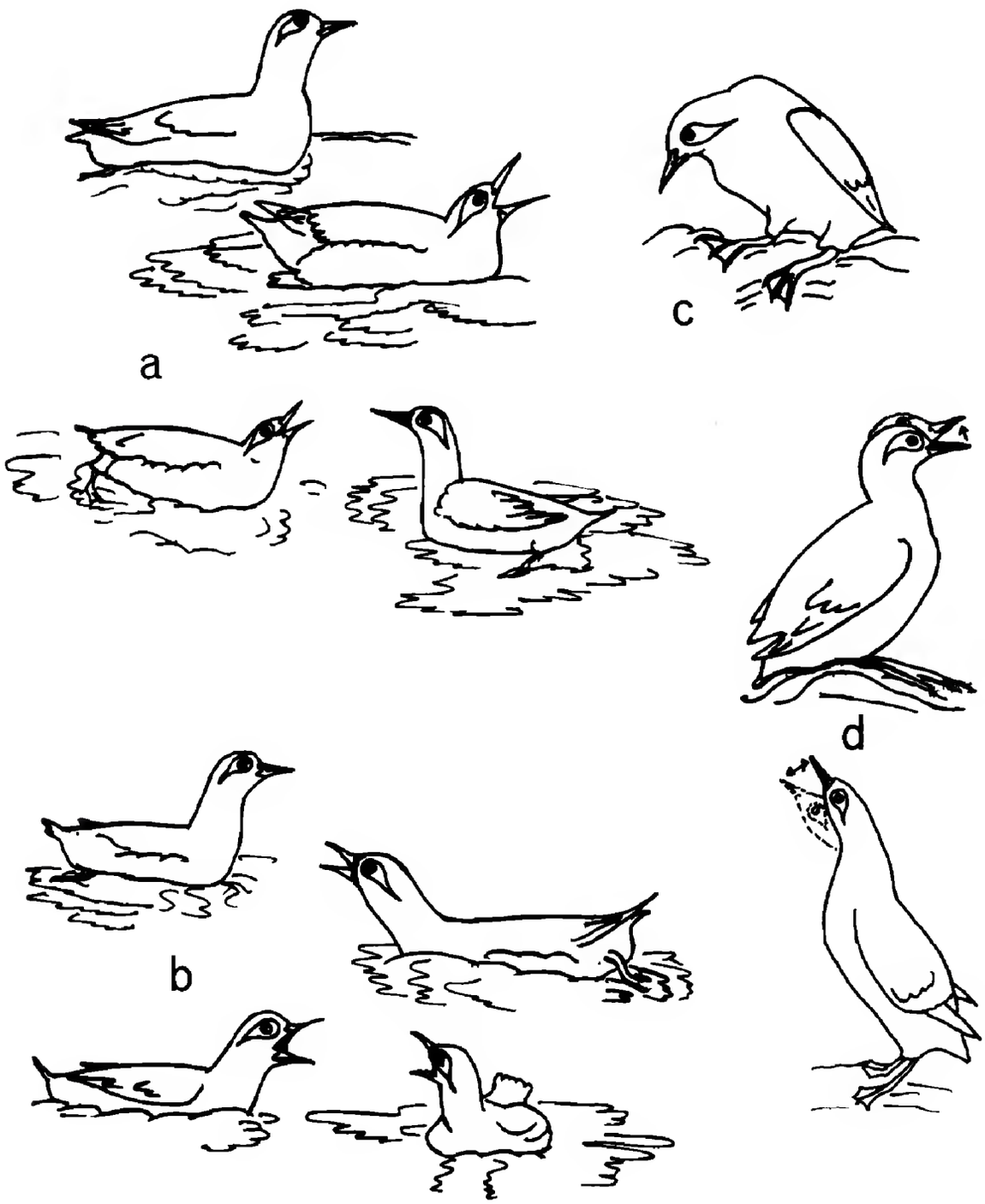

Figure 7. Displays of the Sooty Guillemot: (a) Squat-peeping or Hunch-whistle, (b) Twitter-waggle, (c) Hunching, and (d) Erect Display with Head-flicking.

Table 1. Behaviors of Sooty Guillemot (*Cepphus carbo*).

A. VOCALIZATIONS

Behavior	*Description*	*Context*	*Interpretation of Function*
1. Scream	A long high-pitched "seeeeeeeeee"	Disturbance Alarm	Warning call
2. Chip	A short "tsit" or "whist"	Heard from individual groups, in flight or on the sea or rocks	Mild alarm Sound of contentment Signal to an approaching bird Flight-intention call
3. Trilled Call	A long series of rapid "tsits"	At nest site To mate To young in nest	Stimulates care of young Declares mate and nest territory Maintains pair bond
4. Twitter-billing	Resembles the rapid "tsit" of the trilled song accompanied by headturning, bobbing and flicking.	Face-to-face with mate	Sure sign of being mated (Drent 1965)
5. Squat-peep (Hunch-whistle)	A repeated drawn-out "tsit-tsit-tsit-tsit-seeep-seeep." While sitting or swimming with the neck drawn in, bill up and open displaying the flesh-pink lining. The tail is often cocked.	One of the most common social displays. Usually accompanied by Strut-circling by a second bird.	Sexual readiness Sign of being mated Call to the mate in the presence of an intruder
6. Twitter-waggle	The neck is fully stretched forward, and the head is vigorously waggled from side, accompanied by twittering sounds. The tail is cocked and the wings are slightly drooped.	Constantly displayed in closely associated groups on water or land.	Strongly aggressive, often ends in attack or fight

Table 1 (Cont.)

B. BEHAVIORS WITHOUT VOCALIZATIONS (According to D. Nelson, pers. comm., 1, 2 and 6 are vocal in other species)

Behavior	*Description*	*Context*	*Interpretation*
1. Erect Display	On land the bird stands erect with the bill up. On water the neck is stretched high with bill up. Head is occasionally flicked.	Sometimes precedes Squat-peeping or follows Twitter-waggle	A stance of relaxation after some other action. Possibly associated with territory possession.
2. Strutting	Head held high with the bill pointed down. Tail is often cocked.	Display is towards another bird	Aggressive
3. Wing-flagging	Wings are stiffly held over the body during strut	Walks towards another bird	Strongly aggressive, preliminary to attack. Also a flight intention signal.
4. Hunching	Walk towards another bird with the body hunched and head down. Wings may be drooped.	Display to an intruding bird	Aggressive approach which may end in attack
5. Duel Flight	An aerial chase resulting from a fight, therefore, duel. A contest to outfly the other bird.	Begins with Twitter-waggle and a fight between two birds. Triggers splash-or-scatter-dives in groups of other birds.	Aggressive
6. Headbobbing	Rare. The head and neck are bobbed. Wings held partly open.	Directed towards an intruder or a closely-situated bird	Threat
7. Headturning	Turning of the bill over the back	Associated with preening activity	Preening activity. No social function.
8. Head-dipping	Dipping of the head under water	Increases with disturbance	Search for prey or underwater disturbance
9. Bill-dipping	Dipping of the bill into the water	Increases with disturbance but is a constant habit.	Increases before impending flight. Possibly to rinse salt secretions from the bill.

Preston (1968) described Headturning display in the Black Guillemot as a turning of the bill over or into the scapulars. Pigeon Guillemots also Headturn (Nelson in press). This display occasionally occurred in the Sooty Guillemot. However, in over 300 observations I was uncertain only a few times that turning the head toward the rear and tucking the bill in the scapulars was not associated with preening. Otherwise, Head-turning may be a signal for appeasement toward a Twitter-waggler.

Bill and Head-dipping are habits common to all alcids, as well as to some other waterbirds, and are no less frequent in the Sooty Guillemot. I observed a single bird actively feeding close to shore, and obviously Head-dipping to locate prey before diving to catch it. From about 2 m above, I could also see the fish in the clear water, which left me with no doubts as to the function of Head-dipping in that instance, for the bird peered under water to the right and left until it spied a fish then dashed after it. However, disturbances above or below water also increased the frequency and length of Head-dipping among Sooty Guillemots. For example, a cormorant swimming under a group of Sooty Guillemots precipitated bouts of Head-dipping. Increased Bill-dipping frequency, a lesser but more rapid response with only the bill involved often indicated impending flight.

SUMMARY

A maximum of 400 birds made up the Teuri Island colony of Sooty Guillemots in 1981. No more than half the population defended nests and some of these did not rear young. Although two chicks were often hatched, no pairs were found to rear more than one chick. Three chicks hatched at about 40 g and reached as much as 605 g at 40 to 45 days of age before fledging. One fledgling was seen daily for 16 days feeding alone close to shore. During this time its plumage changed from sooty to mottled brown, and its legs and feet from dark grey to red.

Although behavior patterns were similar to those of other species of *Cepphus*, some displays were less energetic than those demonstrated by related species at the same phase of the breeding season. Behaviors accompanied by vocalizations and other displays were identified.

Colony attendance gradually changed to later in the day as the season progressed. No explanation was discovered for this change.

ACKNOWLEDGMENTS

Thanks are due to Dr. Hisashi Abe of the University of Hokkaido for obtaining the necessary permit for me to work in Teuri Island and for kindly hosting me at the University in Sapporo. Yutaka Watanuki gave unselfishly of his time to work with me on logistics and setting up camp on the island. Without his help this study would not have been possible. Matutoshi Aothuka, warden for birds on Teuri Island, also assisted by banding chicks and by providing other information. Thanks are also due my wife, Shirley, who accompanied me in the field and assisted with recording of data. Andrews University provided travel funds.

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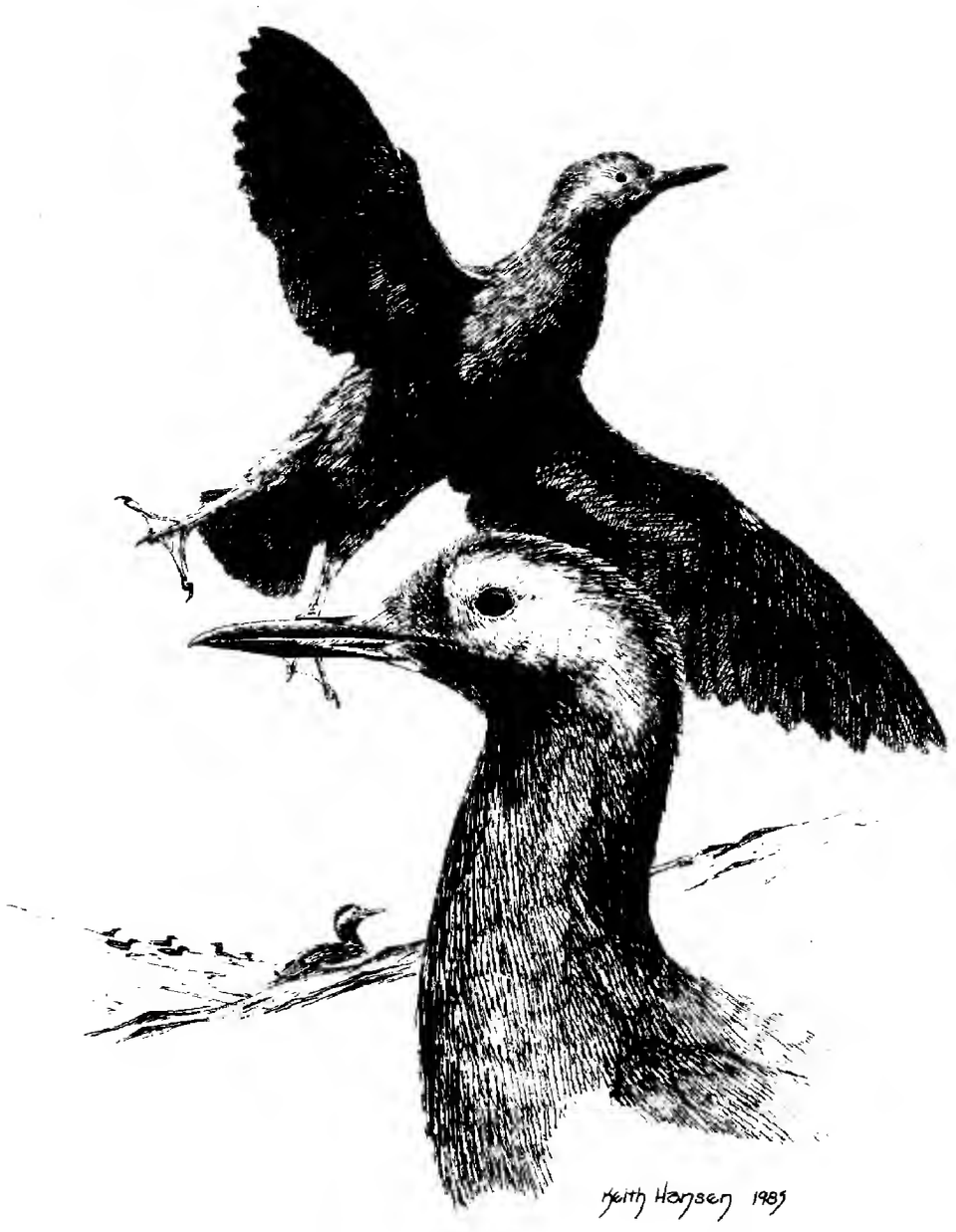

Sooty Guillemot *Sketch by Keith Hansen*

DISTRIBUTION AND ABUNDANCE OF MARINE BIRDS BREEDING BETWEEN AMBER AND KAMISHAK BAYS, ALASKA, WITH NOTES ON INTERACTIONS WITH BEARS

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In 1980 Congress established the 3.5 million-acre Alaska Maritime National Wildlife Refuge, the world's largest marine bird and mammal sanctuary. In a continuing effort to assess the seabird colonies on the some 2500 islands comprising this refuge, the mainland cliffs and islands along the eastern half of the Alaska Peninsula were surveyed in 1980 and 1981. Much of the survey area also lies within the Becharof National Wildlife Refuge and Katmai National Park. Recent offshore oil leasing in Shelikof Strait and lower Cook Inlet requires better documentation of the region's nesting seabirds.

General information on the Alaska Peninsula and some adjacent islands is provided by Murie (1959) and Gabrielson and Lincoln (1959). The first cursory reconnaissance of some of the seabird colonies between Amber and Kamishak bays was conducted in June 1973 (Sowls et al. 1978). In 1973 only a week was spent observing seabirds along this 1000-km stretch of the Alaska Peninsula from a boat. Bailey and others visited parts of this region opportunistically in 1976, and some colonies were more closely viewed from inflatable boats (Sowls et al. 1978), but generally no landings were made, and no time was spent on islands at night in search of nocturnal nesting seabirds.

The coastline to the southwest from Amber Bay to Mitrofania Island was surveyed in 1979 (Bailey and Faust 1981), and Kamishak Bay to the north was surveyed in 1978 (Sowls et al. 1978). Breeding avifauna on Ugaiushak Island has recently been studied extensively (Wehle et al. 1977, Wehle 1978).

The purpose of surveying this segment of the Alaska Peninsula was to locate seabird colonies, determine species composition, and estimate numbers, or at least depict orders of magnitude of species or concentrations which are difficult and time consuming to enumerate. Only after preliminary surveys can key sites be identified for future long-term monitoring of population trends. Proper management of marine birds can then follow based on assessments of long-term population fluctuations of seabirds in relation to commercial fishing, offshore oil exploration, and changes in climatic and oceanographic factors.

STUDY AREA AND METHODS

The 150 islands and adjacent irregular coastline between Amber and Kamishak bays cover roughly an 8000 km^2 area, approximately 56°45'N, 157°20'W to 59°10'N, 154°05'W (Figures 1 and 2). The islands range from unnamed rocks and islets less than 1 ha in size to 300-ha Takli Island; elevations of islands range from a few meters above sea level at Douglas Reef to

160 m at David Island. Most islands are rugged like the adjacent coast of the Alaska Peninsula, but some, like Shaw and Jute islands and those in Wide Bay, are low and relatively flat.

Frequent cloud cover, wind and precipitation prevail in this area. Climatic data for the overall region are available only from Kodiak Island and sporadically from Chignik, the only village on the southeastern part of the Alaska Peninsula. The July mean temperature at Chignik is 11°C with a range of 24°C to 1°C. Chignik receives an annual average of 323 cm of precipitation.

Alpine and moist tundra characterize the islands and much of the adjacent coast. Insular vegetation is dominated by Beach Wildrye (*Elymus arenarius*) and other grasses, sedges and umbellifers. Inland portions of larger islands with few surface- and burrow-nesting seabirds, such as those in Wide Bay, are generally dominated by Crowberry (*Empetrum nigrum*), whereas those with large numbers of burrowing birds, such as Central Island, are covered by grasses and umbellifers, primarily Common Cowparsnip (*Heracleum lanatum*), Seawatch Angelica (*Angelica lucida*) and *Conioselinum chinense*. Scattered Sitka Spruce (*Picea sitchensis*) and Balsam Poplar (*Populus balsamifera*) occur on a few islands in Katmai National Park.

A 4-week reconnaissance involving roughly 500 km of coastline began at Jute Bay on 17 June 1980 and proceeded southwestward toward Amber Bay. On 1 July 1981 a 3-week survey began in Kanatak Lagoon in Portage Bay and proceeded northeastward to Nordyke Island in Kamishak Bay. Portage Bay was bypassed in 1980 because of bad weather. We surveyed all islands and nearly all of the adjacent Alaska Peninsula with a 5-m Avon inflatable boat and two 25-hp outboards. In addition to circumnavigating all islands, we went ashore on over 65 islands. It was not necessary to land on many of the smaller islands in the study area because of the absence of any evidence of breeding seabirds, and a few islets with birds were inaccessible or could not be landed on because of rough seas. Ugaiushak Island was not visited in 1980 because of recent studies there (Wehle 1978).

No counts were conducted during periods of high winds, heavy rain, inadequate light, or markedly low ceilings and visibility. Colonies were indicated on 1:63,360 scale USGS maps. We noted nocturnal nesting species by their vocalizations after dark and by checking burrows.

Population estimates for kittiwakes and cormorants were derived from nest counts, and for murres were based on numbers seen on nesting cliffs and on the water below cliffs. Estimates of murre populations were made in good weather during the middle of the day between the end of egg-laying and the start of fledging, when numbers are most stable (Birkshead and Nettleship 1980). Our counts represent numbers present at a particular time and should be regarded as only approximations of actual breeding populations because of considerable variability in daily and hourly colony attendance and because of the presence of unknown numbers of nonbreeding murres. Accurate determination of the numbers of breeding murres at each colony requires establishment of study plots and repeated counts over a period of several days, efforts beyond the scope of this reconnaissance. From the inflatable, we counted the numbers of murres on cliffs and rafted on the water below them in groups of 10 and 100, using cracks and other features in the cliffs to

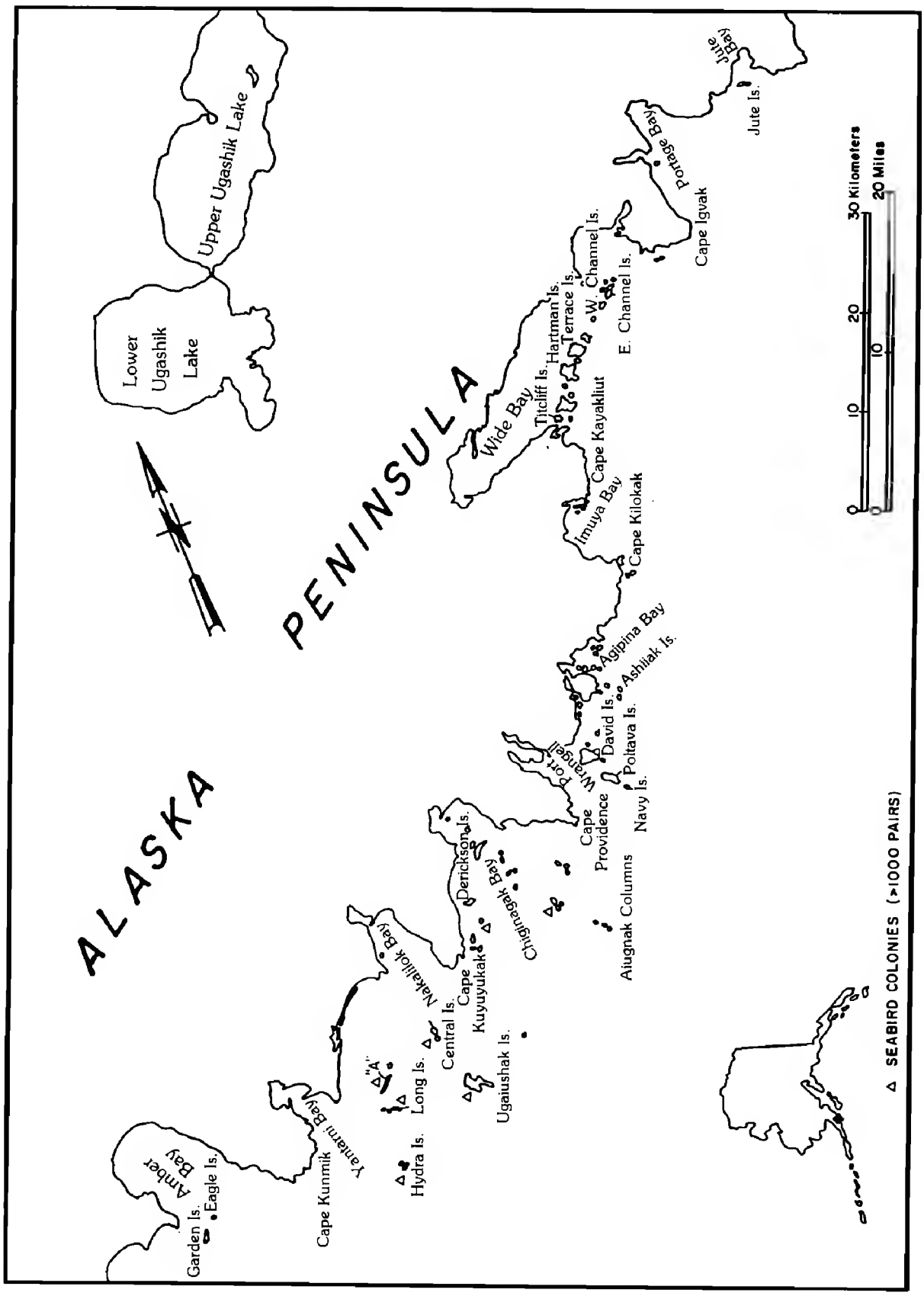

Figure 1. Islands south of the Alaska Peninsula between Jute Bay and Amber Bay, showing location of largest seabird colonies in 1980.

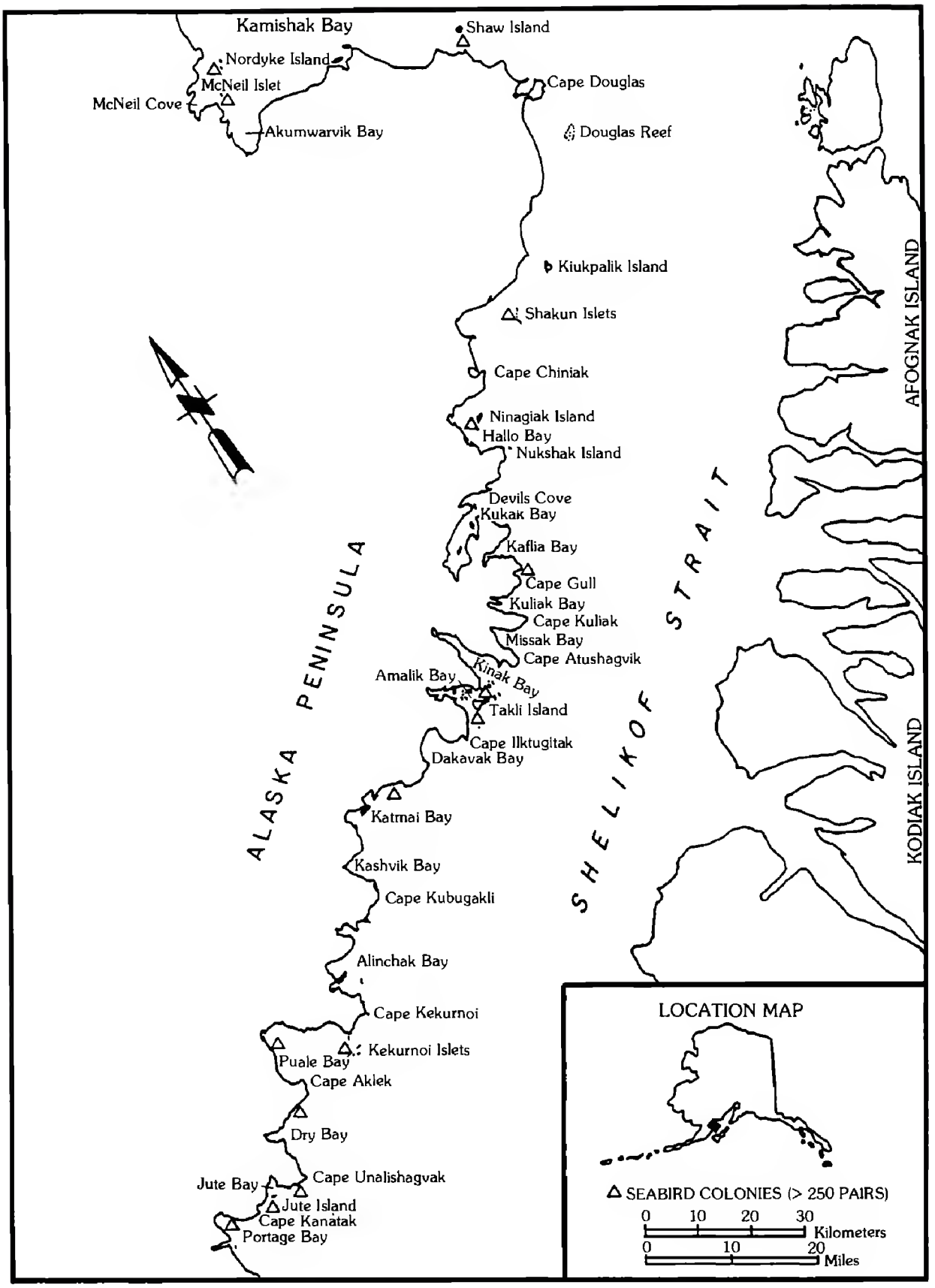

Figure 2. Islands south of the Alaska Peninsula between Jute Bay and Kamishak Bay, showing location of largest seabird colonies in 1981.

partition big colonies. Except for a few colonies visited at the end of the 1981 survey, counts occurred during incubation.

Gull estimates were formulated from numbers of nests and pairs observed on given islands. On small islands we walked the entire area to locate nests; at large colonies, such as on Ninagiak and Shaw islands, we counted gull nests on a portion of the island and then made extrapolations for remaining gull habitat; counts of obviously paired birds in nesting areas were also used. Estimates of gulls nesting on cliff ledges and atop inaccessible stacks were based on counts of evidently territorial birds. Gulls were incubating at the first part of the survey; chicks were present on islands visited later in the survey.

Puffin numbers were derived from a combination of adults repeatedly seen at specific locales and from estimates of burrow numbers in dense colonies. Like most other colonial nesting seabirds, attendance at puffin colonies varies with season, time of day and weather. The large number of islands, extensive distances, foul weather and limited time to complete the reconnaissance precluded establishing any transects or quadrats to determine numbers of burrows and frequency of occupancy. Since insufficient time and personnel were available to establish adequate numbers of census plots on any island to determine statistically valid populations (Nettleship 1976), our estimates should be regarded as minimal indices of population size. Estimates are most useful for comparisons in orders of magnitude between different islands. Since we camped on all islands with large puffin colonies, repeated counts of numbers of birds observed were made at different times of day, or on successive days in some instances, and the highest estimates were used in each case. Puffin burrows were excavated periodically on various islands; birds were still incubating, except on some of the last islands examined, where some downy chicks were encountered. On some islands numbers of active burrows appeared more abundant than accounted for by puffins in the area. In such cases estimates were based more on burrow numbers than on numbers of puffins seen.

Populations of nocturnal hydrobatids and alcids were described as "present" (only a few present) or "abundant" (thousands), depending on the intensity of activity and vocalization and the extent of habitat used.

Estimates of Pigeon Guillemots (*Cepphus columba*) and Parakeet Auklets (*Cyclorrhynchus psittacula*), which utilize rock crevices, represent the number of birds sighted at various islands. No breeding estimates were made for Kittlitz's or Marbled murrelets (*Brachyramphus brevirostris* or *B. marmoratus*), both of which are solitary.

RESULTS AND DISCUSSION

Estimated numbers of breeding marine birds on various islands in 1980 and 1981 are indicated in Table 1 and 2, respectively. The 18 species recorded are discussed below in approximate descending order of abundance in the region. The data for Ugaiushak Island are taken from Wehle et al. (1977)

MURRES. Most of the 85,000 murres in the region nest on the cliffs in or west of Puale Bay, and the only other large colony is on Ugaiushak Island. Murre numbers reported along the cliffs in the Puale Bay area in 1976 (Sowls et al. 1978) were nearly 20%

Table 1. Estimated breeding seabird populations (pairs) between Jute Bay and Amber Bay on the south side of the Alaska Peninsula in 1980.

Species	Jute	Portage Bay	Wide Bay group	Imuya Bay group	Kilokak Rocks	Ashiiak	David	Poltava	Navy	Chiginagak Bay group	Aiugnak Columns	Ugaiushak	Central	Unnamed is. "A"	Long	Hydra	Garden-Eagle	SPECIES TOTALS
Fork-tailed Storm-Petrel										P		1500*	A					
Leach's Storm-Petrel												P	P					
Double-crested Cormorant		1					10			15		34			1			61
Pelagic Cormorant		250	15	80	20	20		60		105	2	57	5		30			644
Red-faced Cormorant		950	145	5	60	1				85		173	175		360			1954
Black Oystercatcher	4	4	45	10	1	2	2	3	2	12		26	3	10	4	3	3	134
Parasitic Jaeger												6						6
Glaucous-winged Gull	80	60	130	40	70	20	20	35		60	45	800	160	100	75	35		1730
Black-legged Kittiwake		15								7025		4500						11,540
Murre spp.										400		4600						5000
Pigeon Guillemot	30	10	110	5	10	35	15	35	5	145	5	235	5	650	100	40	75	1510
Ancient Murrelet												P	P					
Parakeet Auklet								P			P	50	225	40	15	120		450
Rhinoceros Auklet												P				P		
Horned Puffin			10			200	200	190	50	15		9000	2500	400	100	200	80	12,945
Tufted Puffin	200	10	75		70	150	50	60	20	1500		7000	2500	375	3000	1800	50	16,860
ISLAND TOTALS	314	1300	530	140	231	428	297	383	77	9362	52	26,481	5573	1575	3685	2198	208	52,834

P = Present A = Abundant *Not included in totals

Table 2. Estimated breeding seabird population (pairs) between Jute Bay and Kamishak Bay, Alaska Peninsula, in 1981.

Species	Cape Unalishagvak and vicinity	SW Cape Aklek	Puale Bay	Kekurnoi Islets	Alinchak Bay area	Katmai Bay	Amalik-Kinak bays	Cape Gull area	Kukak Bay area	Ninagiak Island	Shakun Islets	Kiukpalik Island area	Shaw Island area	Nordyke Island area	SPECIES TOTALS
Double-crested Cormorant							10							45	55
Pelagic Cormorant	15		5	85		20	330	5	30				80		570
Red-faced Cormorant	5		1070	5		100	200		1				15		1396
Black Oystercatcher				15	5		10	8	20	20	10	5	20	10	123
Mew Gull							P								
Glaucous-winged Gull	40		115	50		150	145	60	50	2000	100	15	1200	500	4425
Black-legged Kittiwake	600			30	135			265	10		80				1120
Murre spp.	19,000	15,000	3250												37,250
Pigeon Guillemot	10		10	40	30	5	170	50	75	10	100	50	10	10	570
Parakeet Auklet											10				10
Horned Puffin	30			20			10			1000	300		30		1390
Tufted Puffin			50	50			280	50	10	2000	350	30	350	50	3220
ISLAND TOTALS	19,700	15,000	4500	295	170	275	1155	438	196	5030	950	100	1705	615	50,129

P = Present

higher than our estimates 5 years later, although this difference may be due to counting discrepancies or vagaries in colony attendance. In 1977 Common Murres (*Uria aalge*) outnumbered Thick-billed Murres (*U. lomvia*) more than 10 to 1 on Ugaiushak (Wehle 1978). Seventy percent of the 800 individuals on an isle in Chiginagak Bay were Common Murres. No Thick-billed Murres were seen at the huge colonies at Cape Unalishagvak and west of Cape Aklek. We did not visit McNeil Islet in Kamishak Bay because of adverse tides; however, 2000 Common Murres nested there in 1978 (Sowls et al. 1978). Although murre colonies in the Puale Bay area are the largest on the Alaska Peninsula mainland, they are less than half the size of the nearby populations in the Semidi and Shumagin islands (Sowls et al. 1978). In 1978 the Puale Bay colonies ranked only 38th in size statewide (Anon. 1979).

TUFTED PUFFIN. Over 40,000 Tufted Puffins (*Fratercula cirrhata*) were estimated on 26 islands. Approximately 35% of the breeding puffins were on Ugaiushak Island, which accounts for over 25% of the total diurnal seabirds breeding in the region. Most of the remaining Tufted Puffins bred on Long, Central, Ninagiak and Hydra islands.

A sizeable Tufted Puffin colony on an unnamed island in the southeastern part of Chiginagak Bay was destroyed by a Brown Bear (*Ursus arctos*). When we visited this island on 2 July 1980, only about 100 puffins were milling about below the grassy, burrow-ridden headlands, and a bear was systematically excavating burrows around the island's perimeter. Entire slopes were dug up to the depths of nest chambers, and egg shells and feathers were common. Very few puffins remained in the small number of burrows overlooked by this bear. We noted similar destruction of other smaller colonies off the Katmai National Park coastline in 1981 and near Afognak Island in 1983.

Only about 200 puffins were recorded at David and Poltava islands in 1980, yet 17,000 were reported there in 1973 (Sowls et al. 1978). Furthermore, we found few burrows on these two islands, which are frequented by bears. It is possible that large feeding flocks off these islands were mistaken for local breeders. Wehle et al. (1977) estimated nearly three times more Tufted Puffins on Central Island in 1976 than we did in 1980; our puffin estimates on nearby Long and Hydra islands were considerably higher than those made in 1976 (Sowls et al. 1978). The only significant colony north of Jute Bay was of approximately 2000 pairs on Ninagiak Island. Compared to most other areas off the Alaska Peninsula, this section of coastline has few Tufted Puffins. The center of abundance of this species is in the eastern Aleutians, where over 1,000,000 or nearly 40% of the state's population breed (Nysewander et al. 1978).

HORNED PUFFIN. An estimated 29,000 Horned Puffins (*Fratercula corniculata*) nested on at least 25 islands or capes in the survey area, with the populations on Ugaiushak and Central islands accounting for 80% of the birds in the region. In 1976, 9000 Horned Puffins were estimated by Wehle et al. (1977) on Central Island, compared to only 5000 in 1980. Central Island is composed largely of colluvium and cliffs, which provide outstanding crevice habitat. Though only 7 km from the mainland, this was the only sizeable island where no significant evidence of bears was found. The only other significant colony east of Amber Bay is on Ninagiak Island. The total number of Horned Puffins breeding along this section of the Alaska Peninsula is small compared to populations in the Shumagins, Semidis and other islands south and west of the survey area (Sowls et al. 1978).

BLACK-LEGGED KITTIWAKE. Nearly 13,000 pairs of Black-legged Kittiwakes (*Rissa tridactyla*) nested on eight islands and two mainland cliffs. The largest colony was situated at a small island on the western side of Chiginagak Bay. We found 7000 pairs on this island compared to less than 2700 pairs in 1976 (Sowls et al. 1978). Four other small colonies reported in 1976 were not recorded on our reconnaissance. Except in the Sandman Reefs off the west end of the Alaska Peninsula, fewer kittiwakes nest along this stretch of the Peninsula than along any other segment (Sowls et al. 1978, Bailey and Faust 1981).

STORM-PETRELS. Thousands of Fork-tailed Storm-Petrels (*Oceanodroma furcata*) nest in crevices on Central Island. This species was discovered only on two other islands besides Central. The previously mentioned unnamed island on the eastern side of Chiginagak Bay on which a bear had destroyed the Tufted Puffin colony was the only island utilized extensively by bears which also had nesting nocturnal seabirds. The population on this island is small and is scattered in rocky areas, judging from vocalization. Three thousand Fork-tails were estimated on Ugaiushak (Wehle et al. 1977). No nocturnal nesters were found north of Chiginagak Bay, leaving a gap of over 300 km to the next known storm-petrel colonies in the Barren Islands (Bailey 1976). No colonies of nocturnals have been recorded across Shelikof Strait along the northwest side of Kodiak Island (Sowls et al. 1978).

Leach's Storm-Petrels (*O. leucorhoa*) occurred in small numbers only on Central and Ugaiushak islands. Enormous numbers of both species of storm-petrels nest in the Shumagin Islands and Sandman Reefs southwest of this survey area (Sowls et al. 1978).

GULLS. Over 70% of the 6150 pairs of Glaucous-winged Gulls (*Larus glaucescens*) recorded for this region were on Ninagiak, Shaw, Nordyke and Ugaiushak islands. A few small, scattered colonies, such as in Kashvik and Agripina bays and on Douglas Reef, are not included in Table 1 or 2. Although nests were located on 62 islands or headlands, breeding was markedly limited by bears, as destroyed or abandoned nests were frequently found. We estimated only approximately 200 gulls collectively on David and Poltava islands, yet 2000 were reported here in 1973 (Sowls et al. 1978). Also, 3000 were reported in 1973 on the islands off Cape Igvak, compared to 170 nests counted in 1980. Ninagiak, the island with the largest colonies in the region, has not been previously recorded (Sowls et al. 1978). Likewise, the colonies in the Shakun Islets to the north were previously unrecorded. Our estimate of 2400 gulls breeding on Shaw Island, the second largest colony along the upper Alaska Peninsula, compares with only 500 recorded there in 1978 (Sowls et al. 1978). We found no gulls nesting on Eagle Island, on which 500 were recorded in 1973. Immature Mew Gulls (*L. canus*) were noted at Port Wrangell, and they probably breed in Amalik Bay.

With the exception of the segment of the Alaska Peninsula between Sutwik and Mitrofania islands, fewer gulls nested along this part of the Peninsula's coastline than elsewhere (Sowls et al. 1978, Bailey and Faust 1981).

PIGEON GUILLEMOT. Guillemots nested on almost all islands of significant size with suitable habitat as well as along some sections of the mainland. Sixty percent of the guillemots recorded west of Jute Bay were on Ugaiushak and on an unnamed island (designated "A") north of Long Island. The latter small island had at least 1300 guillemots, and 3000 were estimated here in 1973 (Sowls et al. 1978). This species was common in Chiginagak Bay, with the largest numbers on Derickson Island. Amalik and Kukak bays and the Shakun Islets had the largest numbers of guillemots in the eastern portion of the survey area.

CORMORANTS. Red-faced Cormorants (*Phalacrocorax urile*) significantly outnumbered Double-crested (*P. auritus*) and Pelagic (*P. pelagicus*) cormorants, but the last species was more widespread. The largest Red-faced Cormorant colonies were in Portage and Puale bays and at Takli Island in Amalik Bay, whereas the Kekurnoi Islets had the largest Pelagic Cormorant populations. Double-crested Cormorants occurred on only eight islands. Although 1500 breeding cormorants were reported on David and Poltava islands in 1973 (Sowls et al. 1978), we saw only 70 nests. Adverse weather prevented our visiting a reported colony of about 600 cormorants nesting on mainland cliffs inside Wide Bay (Sowls et al. 1978). All cormorants nesting on the islands in Wide Bay were on an unnamed island east of Titcliff. We found over 2200 cormorants nesting in the Puale Bay area, but only about 240 were recorded here previously (Sowls et al. 1978). In 1980 we found almost 800 cormorants on Long

Island, where none were reported in 1976, and large population increases were documented at Central Island, Chiginagak Bay, Shaw Island and along the Katmai Coast. The only area off the Alaska Peninsula with larger cormorant colonies than between Amber and Kamishak bays is the Shumagin Islands (Sowls et al. 1978).

PARAKEET AUKLET. Although we observed Parakeet Auklets on eight islands, 75% nested on Central and Hydra islands. Since a few auklets were spotted around Poltava Island and the Aiugnak Columns, small breeding populations are presumed. In 1973 Parakeet Auklets were noted on only three islands in the region (Sowls et al. 1978). We found only one small colony east of Amber Bay. The overwhelming majority of Parakeet Auklets nesting along the Alaska Peninsula is found in the Shumagin and Semidi islands (Sowls et al. 1978).

MARBLED and KITTLITZ'S MURRELETS. We often observed these two species feeding in certain bays along the Alaska Peninsula, especially Portage, Kinak, Agripina, Nakalilok and Amber bays and in Port Wrangell. Pairs or small flocks of murrelets sometimes were associated with Pigeon Guillemots. Kittlitz's Murrelets generally outnumbered their congener.

ANCIENT MURRELET. We recorded Ancient Murrelets (*Synthliboramphus antiquus*) only on Central and Ugaiushak islands. Breeding on the latter island was confirmed by discovery of an abandoned egg in 1976 and 1977 (Wehle 1978); on Central Island we periodically heard Ancient Murrelets in the incessant din of Fork-tailed Storm-Petrel calls. The only Ancient Murrelet noted in 1981 was a single bird outside of Alinchak Bay. Fewer Ancient Murrelets are found along this stretch of the Peninsula than in any other section (Sowls et al. 1978, Bailey and Faust 1981).

RHINOCEROS AUKLET. *Cerorhinca monocerata* nested on Hydra Island and probably on Ugaiushak. Since a few birds were seen flying to and from shore on Ugaiushak in 1976 and 1977, a small breeding population was presumed (Wehle 1978). We heard Rhinoceros Auklets fluttering about after dark and occasionally vocalizing on a headland on the north side of Hydra Island, and a newly hatched chick was excavated from a burrow on 4 July 1980. Auklets nested in small colonies of about 20 pairs on promontories. A storm forced us off the island before we were able to enumerate burrows in daylight. Two individuals were spotted off the Shakun Islets, but no evidence of nesting existed. Only five small colonies have been located south of the Alaska Peninsula; numbers appear highest in the Semidi Islands (Sowls et al. 1978).

AMERICAN BLACK OYSTERCATCHER. Oystercatchers (*Haematophus bachmani*) were noted on at least 60 islands. The greatest concentration of oystercatchers was recorded on the 21 islands in Wide Bay, especially East Channel Island and surrounding islets. Oystercatchers also were especially common on Ninagiak, Shaw, Ugaiushak and unnamed island "A". They were comparatively scarce on the islands in Chiginagak Bay.

PARASITIC JAEGER. Jaegers (*Stercorarius parasiticus*) nested only on Ugaiushak Island, where Wehle (1978) found six pairs in 1977. The only Parasitic Jaeger spotted in 1980 was on Eagle Island, and two were sighted at Cape Douglas in 1981. Elsewhere in the region jaegers nest only in the Shumagins, Semidis and on Sutwik Island (Bailey and Faust 1981, pers. obs.).

OTHER SHOREBIRDS. Shorebirds were generally scarce on the islands in this region, perhaps as a result of the frequent disturbance by bears and the lack of ponds and marshy areas on most islands, except for in Wide Bay and on David, Kiukpalik and Shaw islands. Least Sandpipers (*Calidris minutilla*) probably bred on Garden, Jute and East Channel islands, and Semipalmated Plovers (*Charadrius semipalmatus*) evidently nested on the latter two islands. Red-necked Phalaropes (*Phalaropus lobatus*) may breed on some of the islands in Wide Bay and on Kiukpalik and Shaw

islands. Nonbreeding Whimbrels (*Numenius phaeopus*) were observed on five islands. Rock Sandpipers (*Calidris ptilocnemis*) are likely breeders on Hydra and Jute islands. Small flocks of Black Turnstones (*Arenaria melanocephala*) frequented islands east of Alinchak Bay, particularly the Shakun Islets.

WATERFOWL. We encountered over 2200 Harlequin Ducks (*Histrionicus histrionicus*) on the survey; largest numbers were noted around the unnamed islands near Cape Igvak and Amalik, Puale and Kukak bays. Common Eiders (*Somateria mollissima*) were seen at 14 islands, and nests or broods were found on Ugaiushak, Long, Shakun, Douglas and Shaw islands. Most of the over 200 eiders recorded were on Ugaiushak and Shaw islands; 10 broods were noted on the latter island. A brood of Tundra Swans (*Olor columbianus*) was on Hartman Island. Single Red-breasted Merganser (*Mergus serrator*) and Northern Pintail (*Anas acuta*) nests were discovered on islands in Chiginagak and Wide bays, respectively. Several hundred mainly moulting Common Mergansers (*M. merganser*) occurred in fjords near Port Wrangell, and mergansers also abounded at Nordyke and Kiukpalik islands and at Sukoi, Kuliak, Amalik and Alinchak bays. Most of the 2500 White-winged and Surf scoters (*Melanitta fusca* and *M. perspicillata*) were in Kinak, Amalik, Kuliak and Jute bays and at the Shakun Islets and Kiukpalik Island. Mallards (*A. platyrhynchos*) and Northern Shovelers (*A. clypeata*) breed on Shaw Island, and Green-winged Teal (*A. crecca*) also are likely breeders on Shaw, an exceptionally productive island for waterfowl and shorebirds.

RAPTORS. We recorded a total of 145 Bald Eagles (*Haliaeetus leucocephalus*) and 29 nests west of Jute Bay, and 123 birds and 26 nests eastward to Kamishak Bay. The largest numbers of nests were on the islands in Wide Bay and in Kukak Bay. We found more eagles along the Amber-Kamishak Bay stretch of coastline than along similar segments of the Alaska Peninsula to the southwest. Brown Bears prey on accessible eagle nests, as four destroyed nests were encountered.

Peregrine Falcons (*Falco peregrinus*) nested on one island in 1977 (Wehle 1978) and were suspected breeders at two other locations. A Gyrfalcon (*F. rusticolus*) nest with a chick was found on Terrace Island in Wide Bay. This nest represents the second furthest south known record for this species in Alaska (C. White pers. comm.). Rough-legged Hawks (*Buteo lagopus*) nested on Terrace, Kiukpalik and Nukshak islands. Short-eared Owls (*Asio flammeus*) used Kiukpalik Island.

OTHER BIRDS. Twelve adult Red-throated Loons (*Gavia stellata*) and several chicks were noted on Shaw Island. Unlike along other segments of the Alaska Peninsula, no ptarmigan (*Lagopus* spp.) were found on any of these islands. Sixteen passerine species were recorded; David Island had the greatest diversity. Snow Buntings (*Plectrophenax nivalis*), which we have encountered occasionally on mountain tops of a few of the larger islands elsewhere off the Alaska Peninsula, were extremely abundant on the low-lying islands in Wide Bay.

Approximately 206,000 seabirds of 18 species nested in the region. No estimate was made for nocturnal nesting species or Kittlitz's and Marbled murrelets. Compared to numbers found in most other areas along the Alaska Peninsula and in the northwestern portion of the Gulf of Alaska, the number of seabirds nesting between Amber and Kamishak bays is low. Much larger populations are found in the Barren Islands and around Kodiak to the east, in the Semidi Islands to the south, and in the Shumagins to the southwest (Sowls et al. 1978). Nevertheless, certain colonies in the survey area, such as those on the cliffs near Puale Bay and on the islands around Chiginagak Bay, are of major regional importance. The gross discrepancies in population estimates between our 1980-81 survey and those made on some islands

visited briefly in 1973, 1976 and 1978 can only be partially explained by different observers and methods. No introduced foxes remain on any islands, and only three (David, Ugaiushak and unnamed island "A") evidently were used for fox farming (Bower and Aller 1917). Brown Bears supplant foxes on these islands as the primary limiting factor on nesting of most species of seabirds.

The ubiquitous bears probably are largely responsible for the fact that fewer seabirds nest between Kamishak and Amber bays than along any similar lengths of coastline on the Alaska Peninsula (Bailey 1978; Bailey and Faust 1980, 1981). Over 80% of the estimated 100,000 breeding seabirds between Jute and Kamishak bays are cliff-nesters. Certain island groups, such as those in Wide, Amalik and Kukak bays, are almost devoid of burrowing seabirds because of frequenting bears. We saw over 40 bears on or swimming between islands in the survey area, and trails, scat and diggings were encountered on nearly all islands. Sows with cubs were especially common. Unlike along the western half of the south side of the Alaska Peninsula, there are no villages along the eastern portion of the Peninsula; this lack of human habitation probably accounts for the widespread use of islands by bears in this region. Ten villages are located in the western part of the Peninsula, and local residents generally shoot any bears observed. Bears evidently were eliminated from the Shumagins and other islands off the lower Peninsula. The abundance of bears on islands off the upper Alaska Peninsula has probably greatly increased since 1912, when Katmai volcano buried several villages in ash. Subsequently, part of the coastline was designated a national park, and the area was never resettled. Hence, many seabird colonies undoubtedly disappeared after bears reinvaded islands off the upper Peninsula. Changes in seabird species composition and numbers caused by human influence on insular bear populations may have been as significant as those caused by insular fox farms in other regions.

No Arctic Ground Squirrels (*Citellus parryi*) or other rodents were found on any of the islands surveyed, probably reflecting the general lack of past fox farming, which was most likely due to the abundance of bears. Ground squirrels, voles and other rodents were introduced to the Semidis, Shumagins and many islands off the lower part of the Peninsula to supplement birds as a source of food for foxes.

Over 90% of the region's seabirds nested on seven islands and two mainland capes. The largest populations occurred in the vicinity of Cape Unalishagvak, on Ugaiushak, Central, Ninagiak and Long islands and on an unnamed island in Chiginagak Bay; the greatest species diversity (17) was found on Ugaiushak Island. A majority of the islands in the region had few or no nesting birds because of heavy use by bears. Pigeon Guillemots and American Black Oystercatchers were the most widely distributed species. Four nocturnal species nested in the western half of the region surveyed and were restricted to four islands. Thousands of Fork-tailed Storm-Petrels and some Leach's Storm-Petrels and Ancient Murrelets bred on Central Island. The Rhinoceros Auklet colony discovered on Hydra Island is only the fifth one known along the Alaska Peninsula.

Common Murres were the most abundant birds but were concentrated on two islands and three mainland cliffs. Tufted Puffins nested on 26 islands,

and Black-legged Kittiwakes nested at 13 sites. Glaucous-winged Gulls nested on 62 islands or headlands, but most were recorded on 4 islands. Although Red-faced Cormorants were the most abundant of the three cormorant species present, Pelagic Cormorants nested on more islands; Double-crested Cormorants bred on only eight islands. Parakeet Auklets also inhabited eight islands, and half of the estimated 900 birds used Central Island. Parasitic Jaegers nested only on Ugaiushak.

This survey of seabird colonies along the Alaska Peninsula between Amber and Kamishak bays completes the systematic examination of the entire length of the Alaska Peninsula, except for a few small areas. This work complements similar incremental surveys conducted in the Aleutians, Kodiak, the Barren Islands, Kenai Peninsula, and other islands and segments of coastline along Alaska's mainland (Sowls et al. 1978, Nysewander et al. 1982, Bailey and Faust 1981, and others). With initial information on breeding seabird distribution largely complete, attention must now be devoted to long-term monitoring of population trends on key, representative colonies throughout Alaska.

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ADDENDUM

After this paper was in press a sole written reference to predation of seabirds by Brown Bears was inadvertently found. Bear predation has occurred on St. Lazaria, a 26-ha island in southeast Alaska used by huge numbers of nesting seabirds, mainly storm-petrels (pers. obs.). Willet (Bird-lore 14:419-426, 1912) indicated that Brown Bears are strong swimmers, and he reported that in June 1912 Indians encountered a bear destroying nesting birds on St. Lazaria. He later "searched the island thoroughly in hope of finding the marauder at work." Although the bear was no longer there, he noted that all over the top of the island there were excavations of the bear among storm-petrel nests. He estimated that at least 500 nests had been dug up, and "the incubating birds had been eaten feathers and all." Other species of seabirds had not been disturbed.

In 1977 A.M. Springer and D.G. Roseneau (pers. comm.) repeatedly watched a Brown Bear skillfully remove hundreds of murre eggs and chicks during July and August along narrow ledges on the high cliffs at Cape Lisburne, which is on Alaska's mainland between the Chukchi Sea and Arctic Ocean. A few other bears frequented these cliffs, and at least one bear took eggs and chicks at Cape Thompson, 80 km to the south.—EPB

HABITAT USE BY WINTERING BIRDS OF PREY IN SOUTHEASTERN ARIZONA

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Habitat alteration by man has resulted in population declines in a number of raptor species in North America (Hickey 1969). Breeding raptor studies have long dominated the literature but few studies have been devoted to the winter ecology of raptors (Craighead and Craighead 1956, Southern 1963, Weller 1964, Schnell 1968, Edwards 1969, Koplin 1973, Mills 1975, Page and Whitacre 1975, Wilkinson and Debban 1980). However, data on preferred wintering habitats and relative abundance of each raptor species is required to evaluate the impacts of land management practices and proposals (i.e., transmission lines, oil and gas drilling, geothermal development) upon the birds and their habitat. This study examines the preferred wintering habitats and relative abundances of diurnal raptors, Loggerhead Shrikes (*Lanius ludovicianus*) and Greater Roadrunners (*Geococcyx californianus*) in southeastern Arizona.

STUDY AREA

The study area comprised the Bureau of Land Management administered public lands and adjacent private and state lands in Cochise, Graham, Greenlee and Pinal counties in southeastern Arizona (Figure 1). The 23,826 km^2 study area is predominantly a transition zone between the Sonoran Desert, Chihuahuan Desert, Sierra Madrean and Rocky Mountain vegetation complexes (Table 1). Vegetation was classified as to type according to the Office of Arid Lands Studies (1976) and Brown et al. (1980).

Average winter temperatures in the study area range from 7° to 13°C, with freezing temperatures occurring between October and April. Forty-five percent of the area's rainfall occurs during this period. Unlike summer rainfall, which is typically monsoon-like, winter rains are gentle and may last for several days.

METHODS

Automobile surveys for raptors have proven to be effective for collecting data on distribution and relative abundance (Craighead and Craighead 1956, Johnson and Enderson 1972, Koplin 1973, Woffinden and Murphy 1977, Craig 1978, Wilkinson and Debban 1980, Millsap 1981).

From November through March 1978-1980, we traversed 17 routes three times each at approximately 48 kph. Speeds were somewhat slower in the denser habitats such as pinyon-juniper (*Pinus monophylla-Juniperus monosperma*). We reversed the direction of travel on each successive trip to decrease any bias due to variable daily rhythms and detectability of any given species. The census routes totaled 2187 km; we drove each three times for a total of 6386 km during the study and considered a lateral distance of 150 m on each side of the census route to be thoroughly censused. We noted species, sex and age (if possible), and position for each bird observed.

Table 1. Habitat type prevalence on the study area and total length of census routes conducted, southeastern Arizona, November 1978-March 1980.

HABITAT TYPE		OCCURRENCE[a]	Census
Office of Arid Lands Study Classification	Corresponding Brown, Lowe and Pase Classification	% Total Area	# km Traveled
Desert Scrub	Chihuahuan Desertscrub Sonoran Desertscrub Disclimax Grassland	43.5	1833
Creosotebush	Chihuahuan Desertscrub Sonoran Desertscrub	23.3	1205
Mesquite	Shrub-scrub Disclimax Grassland Chihuahuan Desertscrub Sonoran Desertscrub	4.5	973
Grassland	Scrub-grassland	6.1	726
Agricultural Land	Agricultural Land	4.1	701
Mountain Shrub	Encinal	8.0	429
Saltbush	Chihuahuan Saltbush Sonoran Saltbush	2.2	195
Broadleaf Riparian	Broadleaf Riparian	0.1	143
Half-shrub	Disclimax Grassland	6.6	123
Pinyon-Juniper	Pinyon-Juniper	0.4	23
Barren Ground	Barren Ground	1.2	35
	Total	100.0	6386

[a]Planimetered from Office of Arid Lands Studies. 1976. Vegetation map of the Upper Gila-San Simon grazing environmental statement area. Univ. Arizona, Tucson.

Table 2. Number of raptors sighted in selected habitats in southeastern Arizona, November 1978-March 1980.

Habitat	Species observed	Individuals observed	Relative abundance index	Relative abundance index exclusive of roadrunners and shrikes
Agricultural Land	12	217	310	203
Grassland	11	146	201	126
Broadleaf Riparian	7	22	154	126
Mesquite	9	114	117	69
Desert Scrub	10	190	104	62
Half-shrub	5	12	98	41
Saltbush	6	18	92	66
Pinyon-Juniper	2	2	87	87
Creosotebush	9	85	71	36
Mountain Shrub	4	7	16	9

Duplication of sightings was minimized by noting peculiar characteristics and direction of flight. We believe the relative error factors were relatively constant, thus allowing between-habitat comparisons to be made.

A relative abundance index was generated according to Woffinden and Murphy (1977) as follows:

$$\frac{\text{Total number of a species observed}}{\text{Total number of km traveled}} \times 1000 = \text{relative abundance index}$$

RESULTS AND DISCUSSION

We identified a total of 813 birds to species and classified them by habitat occupied. Golden Eagles (*Aquila chrysaetos*), Red-tailed Hawks (*Buteo jamaicensis*), Cooper's Hawks (*Accipiter cooperii*), Sharp-shinned Hawks (*Accipiter striatus*), Prairie Falcons (*Falco mexicanus*), American Kestrels (*Falco sparverius*), Great Horned Owls (*Bubo virginianus*) and Loggerhead Shrikes are yearlong residents in the study area. Their numbers probably increase during winter with the influx of migratory northern birds, although a portion of the resident population may migrate southward due to displacement by winter residents from the north or in avoidance of winter environmental stresses. The Bald Eagle (*Haliaeetus leucocephalus*), Ferruginous Hawk (*Buteo regalis*), Rough-legged Hawk (*Buteo lagopus*), Northern Harrier (*Circus cyaneus*) and Merlin (*Falco columbarius*) occur only as winter visitors. The Greater Roadrunner is resident.

Habitat Use

Agricultural lands—including irrigated pasture and fallow cotton and corn fields—had the highest relative abundance index and the greatest species diversity of all habitats (Table 2). This finding was true whether or not roadrunners and shrikes were included. This situation is somewhat surprising as agricultural lands in southeastern Arizona are often considered to be

Figure 1. Wintering birds of prey study area, Safford District, U.S. Bureau of Land Management, Arizona.

"biological deserts." We believe that the high use of agricultural lands was due to the large number of available perches (i.e., telephone poles and fences), ease of sighting existing prey, and presence of edges and fence rows. Red-tailed Hawks, Northern Harriers, American Kestrels and shrikes were the most commonly observed species in agricultural lands (Table 3).

Grasslands ranked second in terms of both relative abundance index and species diversity. Predominate species were similar to those in agricultural lands. Exclusive of roadrunners and shrikes, broadleaf riparian habitats had an equivalent relative abundance index, but fewer species. Broadleaf riparian habitats predominately supported Bald Eagles, Golden Eagles, Red-tailed Hawks and American Kestrels.

Mesquite (*Prosopis juliflora*), saltbush (*Atriplex* spp.), desert scrub, half-shrub and pinyon-juniper had similar relative abundance indices. Half-shrub was the only habitat in this group that had significantly fewer raptors when roadrunners and shrikes were excluded from the total. Desert scrub and mesquite supported considerably more species than did saltbush, half-shrub and pinyon-juniper habitats.

Raptor abundances were lowest in Creosotebush (*Larrea tridentata*), mountain shrub, and barren ground habitats (in descending order). Creosotebush supported twice as many species as did mountain shrub. No raptors, shrikes or roadrunners were observed in barren ground (which was thus excluded from Table 3).

Birds were more difficult to observe as structural diversity—i.e., layers or tiers of vegetation—increased within plant communities. Agricultural lands, grasslands, desert scrub, half-shrub, saltbush, Creosotebush and mountain shrub were accurately censused; whereas, raptor populations in broadleaf riparian, mesquite and pinyon-juniper were undoubtedly underestimated.

Species Accounts

Bald Eagles were not encountered on any census route but were seen elsewhere in the area during the study. Due to the importance of the Bald Eagle, we systematically inventoried all potential wintering habitat to ascertain the number and locations of all individuals within the District. Fifteen individuals (8 adults, 7 immatures) were observed, all in broadleaf riparian habitat. In previous winters, Bald Eagles have been sighted in arid uplands. Apparently they prefer, but are not dependent upon, broadleaf riparian habitat.

We observed Golden Eagles in 6 of the 12 habitat types (Table 3). Relative abundance indices indicated that they preferred, in decreasing order, broadleaf riparian, grassland, mesquite, desert scrub, Creosotebush and agricultural habitats. The preference of broadleaf riparian habitat may be misleading as the habitat is of a linear nature and the eagles may have been foraging along the ecotone. Craig (1978) observed a similar preference for native vegetation over agricultural land in Idaho. Millsap (1981) found that in central Arizona Golden Eagles overwhelmingly preferred desert grasslands and did not occur in broadleaf riparian habitat.

Red-tailed Hawks occurred in all 10 habitats. In decreasing order, they preferred broadleaf riparian, agricultural, pinyon-juniper and grassland

habitats. Red-tailed Hawks in this study and in Millsap (1981) used a broad spectrum of habitats and were the most adaptable raptor studied. The ratio of adults to immatures was approximately 3:1. Adult to juvenile comparisons were pinyon-juniper (100% vs 0%), mountain shrub (100% vs 0%), riparian (100% vs 0%), desert scrub (84% vs 16%), mesquite (78% vs 22%), agricultural land (72% vs 28%), Creosotebush (63% vs 37%), and grassland (61% vs 39%). Immatures predominated only in saltbush (100%) and half-shrub (100%).

Ferruginous and Rough-legged hawks occurred in only three habitats. Both species occurred in agricultural land and grassland. Ferruginous Hawks were observed twice in mesquite, and a Rough-legged Hawk was once seen in the half-shrub habitat. Both species in this study and in Millsap (1981) preferred open agricultural land and grasslands to more structurally-complex habitats. Craig (1978) and Millsap (1981) observed the Rough-legged Hawk to use similar habitat in Idaho and Arizona, respectively. Wakely (1978) found that Ferruginous Hawk habitat preference was correlated with lack of vegetative cover and not prey densities.

Cooper's Hawks were observed in all habitats except half-shrub. Relative abundance indices indicated that it preferred those habitats with more layers or tiers of vegetation such as pinyon-juniper, desert scrub, broadleaf riparian, Creosotebush and mesquite. Millsap (1981) observed similar preferences for mesquite-saltcedar (*Tamarix chinensis*) and cottonwood (*Populus fremontii*)-willow (*Salix* spp.) in central Arizona.

Sharp-shinned Hawks occurred in four habitats. Relative abundance indices were highest for the broadleaf riparian and agricultural habitats and considerably lower for Creosotebush and desert scrub. Sharp-shinned Hawks in central Arizona were much more common in the mesquite-saltcedar and cottonwood-willow habitats, which were more structurally diverse (Millsap 1981).

Northern Harriers and Prairie Falcons were observed in seven of the habitats. Of the 79 harrier sightings, 24% were males, 46% females or immatures, and 30% unidentified. Relative abundance indices indicated Northern Harriers preferred agricultural lands, saltbush and grasslands over the other habitats. Similarly, harriers used agricultural lands in Idaho (Craig 1978). Harriers and Prairie Falcons in central Arizona also preferred low structurally-complex vegetation communities, primarily Creosotebush-Bursage (*Ambrosia dumosa*) and desert grasslands (Millsap 1981). Prairie Falcons were abundant in grasslands, agricultural lands and half-shrub in this study (Table 3). Prairie Falcons preferred native vegetation in Idaho (Craig 1978); whereas, this study demonstrated that they used habitats with low structural diversity (i.e., native vegetative types and agricultural lands) regardless of origin.

A solitary Merlin was observed in agricultural land. The only Merlin seen by Millsap (1981) in central Arizona was in a structurally similar habitat, desert grassland.

American Kestrels were observed in 6 of the 10 habitats. Relative abundance indices indicated an overwhelming preference for agricultural lands and a secondary preference for grasslands. Millsap (1981), however, found kestrels in central Arizona primarily in cottonwood-willow habitat and secon-

Table 3. Number of raptors sighted and relative abundance indices (R.A.I.) by selected habitats in southeastern Arizona, November 1978-March 1980.

HABITAT TYPE:	Agricultural Land		Grassland		Broadleaf Riparian		Mesquite		Desert Scrub	
SPECIES	No.	R.A.I.	No.	R.A.I.	No.	R.A.I.	No.	R.A.I.	No.	R.A.I.
Bald Eagle					15*					
Golden Eagle	1	1.4	6	8.3	3	21.0	4	4.1	4	2.2
Red-tailed Hawk	37	52.8	30	41.3	11	76.9	30	30.8	62	33.8
Ferruginous Hawk	6	8.6	4	5.5			2	2.1		
Rough-legged Hawk	2	2.9	3	4.1						
Cooper's Hawk	1	1.4	1	1.4	1	7.0	6	6.2	13	7.1
Sharp-shinned Hawk	3	4.3			1	7.0			2	1.1
Northern Harrier	29	41.4	17	23.4			14	14.4	6	3.3
Prairie Falcon	5	7.1	8	11.0			5	5.1	4	2.2
Merlin	1	1.4								
American Kestrel	57	81.3	22	30.3	2	14.0	6	6.2	22	12.0
Great Horned Owl			1	1.4					1	0.5
Greater Roadrunner	8	11.4	2	2.8			4	4.1	3	1.6
Loggerhead Shrike	67	95.6	52	71.6	4	28.0	43	44.2	73	39.8
Total	217	309.6	146	201.1	22	153.9	114	117.2	190	103.6

*Represents Bald Eagles sighted during a separate inventory effort.

Table 3 (Cont.)

HABITAT TYPE:	Half-shrub		Saltbush		Pinyon-Juniper		Creosotebush		Mountain Shrub	
SPECIES	No.	R.A.I.	No.	R.A.I.	No.	R.A.I.	No.	R.A.I.	No.	R.A.I.
Bald Eagle										
Golden Eagle							2	1.7		
Red-tailed Hawk	2	16.3	5	25.6	1	43.5	19	15.8	3	7.0
Ferruginous Hawk										
Rough-legged Hawk	1	8.1								
Cooper's Hawk			1	5.1	1	43.5	8	6.6	1	2.3
Sharp-shinned Hawk							4	3.3		
Northern Harrier	1	8.1	6	30.8			6	5.0		
Prairie Falcon	1	8.1	1	5.1			3	2.5		
Merlin										
American Kestrel							2	1.7		
Great Horned Owl										
Greater Roadrunner			1	5.1			3	2.5	1	2.3
Loggerhead Shrike	7	56.9	4	20.5			38	31.5	2	4.7
Total	12	97.5	18	92.2	2	87.0	85	70.6	7	16.3

darily in desert grasslands. Craig (1978) recorded similar habitat utilization in Idaho. Of the 110 kestrels observed in this study, 56 (50%) were males and 54 (50%) were females. This even sex ratio differs from the preponderance of females reported by Koplin (1973), Mills (1975, 1976), and Wilkinson and Debban (1980). Female kestrels preferred grassland (55% female vs 45% male), Creosotebush (67% vs 33%), and agricultural lands (53% vs 47%). Males predominated in mesquite (75% males vs 25% females), saltbush (100% vs 0%), and desert scrub (62% vs 38%). Female kestrels, presumably dominant, occupied the preferred habitat types; whereas, males were displaced to marginal habitats.

We encountered Great Horned Owls, which are primarily nocturnal, in desert grasslands and desert scrub. We do not believe that this finding accurately reflects their habitat utilization or preference.

Roadrunners occurred in seven of the habitats. Relative abundance indices indicated a preference for agricultural lands, saltbush and mesquite.

We observed Loggerhead Shrikes in every habitat, except pinyon-juniper. Relative abundance indices indicated a preference for agricultural land, grassland, half-shrub and mesquite.

ACKNOWLEDGMENTS

We would like to thank Paul Tankersley for assisting with the field work. We would also like to thank Stephen M. Russell for his editorial review and comments on the draft.

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Accepted 17 May 1984

Red-tailed Hawk *Sketch by Cameron Barrows*

BULLETIN BOARD

GRASSHOPPER SPARROW STATUS IN SOUTHERN CALIFORNIA

Information on the past and present status of the Grasshopper Sparrow (*Ammodramus savannarum*) as a breeding species in southern California (south of Monterey—Inyo counties) is needed, for a preliminary study on the current population status and possible decline of this species in recent years. Please include the following information:

1) exact location of breeding birds; 2) date of observation; 3) number of birds; 4) evidence of breeding; 5) current status of site, if known; 6) habitat type, if known. All contributors will be gratefully acknowledged. Robert L. McKernan, Section of Ornithology, Los Angeles County Museum of Natural History, 900 Exposition Blvd., Los Angeles, California 90007.

RAPTOR RESEARCH FOUNDATION CONFERENCE—NOVEMBER 1985 ANNOUNCEMENT AND FIRST CALL FOR PAPERS

The 1985 Raptor Research Foundation (RRF) International Meeting and Symposium on the Management of Birds of Prey will be held at the Capitol Plaza Holiday Inn in Sacramento, California, 2-10 November 1985. Highlights of the meeting will include 1) the Second RRF Conference on Raptor Conservation Techniques—Twelve Years of Progress, 1973-1985; 2) a Western Hemisphere Meeting of the World Working Group on Birds of Prey (ICBP); 3) the Second International Vulture Symposium; 4) A Western North American Osprey Symposium; 5) a Workshop on North American Candidate Endangered Raptors; 6) an International Symposium on Raptor Reintroduction; and 7) a Symposium on Raptor Rehabilitation, Captive Breeding, and Public Education. For more information or if you are interested in presenting a paper, please contact Dr. Richard R. Olendorff, U.S. Bureau of Land Management, 2800 Cottage Way, Sacramento, California 95825, or Nancy Venizelos, San Francisco Zoological Society, Sloat Blvd. at the Pacific Ocean, San Francisco, California 94132.

WESTERN BIRD BANDING ASSOCIATION ANNUAL MEETING

The Western Bird Banding Association will hold its annual meeting 3-5 June 1985, prior to the joint meeting of the Wilson and Cooper ornithological societies to be held in nearby Boulder, Colorado. The WBBA meeting, at YMCA of the Rockies, Estes Park (adjacent to Rocky Mountain National Park), will include paper sessions, informal workshops and demonstrations, and field trips. Planned owling trips(s) will provide a chance of hearing or seeing Boreal Owls.—*Ronald A. Ryder*, Dept. of Fishery and Wildlife Biology, Colorado State University, Fort Collins, Colorado 80523.

NOTES

FIRST RECORD OF Le CONTE'S SPARROW IN OREGON

JEFF GILLIGAN, 26 N.E. 32nd Avenue, Portland, Oregon 97232
OWEN SCHMIDT, 1220 N.E. 17th Avenue #2-D, Portland, Oregon 97232
DAVID IRONS, 4005 S.E. Lambert, Portland, Oregon 97202
RICHARD SMITH, 12415 N.W. Haskell Court #18, Portland, Oregon 97229

Gilligan spotted Oregon's first Le Conte's Sparrow (*Ammodramus leconteii*) while birding with Schmidt, Irons and Smith on 27 Sep 1983, in the tiny oasis town of Fields, Harney Co. We first saw the bird around 0900 in 3 m high willows (*Salix* sp.) along the creek that flows through town. These trees were filled with migrating passerines including a Blackpoll Warbler (*Dendroica striata*) and a Clay-colored Sparrow (*Spizella pallida*), both vagrants in Oregon. The record has been submitted to the Oregon Bird Records Committee.

The Le Conte's Sparrow soon disappeared into a nearby swale, mostly grassy with small willows and brush that had been killed 2 years earlier by fire. We saw it many times over the next 6 hours, in some cases getting views as long as a minute but usually just catching glimpses. One diagnostic photograph (Figure 1) was obtained when the bird was flushed onto a small snag. The click of the camera shutter frightened the bird back into the grass.

Figure 1. Le Conte's Sparrow, Fields, Harney Co., Oregon, 27 Sep 1983.
Photo by Jeff Gilligan

This description was taken from field notes prepared by Irons and Gilligan immediately after the sighting: Size—small, about the size of a Lincoln's Sparrow (*Melospiza lincolnii*). Head—very pale central crown stripe bordered by a distinct blackish line on each side; broad, bright orange-buff supercilium; black postocular streak; distinct gray ear patch; lower face orange-buff, somewhat paler than supercilium. Bill—short, conical. Eye—large, dark. Nape—grayish, steaked with reddish-brown. Chest—orange-buff. Sides—orangish, well streaked with dark brown. Abdomen—whitish. Back—feathers blackish-brown, broadly edged with buff, forming several broad buffy lines running the length of the back. Wings—brown, feather fringes paler brown. Tail—short; undertail—orangish-buff.

The broad buffy streaks on the blackish-brown back, the distinct gray earpatch, and the orange-buff supercilium eliminate any race of the Grasshopper Sparrow (*Ammodramus savannarum*). The distinct gray earpatch, the steaked nape, the pale crown stripe, and the broadness and buffy color of the back streaks eliminate the inland race of the Sharp-tailed Sparrow (*Ammodramus caudacutus nelsoni*).

Le Conte's Sparrow breeds as far west as southern Mackenzie, east-central British Columbia, and north-central Montana (Godfrey 1979, AOU 1983). It migrates regularly through the Great Plains to its wintering grounds in south-central and southeastern United States (Terres 1980, AOU 1983). The AOU (1983) lists Le Conte's Sparrow as "casual west to Washington, Idaho . . . and California," but Burleigh (1972) calls it rare in Idaho, "apparently of casual occurrence in the northern part of the state," with only one documented record. Washington has two records, one of a bird that killed itself against a window in Kennewick, Benton Co., on 29 May 1964 (Roberson 1980, Weber and Larrison 1977), and one of a bird seen 15 Nov 1982 at Willapa National Wildlife Refuge in Pacific Co. (Hunn and Mattocks 1983). Roberson (1980) lists seven records for California, six of which he considered to be fall vagrants. The earliest was 13 Oct 1970, on Southeast Farallon Island.

Winds were from the southwest on the morning this bird was seen. In fall 1983, as in fall 1982 when we birded the same area on about the same date, "eastern" vagrants were seen at Fields during periods of southwest winds.

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BLACK-SHOULDERED KITE AND NORTHERN GOSHAWK INTERACTIONS WITH PEREGRINE FALCONS AT SAN MIGUEL ISLAND, CALIFORNIA

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ROBERT L. DELONG, National Marine Mammal Laboratory, NMFS, NWAFC, 7600 Sand Point Way, NSA Bldg. 32, Seattle, Washington 98115

Although the Black-shouldered (White-tailed) Kite (*Elanus caeruleus*) has not been known to nest on the California Channel Islands, it was locally abundant in mainland coastal areas of California in the 19th century (Waian and Stendall 1970). The kite population in the Santa Barbara region has increased substantially during the last 30 years, after being reduced to very small numbers by habitat destruction, shooting and egg collecting in the early 1900s (Waian and Stendall 1970, Garrett and Dunn 1981). The species has not been previously reported from San Miguel Island, although there are four recent autumn sightings from nearby Santa Cruz and Santa Rosa islands (Garrett and Dunn 1981).

On 28 October 1982, Stewart observed an adult Black-shouldered Kite hunting near Nidever Canyon on San Miguel Island. The kite was seen again the next morning hunting in the same area. An adult Black-shouldered Kite was seen on 14 November 1982 hunting over the dry lake bed near the west end of the island. Stewart observed the bird for about 20 minutes before a Peregrine Falcon (*Falco peregrinus*) flew over Green Mountain from the east. The falcon harassed and chased the kite as they both ascended and flew to the south. They disappeared from sight about 15 minutes after the encounter began. A third sighting of an adult Black-shouldered Kite was made near Nidever Canyon on 17 November 1982.

The Northern Goshawk (*Accipiter gentilis*) has been observed occasionally on the southern California mainland in Santa Barbara, Ventura and Los Angeles counties but it has never been reported from any of the Channel Islands (Garrett and Dunn 1981). Peregrine Falcons nested, although apparently in small numbers, on San Miguel Island in the early 1900s but the population was extinct by the 1940s (Kiff 1980). Peregrines have been regularly sighted at San Miguel Island in autumn and winter in recent years (Jehl 1980, Stewart unpubl. data). Most of these sightings are thought to be of transient birds although a few peregrines may have wintered on the island. On 12 November 1982, as we were observing a Peregrine Falcon hunting from a bluff at Harris Point, an adult Northern Goshawk suddenly appeared over the bluff. It flew directly at and began harassing the peregrine. The two birds interacted for about 15 minutes before the goshawk flew off towards the east. The apparent "aerial combat" consisted of the goshawk initially stooping on the peregrine. The birds fell together to within about 1 m of the ground, with the goshawk above the falcon, at which time the falcon countered by chasing the goshawk vertically to about 100 m to 150 m altitude. The birds never made physical contact and the sequence was repeated eight times before the goshawk departed to the east. The peregrine then resumed hunting at the same location.

Later, on 14 November 1982, Stewart observed an adult goshawk (probably the same bird) at the south end of the dry lake bed near Green Mountain and watched it for about 40 minutes before it flew off to the southwest.

These observations are apparently the first records of the Black-shouldered Kite and the Northern Goshawk at San Miguel Island and the first record of the Northern Goshawk on the Southern California Channel Islands.

NOTES

We thank Joseph R. Jehl, Jr., Ralph W. Schreiber, Guy McCaskie, H. Lee Jones, Dennis M. Power, Kimball L. Garrett and William T. Everett for commenting on the manuscript.

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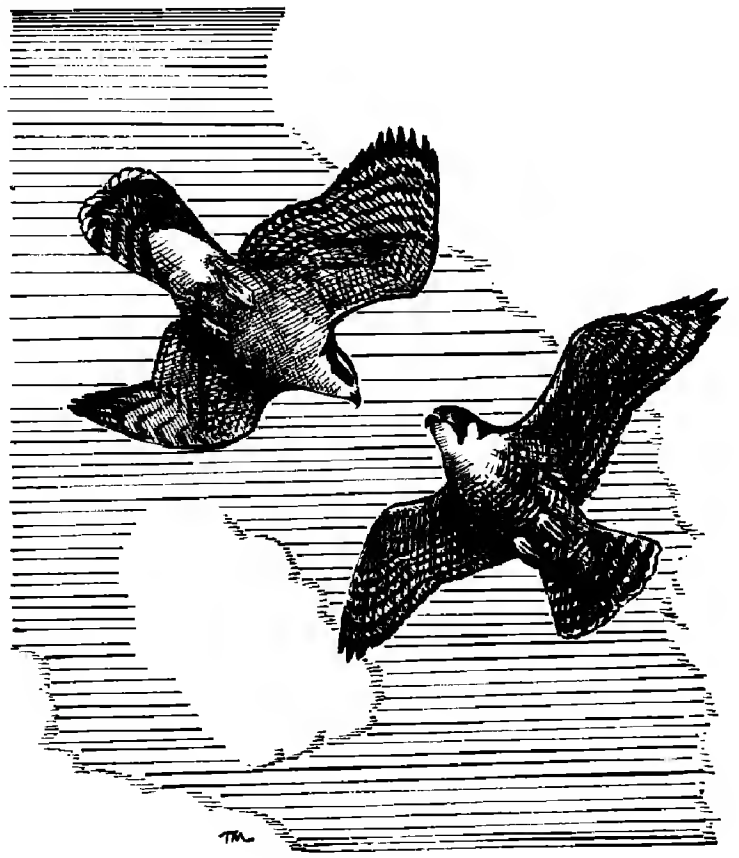


Northern Goshawk and Peregrine Falcon

Sketch by Tim Manolis

SOME RECENT NESTING RECORDS FOR THE SNOWY PLOVER IN THE SAN JOAQUIN VALLEY, CALIFORNIA

GARY L. IVEY, Kern National Wildlife Refuge, P.O. Box 219, Delano, California 93216 (present address: Malheur National Wildlife Refuge, P.O. Box 113, Burns, Oregon 97720)

A survey to determine the breeding status of the western race of the Snowy Plover (*Charadrius alexandrinus nivosus*) in California was conducted from 1977 to 1980 (Page and Stenzel, West. Birds 12:1-40, 1981). The San Joaquin Valley was surveyed in 1978 but the only Snowy Plovers found there that were suspected of breeding were one pair at Goose Lake, Kern County. Page and Stenzel (1981) also summarized historical breeding records for California, including the San Joaquin Valley. Gary Zahm (pers. comm.) reported two pairs of Snowy Plovers with broods on and near tile drainage evaporation ponds at Kesterson National Wildlife Refuge, Merced County, in June 1981. On 1 June 1982 I located nesting Snowy Plovers on newly developed tile drainage evaporation ponds, approximately 30 km south of Corcoran, Kings County.

I conducted periodic surveys of the Snowy Plover nesting population on two groups of evaporation ponds through the summer of 1982. I was able to survey only about 80% of the potential nesting habitat because some of it was on remote islands which were difficult to census. I observed several nests containing from one to three eggs, one nest with four eggs, and numerous young. The peak count was 126 adult-sized birds in early July. This total may have included some young of the year because I did not attempt to distinguish adults from fledged young. I estimated that approximately 60 pairs of Snowy Plovers nested on these areas in 1982.

Tile drainage evaporating ponds were developed in arid regions where summer evaporation is high and evaporating irrigation waters carry accumulations of salts. These ponds, described by Summers (American Society of Agricultural Engineers Paper No. 75-2064, 1975), are similar structurally to commercial salt evaporation ponds in the San Francisco Bay Area, which are also used extensively by nesting Snowy Plovers (Page and Stenzel 1981).

Ponds surveyed in 1982 were constructed in 1980 and 1981 in southeastern Kings County. The ponds encompassed the combined total of 998 ha. About 95% of the total area was covered with water; the remainder consisted of dikes, islands and service roads.

Snowy Plovers nested on the dikes, islands and roads around the ponds. These areas were generally devoid of vegetation because of high salinity. High populations of brine flies (family Ephydridae), a major food source for Snowy Plovers (Purdue, Southwestern Naturalist 21:347-357, 1976), occurred along the margins of the ponds. Other invertebrates were also present in high densities. Water salinity in the ponds (measured by specific conductance) ranged from about 10,000 to 100,000 micromhos per centimeter at 25°C (S. Hall pers. comm.).

During the summer 1982, an additional 259 ha in Kern County were incorporated into the evaporation pond complex. The new area was filled with water during fall and winter 1982-83, and supported nesting Snowy Plovers during the 1983 breeding season (D. Severson pers. comm.). This observation indicates that Snowy Plovers will readily colonize new habitats of this type.

Because of the magnitude of the soil salinity problem, several areas are currently being developed as evaporation basins in the San Joaquin Valley. It is likely Snowy Plovers will colonize these new basins when they are completed. Although these ponds are providing additional Snowy Plover habitat, the levels of potential toxicants accumulated in tile drainage waters, and how these toxicants may affect Snowy Plovers and other nesting birds, need to be investigated.

I would like to express my thanks to C.D. Littlefield and Gary Page for their comments on this manuscript, and to Dee Ehlers for typing assistance.

Accepted 21 August 1984

REPORT TO MEMBERS

TERENCE WAHL, President, Western Field Ornithologists

Western Field Ornithologists' annual meeting was held at San Rafael, California, 28-30 September 1984. Registration was about 50, with the usual predominance of California members. The WFO Board of Directors met on Friday, 28 September, from 1700-2200. The membership business meeting took place on Saturday, 29 September, prior to the papers session. A brief board meeting took place following the papers session, and the annual banquet and program followed. Field trips were offered Friday, Saturday and Sunday.

WFO's situation has improved considerably in the past year. *Western Birds* publication is almost up to date and the journal continues to improve, thanks to the efforts of Editor Alan Craig, associate editors, contributors, Editorial Board, and members of the Board of Directors.

Our financial condition has strengthened past the point of solvency to a welcome degree of security. This reflects new memberships, sales of reprints and T-shirts, income from boat trips and last year's annual meeting, and attention from board members.

Board members, officers and members on the membership promotion committee have set WFO on an enthusiastic drive in soliciting memberships through advertisements in ornithological publications, distributing brochures at meetings throughout western North America, and other efforts too detailed to describe here.

All this good news reflects the dedication of WFO members and officers toward strengthening the organization and its journal. We hope all members will point out to others interested in western field ornithology the value of belonging to WFO, receiving the journal, attending annual meetings (see below for further information), and being able to publish papers in what we believe is a quality scientific journal with its emphasis on identification, distribution, and western field ornithology. New members increase our ability to publish more articles on these subjects.

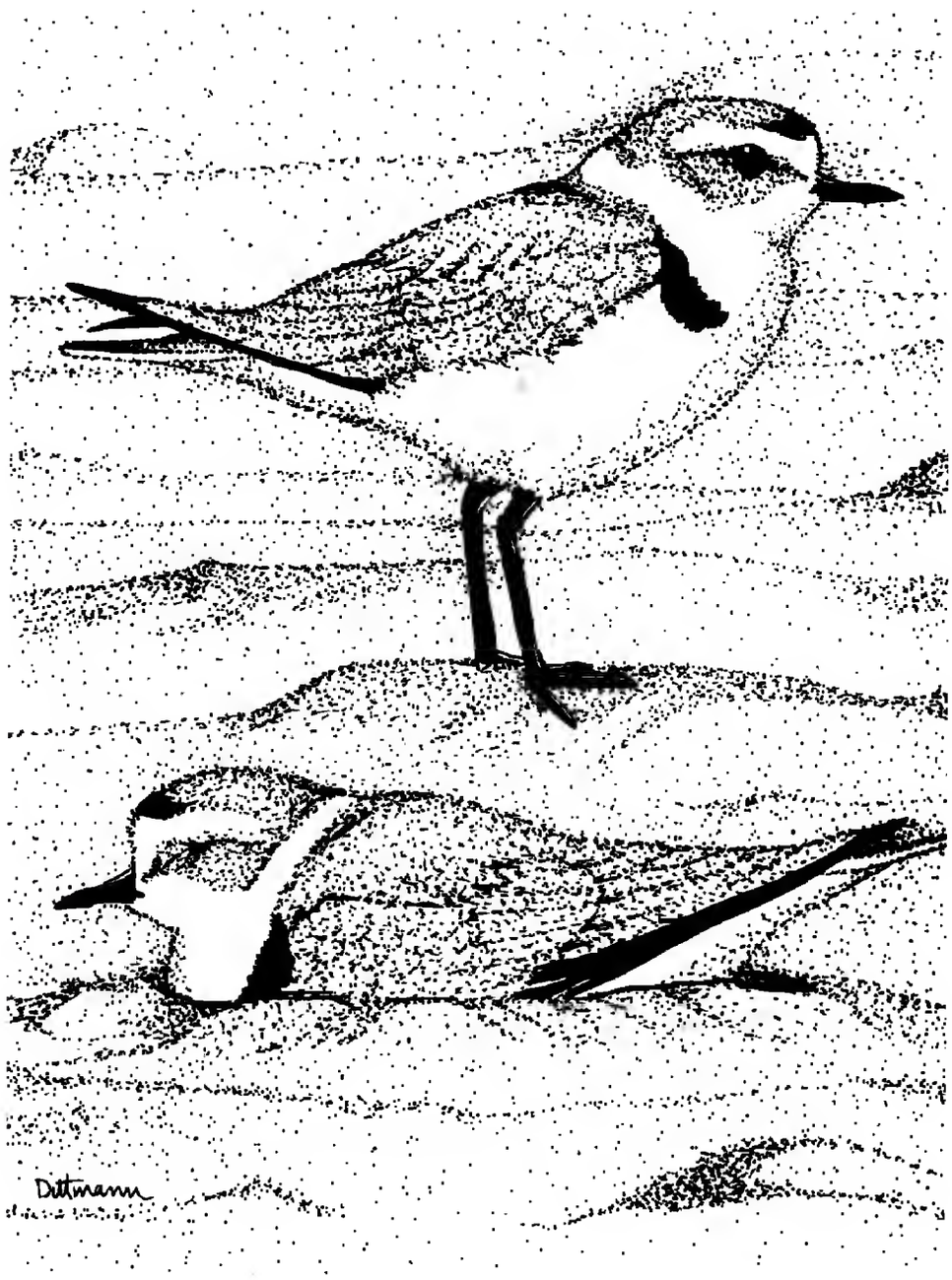
Dave Shuford gave a presentation on the Marin County breeding bird atlas. Tim Manolis discussed creating a county recording system in California. Jon Winter told us about the status of the Great Gray Owl in California. Joe Morlan discussed problems of identification of fall warblers. And Ed Harper presented an identification quiz, using a series of slides of mystery birds. Ed also presented the post-banquet program of beautiful slides of birds from many parts of western North America. As usual, these presentations were well received and much appreciated.

The membership elected Tim Manolis, Guy McCaskie and Joe Morlan to 3-year terms as WFO directors. The board elected Laurie Binford to be President, Tim Manolis Vice-President, Garth Alton Treasurer/Membership Secretary, and Jean-Marie Spoelman Recording Secretary for 1-year terms.

Field trips during this annual meeting visited a number of the well-known birding spots in Marin County and the Point Reyes area and, while vagrants were minimal, were enjoyed by all. Undoubtedly the most memorable event of the weekend, however, was the now-famous discovery of the Dusky

Warbler and subsequent convening of seemingly all California birders within a matter of hours at the Hayward Shoreline Marsh. Naturally, we believe that circumstances associated with our meeting led to its discovery at that time—another reason for attending meetings!

We thank John Luther, Tim Manolis, Kurt Campbell and all those who served on the local committee for their efforts. I thank all the members of WFO's board, its officers and members for their efforts over the past 3 years in getting us to where we are now, and feel confident that the efforts have laid the groundwork for further strengthening of WFO and growth of *Western Birds*.



Snowy Plover *Sketch by Donna Dittmann*

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Compiled by *Mildred Comar*

Volume 15, Number 4, 1984

Cover photo by Edward Harper: Sharp-tailed Sandpiper (*Calidris acuminata*), Alexai Point, Attu Island, Alaska, 13 September 1983.

Manuscripts should be sent to Alan M. Craig, P.O. Box 254, Lakeview, CA 92353. For matters of style consult *Suggestions to Contributors to Western Birds* (6 pp. mimeo available at no cost from the Editor) and *Council of Biology Editors Style Manual* 4th edition, 1978 (available from the American Institute of Biological Sciences, 1401 Wilson Boulevard, Arlington, VA 22209 for $12.00).

Papers are desired that are based upon field studies of birds, that are both understandable and useful to amateurs, and that make a significant contribution to scientific literature. Appropriate topics include distribution, migration, status, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, the techniques for identifying, 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 papers dealing with studies accomplished in or bearing on Rocky Mountain states and provinces westward, including Alaska and Hawaii, adjacent portions of the Pacific Ocean and Mexico, and western Texas.

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.