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FALL MIGRATION OF DIURNAL RAPTORS AT PT. DIABLO, CALIFORNIA

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For several years prior to the fall of 1972, I noted raptors migrating past my office window at the east end of Golden Gate Park, San Francisco, California. Concluding that I was by chance positioned along a raptor flyway, I set out to find a location where the birds would be more concentrated and easily observed. An examination of contour maps indicated that the hills at and near the base of Pt. Diablo, overlooking the mouth of San Francisco Bay, in the Marin (Co.) Headlands portion of the Golden Gate National Recreation Area, might offer the desired characteristics. On 21 September 1972, after seeing several hawks from my window, I visited Pt. Diablo and was rewarded with 162 individuals of 10 species of raptors in 3.17 hours of observation. That fall, on 29 partial days (102.33 hours), I recorded 4034 individuals of 14 species, thus establishing the importance of Pt. Diablo as the only known major hawk lookout in western North America.

Additional counts were made sporadically by myself and other observers during the falls of 1973-77. The primary purpose of this report is to present the data on relative abundance, timing and species diversity gathered during the six falls. A few comparisons are made with migration at Hawk Mountain, Pennsylvania. Thorough analysis of other aspects of the phenomenon must await data from continuous coverage.

DESCRIPTION OF AREA

The Pt. Diablo Hawk Lookout consists of two hills about 275 m high and 0.6 km apart and connected by a saddle-like ridge that runs southwest-northeast. The southwestern hill, which is honeycombed with old military bunkers, is called "Bunker Hill" by local birders and "Hill 129" by personnel of the Golden Gate National Recreation Area. Its top consists of cement bunkers and platforms on a short, narrow grassy ridge that peaks at the northeastern end. The northeastern hill, called "Cross Hill" by birders, is topped by an abandoned parking lot. The sides of

both hills are covered with grass and low chaparral, and Bunker Hill has small patches of pines that attract migrant passerines and, occasionally, hunting accipiters.

Bunker Hill is the better of the two hills for fall raptor observation, because it affords an unobstructed view to the west and northwest, whence come most of the birds. The flat top of Cross Hill makes observation more difficult; however, this seems to be the better observation point in spring. Binford (1977) gives highway directions to both hills.

OBSERVATIONS

Fall counts were conducted sporadically from 1972 through 1977. The earliest date was 15 August and the latest 6 December. Observations totaled 262.6 hours distributed over 72 partial days as follows: August, 22.2 hours, 5 days; September, 123.2, 33; October, 78.2, 21; November, 38.0, 12; and December, 1.0, 1. The vast majority of observations were made between 1000 and 1400 (PST), the prime period for raptor migration. Most of the counts were made by B. J. McCaffery or myself; the 20 other observers who generously provided data are listed under Acknowledgments.

The number of individual raptors observed at a lookout depends on, among other factors, the completeness of coverage on both a daily and seasonal basis. Continuous coverage of Pt. Diablo was impossible because of a military rifle range that, when active, necessitated closure of Bunker Hill. Because coverage was not continuous, neither the actual counts of individuals nor figures derived from them can be used to determine *true* abundance. They can, however, be used as approximate measures of *relative* abundance when combined for the six falls and converted into percentages of the total or into passing rates, i.e. the number of raptors per hour of observation. Percentages are shown in Table 1 and passing rates in Figures 1B-6. Even these calculations cannot completely eliminate errors resulting from interspecific variation in seasonal or daily timing of migration. For instance, a species that routinely migrates early or late in the day or season, when coverage was least extensive, would have relatively lower totals. However, I believe that this type of error is minimal.

RELATIVE ABUNDANCE

During the 262.6 hours of observation, 8696 individual raptors were recorded. Table 1 gives the 18 species that have been recorded and the relative abundance of each. The actual number of individuals seen over the six-fall span is presented for each species, but because these figures are difficult to visualize as measures of relative abundance, I have converted them into percentages of the total 8696 birds. I have also applied classical terminology to indicate relative abundance because

percentages are difficult to remember. These terms are based on the number of individuals that would be expected to pass in one typical flight day during the species' peak 10-day period, assuming twelve-hour days and 4 hours each at 100%, 50% and 10% of the maximum 10-day passing rate. The periods and approximate passing rates are shown in Figures 2-6. The scale is as follows: *abundant,* $625^{+}+$ individuals per day; *very common,* 125^{+}-625; *common,* 25^{+}-125; *fairly common* 5^{+}-25; *uncommon,* 0-5 per day, averaging $5^{+}+$ per fall season; *rare,* 0-5, 1-5; *occasional,* 0-1 per day, averaging once per 1^{+}-5 years; *casual,* 0-1, 5^{+}-25; *accidental,* 0-1, $25^{+}+$. Species in the first six categories occur annually, whereas the others do not. Superscript "plus" signs indicate fractions.

In these classical terms, two species are considered very common, two common, three fairly common, four uncommon, three rare, three occasional, and one accidental. The three commonest species were Red-tailed, Sharp-shinned, and Cooper's hawks. Their respective percentages of the total raptors, based only on identified individuals, were 28.25, 28.22, and 19.96%. However, 517 (5.94%) unidentified accipiters were observed. If these are allocated according to the same ratio (1:1.41) noted for identified Cooper's and Sharp-shinned hawks (disregarding Goshawk and the five unidentified buteos), there were about 2758.5 (31.72%) Sharp-shinned and 1948.5 (22.41%) Cooper's. Thus the Sharp-shinned was the most common species, surpassing even the Red-tailed, and these three species accounted for approximately 82.38% (7164 birds) of the total.

Four other species accounted for an additional 15.72%: Turkey Vulture (9.81%), American Kestrel (3.17), Marsh Hawk (1.60), and Red-shouldered Hawk (1.14). Thus seven species, termed very common to fairly common in relative abundance and each occurring probably every suitable day during its peak period, accounted for about 98.10% of the total individuals. The remaining 11 species, considered uncommon to accidental, accounted for less than 1% each and only about 1.90% together.

TIMING OF MIGRATION

To demonstrate timing of fall migration at Pt. Diablo, I present histograms based on passing rates (Figures 1B-6). Despite the paucity of data, the rarer species (except Mississippi Kite) are included because in most cases their dates of occurrence fit patterns I have noted elsewhere in northern California. Periods of peak abundance for some species can be determined from gross inspection of the histograms, but for other species (e.g., Marsh Hawk, White-tailed Kite) histograms are not adequate. Therefore, I calculated "average dates" based on actual dates of occurrence weighted by abundance (in terms of passing rates, pr) according to the formula: $\lesssim(\text{pr} \bullet \text{date}) \div \lesssim\text{pr}$.

Table 1. Relative abundance, in terms of the number of individuals seen, percent of total and classical terminology (see text), of migrating diurnal raptors recorded at Pt. Diablo, California, during 262.6 hours of timed observations in six falls, 1972-77. Numbers in parentheses reflect allocation of the 517 unidentified accipiters between Cooper's and Sharp-shinned hawks according to the ratio 1:1.41 observed for identified birds. Figures in brackets represent additional records obtained outside timed periods (see Species Accounts).

	Number of individuals	Percent of total	Classical terminology
Turkey Vulture *(Cathartes aura)*	853	9.81	Common
White-tailed Kite *(Elanus leucurus)*	30	.34	Uncommon
Mississippi Kite *(Ictinia mississippiensis)*	0 [1]	.00 [+]	Accidental
Goshawk *(Accipiter gentilis)*	1 [+1]	.01	Occasional
Sharp-shinned Hawk *(A. striatus)*	2454 (2758.5)	28.22 (31.72)	Very Common
Cooper's Hawk *(A. cooperii)*	1736 (1948.5)	19.96 (22.41)	Common
Red-tailed Hawk *(Buteo jamaicensis)*	2457	28.25	Very Common
Red-shouldered Hawk *(B. lineatus)*	99	1.14	Fairly Common
Broad-winged Hawk *(B. platypterus)*	65 [+11]	.75	Uncommon
Swainson's Hawk *(B. swainsoni)*	3	.03	Rare
Rough-legged Hawk *(B. lagopus)*	3	.03	Rare
Ferruginous Hawk *(B. regalis)*	4	.05	Rare
Golden Eagle *(Aquila chrysaetos)*	9	.10	Uncommon
Marsh Hawk *(Circus cyaneus)*	139	1.60	Fairly Common
Osprey *(Pandion haliaetus)*	41	.47	Uncommon
Prairie Falcon *(Falco mexicanus)*	1	.01	Occasional
Peregrine Falcon *(F. peregrinus)*	1 [+1]	.01	Occasional
American Kestrel *(F. sparverius)*	276	3.17	Fairly Common
Accipiter sp.	517 (0)	5.94 (0.00)	
Buteo sp.	5	.06	
Falco sp.	2	.02	
Totals:	8696 (8696)	99.97 (99.98)	

Patterns of abundance. The raptors as a whole, as well as the individual species, exhibited distinct patterns of increase and decrease with time. For all species together (Figure 1B), migration progressed at a low intensity during the last two-thirds of August, increased rather abruptly in the first 10 days of September, reached a peak in the last 10 days of September, maintained a somewhat lower but fairly constant level through the end of October, and then decreased rather abruptly, reaching a low level in late November. Histograms for the three commonest species, the Red-tailed, Sharp-shinned and Cooper's hawks, demonstrate that the fairly constant level for the last third of September through October was primarily a result of coincident decreases in the two accipiters and an increase in the Red-tailed. The increase from the first to the second periods of November was a result of an influx of Red-tailed Hawks and may have reflected the arrival of adults, which averaged later than immatures (pers. obs.).

Histograms for the eleven commonest species show three rather distinct patterns of abundance: (1) The Turkey Vulture and American Kestrel increased gradually to a rounded peak, then decreased gradually. (2) The Red-tailed Hawk, Marsh Hawk and perhaps White-tailed Kite also increased gradually but reached a sharp peak and then decreased rather abruptly. (3) The Sharp-shinned, Cooper's, Broad-winged and Red-shouldered hawks, Golden Eagle and Osprey increased rather abruptly to a sharp peak followed by a gradual decrease. More data are needed to test the validity of these patterns.

Even though passing rates based on less than continuous coverage are not measures of *true* abundance, I offer the following figures so that visitors will gain some idea of what to expect on days with good visibility and during the best times of day (ca. 1000-1400 PST) and year (ca. 21 Sep.-31 Oct.). The maximum daily passing rate recorded was 129.65 birds per hour (1 bird per 28 sec.) during a 4.25-hour period on 22 Sep. 1977; 458 (88.9%) of the total 515 birds were accipiters. Passing rates exceeded 60 birds per hour (1 per min.) on 10 (13.9%) of the 72 partial days of observation, all between 21 Sep. and 28 Oct. The average during the very best period, 21 Sep.-10 Oct., was 49.92 birds per hour (1 per 1 min., 12 sec.), while the average for all 72 partial days was 33.15 per hour (1 per 1 min., 49 sec.).

Sequence of occurrence. The sequence in which the 17 non-accidental species occurred may be determined by comparing peak periods and "average dates" shown in Figs. 2-6. The Swainson's Hawk, Osprey and perhaps Prairie Falcon were early migrants; the first two had peak periods and "average dates" in mid-September, and their migration was largely over before 1 October. The White-tailed Kite averaged slightly later but may also be termed an early migrant; its migration was over by late October. Seven species had "average dates" and peak periods close

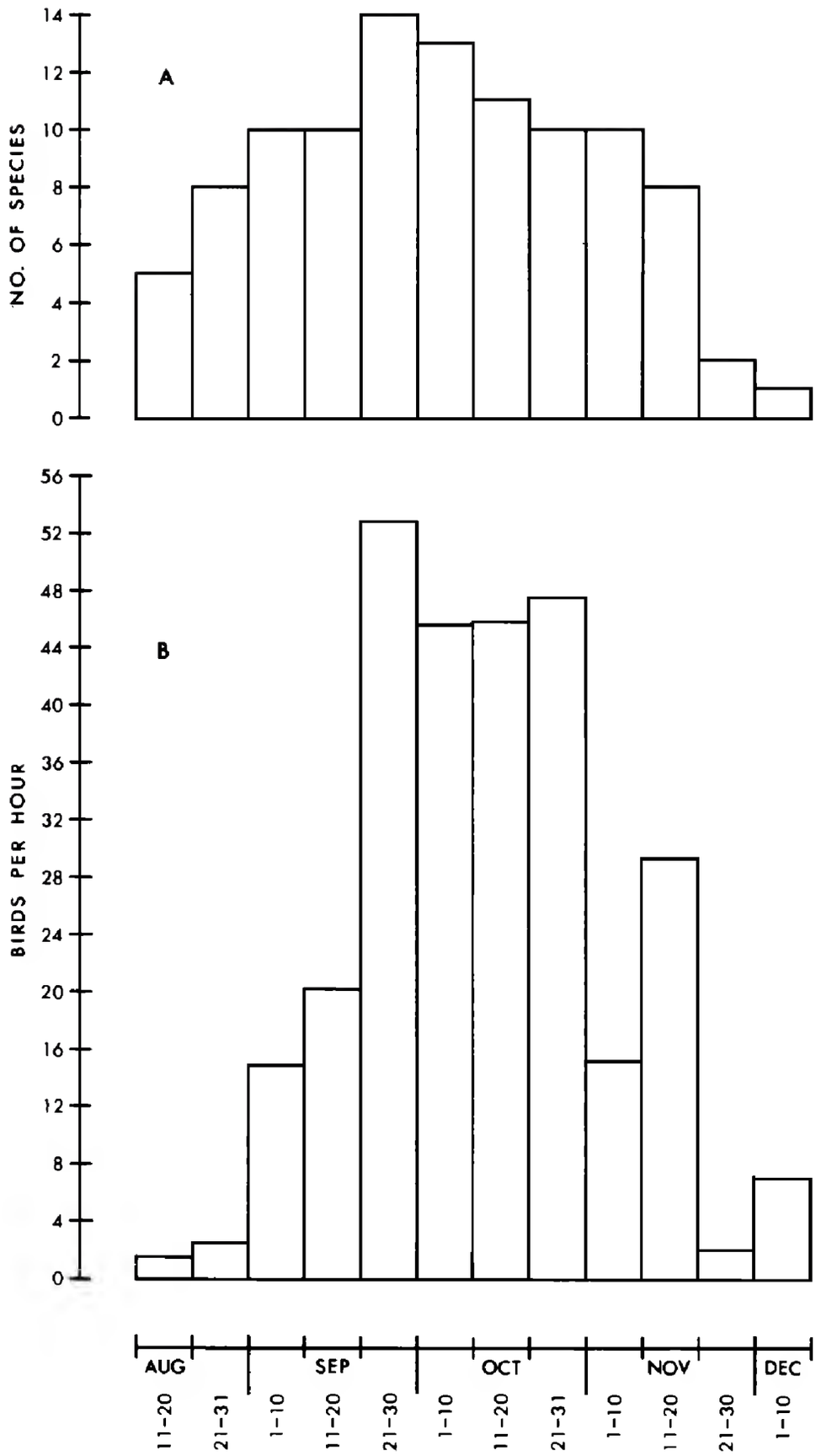

Figure 1. Temporal species diversity (A) and temporal distribution (B) of migrating diurnal raptors recorded at Pt. Diablo, California, during the six-fall period 1972-77. The histogram for species diversity includes all records for the 18 species (see Species Accounts), while that for distribution is based on the 8696 individuals seen during 262.6 hours of timed observations.

to 1 October and can be considered late-September through October, or mid-term migrants: American Kestrel, Sharp-shinned, Cooper's, Broad-winged and Red-shouldered hawks, and probably Peregrine Falcon and Ferruginous Hawk. The Turkey Vulture and Marsh Hawk were somewhat later, still with "average dates" in early October but with peak periods in mid- to late October. The Red-tailed Hawk and Golden Eagle were even later, averaging mid-October, and the Rough-legged Hawk and Goshawk were the latest, with "average dates" in November.

Duration. Migration was in progress at very low intensities when both the earliest (15 August) and latest (6 December) observations were made (Figure 1B). The extreme limits of the migration period probably are early August and late December.

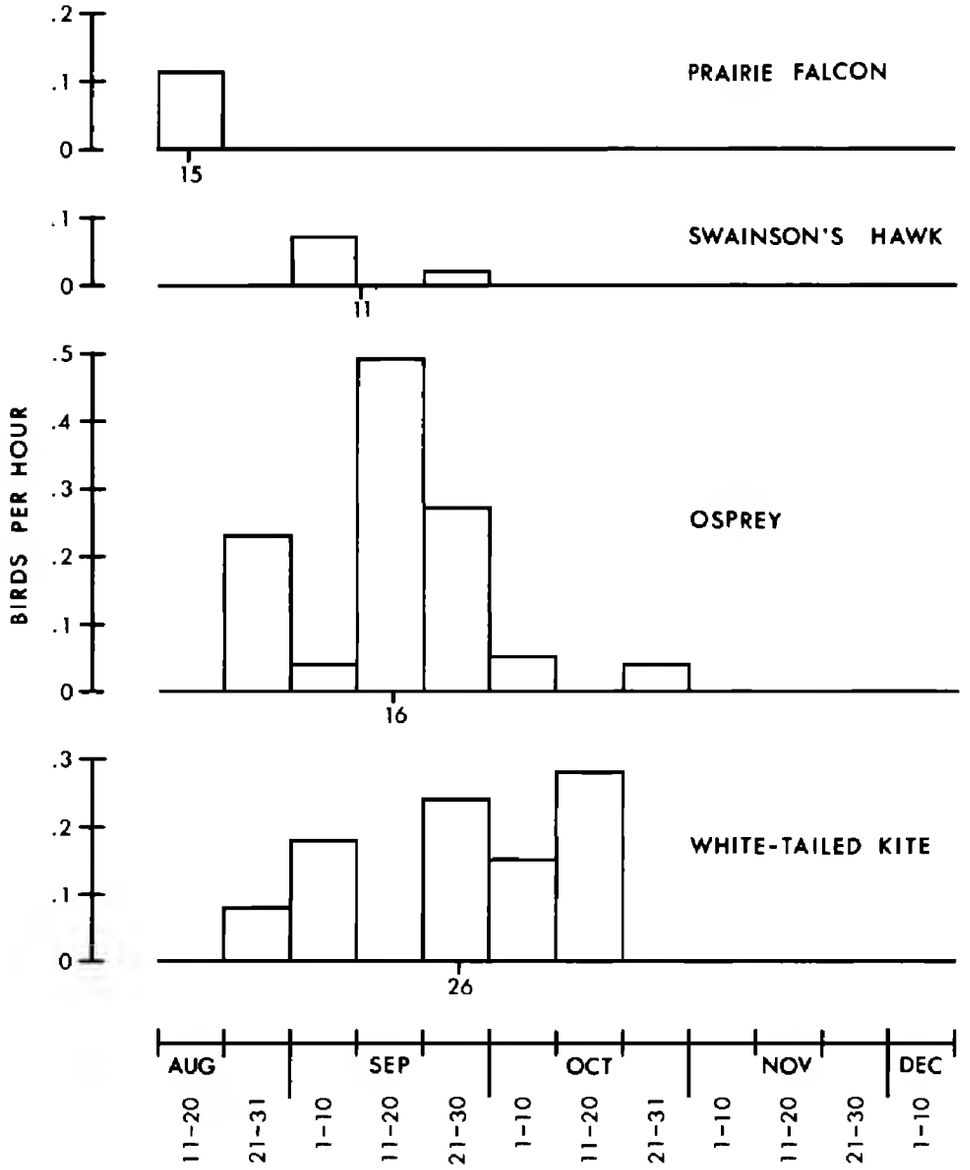

Figure 2. Temporal distribution of migrating diurnal raptors recorded at Pt. Diablo, California, during 262.6 hours of observation in the six-fall period 1972-77. Specific dates are "average dates" of occurrence weighted by passing rates (see text).

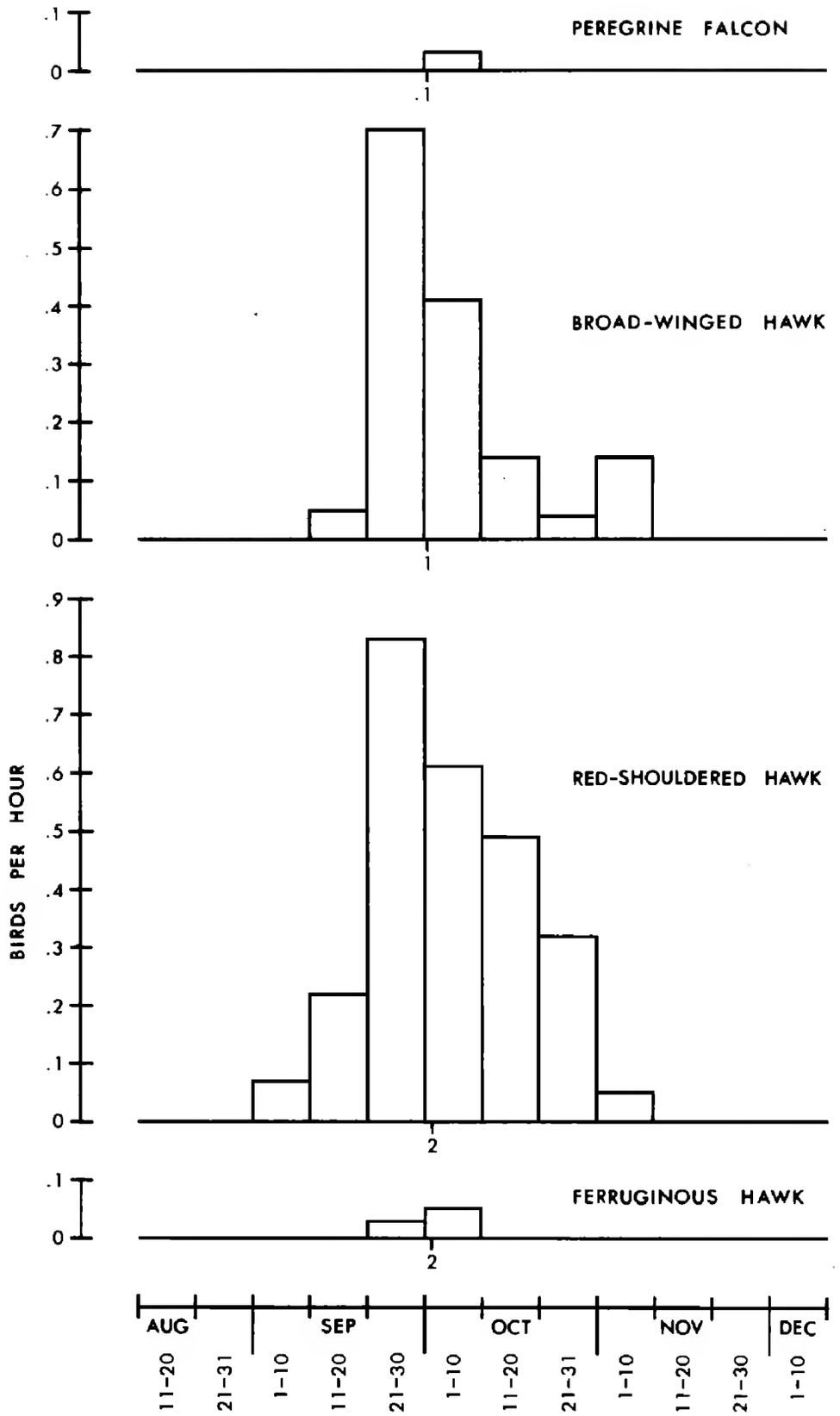

Figure 3. Temporal distribution of migrating diurnal raptors recorded at Pt. Diablo, California, during 262.6 hours of observation in the six-fall period 1972-77. Specific dates are "averages dates" of occurrence weighted by passing rates (see text).

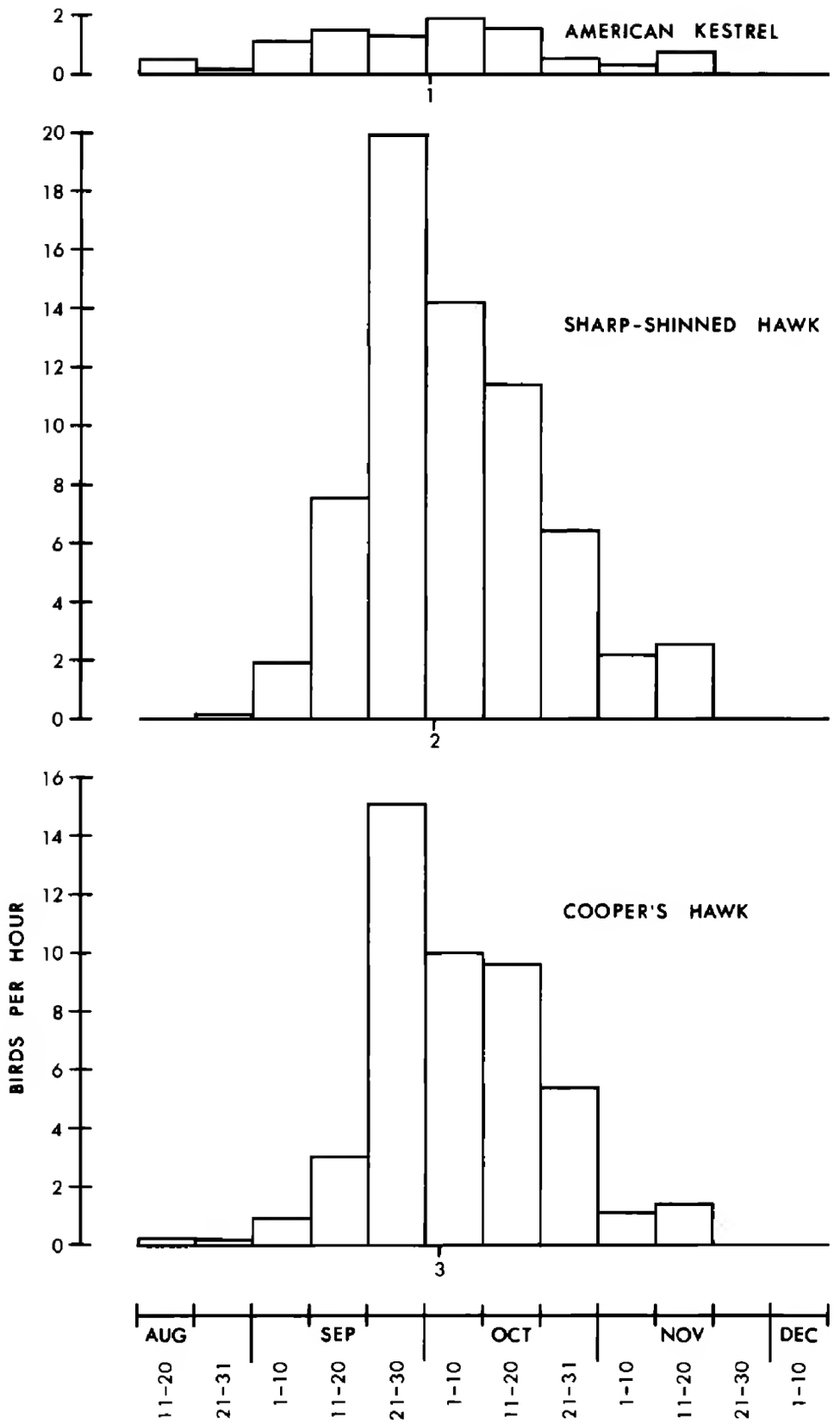

Figure 4. Temporal distribution of migrating diurnal raptors recorded at Pt. Diablo, California, during 262.6 hours of observation in the six-fall period 1972-77. Specific dates are "average dates" of occurrence weighted by passing rates (see text).

Analysis of the duration of the migratory period for individual species must await data from continuous coverage. It is interesting to note, however, that five of the six commonest species (Turkey Vulture, Red-tailed, Cooper's and Marsh hawks and American Kestrel) were recorded during periods lasting over 3 months (range 96 to 111 days), while the four next commonest species, the White-tailed Kite, Red-shouldered and Broad-winged hawks and Osprey, were seen during periods lasting

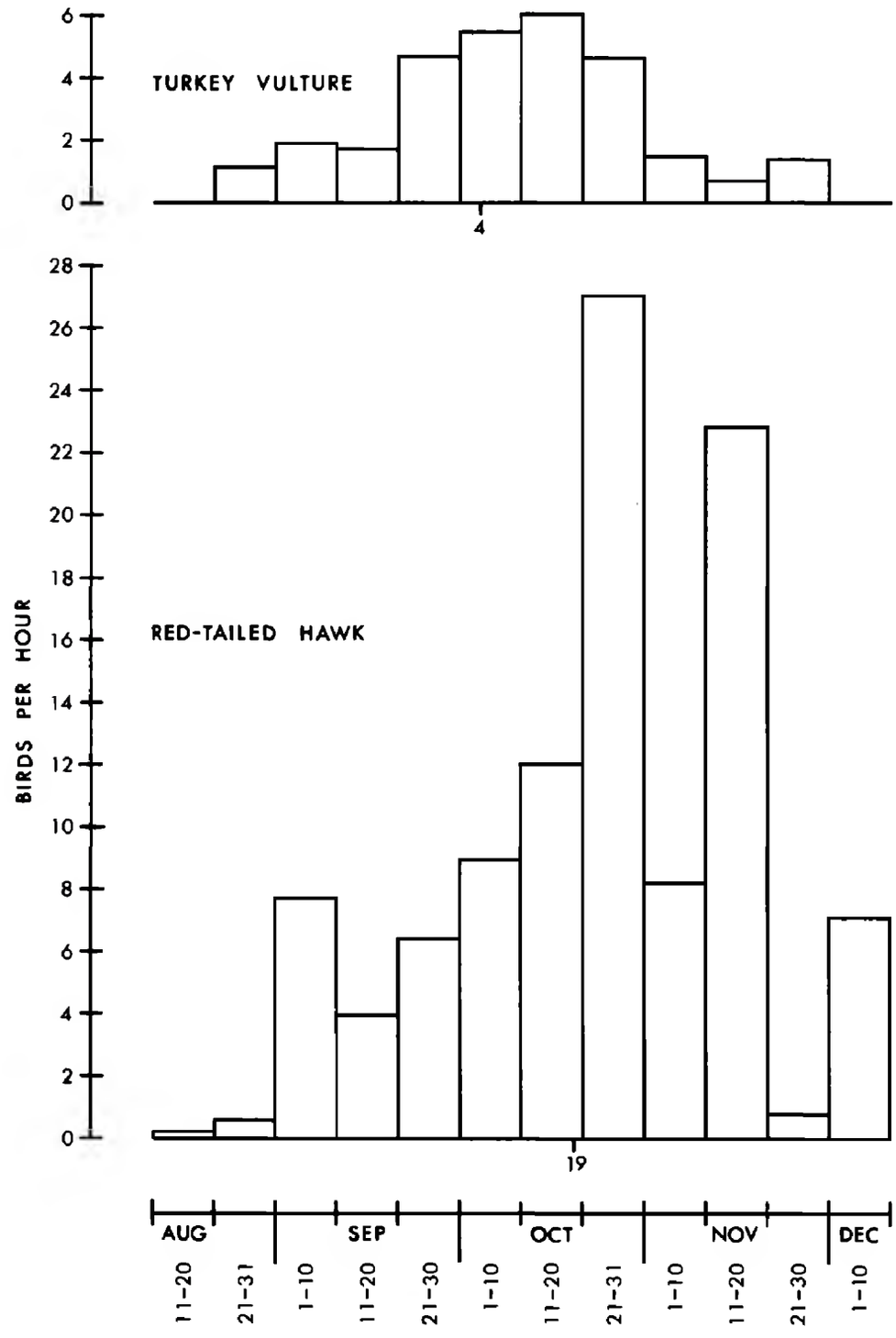

Figure 5. Temporal distribution of migrating diurnal raptors recorded at Pt. Diablo, California, during 262.6 hours of observation in the six-fall period 1972-77. Specific dates are "average dates" of occurrence weighted by passing rates (see text).

only about 2 months (52-62 days). The Sharp-shinned Hawk occupied an intermediate position of about 2.75 months (82 days).

SPECIES DIVERSITY

The number of species per 10-day period (Fig. 1A) varied from 1 to 14 and generally followed the curve for abundance (Fig. 1B), although the increase of species before and decrease after the late-September peak were somewhat more gradual. Species and individuals both dropped off rather sharply in the last third of November, although this was at least

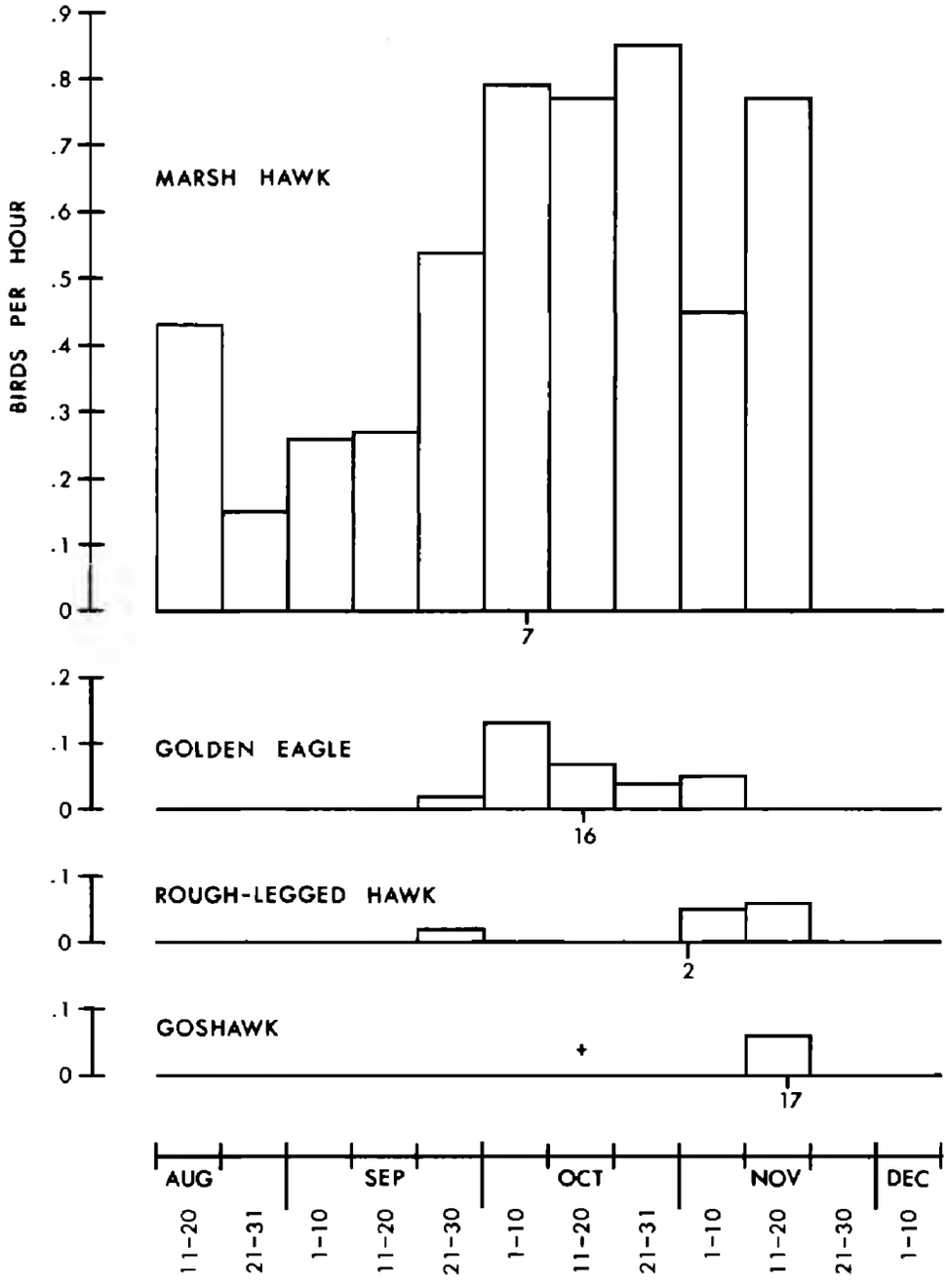

Figure 6. Temporal distribution of migrating diurnal raptors recorded at Pt. Diablo, California, during 262.6 hours of observation in the six-fall period 1972-77. Specific dates are "average dates" of occurrence weighted by passing rates (see text).

partly an artifact of incomplete coverage. Daily species totals varied from 0 to 11, with an overall average of 6.49. For the very best period, 21 Sep.-10 Oct., totals ranged from 5 to 11 and averaged 8.15. Continuous coverage would, of course, affect these figures.

SPECIES ACCOUNTS

Prior to this study, neither the White-tailed Kite nor Red-shouldered Hawk was known to be migratory in California (Small 1974). Their abundance, annual regularity and southward movement at Pt. Diablo suggest true migration rather than random post-breeding dispersal, but corresponding spring data are needed for confirmation.

The regular occurrence of the Broad-winged Hawk was most unexpected, as there were only about 15 previous records for the entire state. Details for this and the seven rare to accidental species are presented below; data for the commoner species are contained in Table 1 and Figures 2-6.

Mississippi Kite. Accidental fall visitant. A single adult was seen well by W. M. Pursell and A. Mericourt on 13 Sep. 1976 (Winter and Erickson 1977). This was only the second record for northern California; the first was an immature seen by B. Clow 3 miles east of Cape Mendocino, Humboldt Co., on 6 Sep. 1975 (Stallcup and Winter 1976); the closeness of the two dates is perhaps significant.

Goshawk. Occasional fall transient here and elsewhere on the coast of northern California. Two records: one immature seen by L. C. Binford on 17 Nov. 1972 during an invasion year for numerous northern or montane species, and one adult observed by W. M. Pursell on 20 Oct. 1974 (Stallcup et al. 1975).

Broad-winged Hawk. Uncommon fall transient. At least 76 individuals were observed at Pt. Diablo in the falls of 1972-77. Extreme dates were 15 Sep. (1975) and 5 Nov. (1975). The true average date for all records was 4 Oct., and the "average date" weighted by passing rate, based on the 65 birds recorded during timed periods, was 1 Oct. The maximum daily count was 14 on 30 Sep. 1974 (L. C. B.), of which eight were in sight at one time. Three immatures of the very rare dark phase were seen: 4 Oct. 1974 (L. C. B.), 6 Oct. 1974 (S. F. Bailey) and 28 Oct. 1972 (L. C. B.). This suggests that Pt. Diablo Broad-winged Hawks originate in the northwestern part of the species' range, where the melanistic morph seems to occur most often.

Swainson's Hawk. Rare fall transient here and elsewhere along the coast of northern California. Three records, all for single immatures: 4 and 23 Sep. 1975 (L. C. B.) and 7 Sep. 1976 (B. J. McCaffery). The last bird was wing-tagged as a juvenile near Richland, Benton Co., southeastern Washington in 1975 or 1976 (McCaffery pers. comm.; Winter and Erickson 1977).

Rough-legged Hawk. Rare fall transient; possibly increases to uncommon status during some invasion years. Probably has been seen at Pt. Diablo more often than the three times for which I have data: single birds on 30 Sep. 1977 (B. D. Parmeter, W. M. Pursell et al.) and on 5 and 17 Nov. 1972 (L. C. B.).

Ferruginous Hawk. Rare fall transient here and elsewhere on the coast of northern California. Four records: 21 Sep. 1977 (J. W. Shipman and L. Compagno), 30 Sep. 1977 (B. D. Parmeter, W. M. Pursell et al.), 1 Oct. 1977 (S. F. Bailey) and 7 Oct. 1972 (L. C. B.).

Prairie Falcon. Occasional fall transient here and elsewhere on the coast of northern California. One record: a single bird seen by B. A. Sorrie on 15 Aug. 1977.

Peregrine Falcon. Occasional fall transient. Two records: one seen by S. F. Bailey et al. on 1 Oct. 1977 and one photographed by J. W. Shipman and L. Compagno on 6 Oct. 1977. The scarcity of the Peregrine Falcon and apparent absence of the Merlin *(Falco columbarius)*, despite their regularity elsewhere on the northern California coast, may reflect behavioral responses to local geography. Both species are direct flyers that show little avoidance of water barriers or dependence on updrafts, and in fact seem to favor outer beaches where available (pers. obs.); possibly Marin Co. birds cut directly across the extreme mouth of San Francisco Bay rather than detouring eastward to Bunker and Cross hills. As support for this theory, Peregrine Falcons are seen with more regularity to the west of Bunker Hill over Rodeo Lagoon, and even the bird seen from Bunker Hill on 1 Oct. 1977 was described by Bailey (pers. comm.) as "far to the west-northwest and northwest."

COMPARISONS WITH THE EASTERN UNITED STATES

I have compared certain aspects of migration at Pt. Diablo with data given by Haugh (1972) for Hawk Mountain, which is near Allentown, Pennsylvania, and is on a latitude about 320 km north of San Francisco. Although detailed comparisons of abundance must await data from continuous coverage of Pt. Diablo, some statements are warranted. Certainly, the Broad-winged Hawk is much less numerous and the Cooper's Hawk much more so at Pt. Diablo. Aside from the western species (Swainson's Hawk, Ferruginous Hawk and Prairie Falcon), only one other species, the Turkey Vulture, is clearly more common at Pt. Diablo. On the other hand, seven species occur in larger numbers at Hawk Mountain: Goshawk, Red-shouldered Hawk, Bald Eagle, Osprey, Peregrine Falcon and Merlin; the eagle and Merlin have not been recorded at Pt. Diablo, but should occur in small numbers.

The patterns of abundance for individual species at Hawk Mountain are similar to the three noted at Pt. Diablo, except that the two accipiters decrease abruptly and the Golden Eagle increases gradually to a rounded peak.

The duration of the fall migratory period is similar at the two lookouts, both having low intensities of movement in the last half of August and first part of December. The relative durations for individual species are also fairly similar, with the Red-tailed Hawk, Cooper's Hawk, Marsh Hawk and American Kestrel spending about 3 months on migration, the Sharp-shinned Hawk, Red-shouldered Hawk and Osprey about 2.5 months, and the Broad-winged Hawk about 1.5 months. The Golden Eagle, however, has an extended period of about 3.5 months, rather than 1 month, at Hawk Mountain.

In timing of peak periods, the most striking differences are that at Pt. Diablo the Broad-winged Hawk peaks about 2 weeks *later* and the Red-

shouldered Hawk somewhat over 3 weeks *earlier* than at Hawk Mountain. The Red-tailed Hawk, Golden Eagle, Sharp-shinned Hawk and Cooper's Hawk also peak earlier at Pt. Diablo, by about 2 weeks for the first two species and 1 week for the accipiters. The Marsh Hawk, Osprey and American Kestrel peak at about the same time at the two lookouts, but the first two species seem to average a few days earlier and the American Kestrel a few days later at Pt. Diablo. Three additional species, for which data are few, the Rough-legged Hawk, Peregrine Falcon and Goshawk, also appear to occur a few days earlier. Thus with the notable exception of the Broad-winged Hawk and possibly the American Kestrel, migration is earlier at Pt. Diablo than at Hawk Mountain, in spite of the 320-km difference in latitude. Distance to the nearest breeding grounds, which are in central Alberta about 1750 km from Pt. Diablo, may account for the lateness of the Broad-winged Hawk.

SOURCE OF RAPTORS

Several factors probably contribute to the concentration of raptors at Pt. Diablo. Perhaps most important is the juxtaposition of the ocean and bay. The ocean shore of Marin Co. runs northwest-southeast, while the northwestern shore of the northern arm of San Francisco Bay runs approximately north-south. The land between thus forms a funnel culminating at Pt. Diablo. Both shorelines probably form leading lines, especially for those species such as buteos that hesitate to cross large bodies of water. In addition, the mountain ranges in this area form long northwest-southeast ridges, the most important of which is Bolinas Ridge, extending for some 55 km from Tomales to the Marin Headlands. Other long ridges form a series of lines parallel to the coast and extend nearly from the Oregon border. The importance of Bolinas Ridge is suggested by the fact that many raptors approach Bunker Hill from the northwest and especially west, with the latter birds originating in the northwest but being forced to follow the eastward curve of the Marin Peninsula. Very likely many of the raptors observed at Pt. Diablo in fall originate in the northwestern coast belt of North America. However, evidence demonstrates that some come from the Great Basin and Great Plains; these birds could take a westward or southwestward course to the coast much in the manner of certain water birds, such as the California Gull *(Larus californicus)* and Western Grebe *(Aechmophorus occidentalis)*, and then turn to follow the coast southward. A Swainson's Hawk wing-tagged near Richland, Washington, east of the Cascade Range, was seen at Pt. Diablo. The Broad-winged Hawk is not known to breed west of central Alberta, whence probably came at least the three dark phase birds observed at Pt. Diablo. Finally, the Ferruginous Hawks could have come only from their breeding grounds to the northeast.

SUMMARY

Pt. Diablo, located just north of San Francisco, California, is the only known major hawk lookout in western North America. Since its discovery in the fall of 1972, 18 species of diurnal raptors have been recorded. Sporadic observations totaling 262.6 hours over 72 days in the falls of 1972 through 1977 produced 8696 individual birds. The relative abundance of each species is given. Seven species, termed very common to fairly common, accounted for about 98.10% of the total. The most numerous three, the Sharp-shinned (~31.72%), Red-tailed (28.25), and Cooper's (~22.41) hawks, produced about 82.38% of the total.

Raptor migration begins in earnest about the first of September, reaches a peak in number of individuals in the end of September, and tapers off to a low level in late November. Limited migration takes place at least as early as mid-August and as late as early December. Peak periods and "average dates," which together provide a sequence of occurrence, are presented for each species, and three patterns of abundance are postulated.

The temporal pattern for species diversity is similar to that for abundance. Separate accounts are presented for the rarer species. The White-tailed Kite and Red-shouldered Hawk, previously thought to be sedentary in California, are shown to be migratory in fall. The Broad-winged Hawk, believed to be a casual vagrant in the state, is an uncommon fall transient at Pt. Diablo.

Most individuals at Pt. Diablo probably originate in the northwestern coastal areas of North America and use northwest-southeast ridges, the Pacific coast, and locally the shore of San Francisco Bay as leading lines and sources of updrafts, but some birds come from northeast of the Cascades.

Only two species (Turkey Vulture and Cooper's Hawk) are more common at Pt. Diablo than at Hawk Mountain, Pennsylvania, while seven are more common at the latter. Most species peak earlier at Pt. Diablo. In most other aspects studied, migration is rather similar at the two lookouts.

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SIZE SELECTIVE PREDATION AND FOOD HABITS OF TWO CALIFORNIA TERNS

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Evidence for size selective predation by seabirds is anecdotal or, at best, qualitative; however, several studies suggest that prey size selection is a fairly common phenomenon partitioning the food resource among sympatric seabirds (Bourne 1955, Ashmole 1968, Bédard 1969, Baltz and Morejohn 1977).

The present study documents size selection of prey species by two species of seabirds, the Caspian Tern *(Sterna caspia)* and the Forster's Tern *(S. forsteri)*. These two seabirds, although differing greatly in size, have broadly overlapping breeding seasons and similar foraging strategies. The study was done in Elkhorn Slough, Monterey County, California, where the fish fauna is well known (Cailliet et al. 1977); both terns forage in the slough and breed nearby. Since size differences are greater than 130:100 (culmen 174:100; gape width 191:100; weight 459:100), the terns were expected to exploit different elements of the prey community, as predicted by Hutchinson (1959) and MacArthur and Levins (1964).

METHODS

Six specimens of both species of terns were collected on 11 July 1975. On 28 July 1977, 5 Caspian Terns and 9 Forster's Terns were collected. A total of 11 Caspian Terns and 15 Forster's Terns thus were utilized. Weights and measurements were taken from fresh specimens following Ashmole (1968). Contents of the proventriculus and ventriculus were removed and sorted. Otoliths were washed and stored dry as recommended by Fitch and Brownell (1968). Other contents such as fish flesh and bones were preserved in formalin and then stored in 40% isopropyl alcohol. The minimum number of prey represented by otoliths was taken to be the greatest number of right or left otoliths of similar size.

Weights and standard lengths (SL) of Shiner Perch *(Cymatogaster aggregata)* represented by otoliths were estimated from regressions on specimens collected in Elkhorn Slough (formulae available from authors). Two otoliths, one representing a juvenile and the other an adult Shiner Perch taken by a Forster's Tern and a Caspian Tern, respectively, were too eroded to determine prey size and were excluded from

statistical tests. For Northern Anchovy *(Engraulis mordax)*, lengths and weights were calculated from otolith measurements using relationships provided by Clark and Phillips (1952) and Spratt (1975). Sizes of other prey species were measured or estimated from reference collection specimens at Moss Landing Marine Laboratories.

Many of the prey items were represented only by otoliths. Some were represented by identifiable, partially digested whole fish. Since analysis on a gravimetric basis would have overestimated the importance of prey represented by partially digested or undigested items, the diets were compared numerically. Analyses of the stomach contents of terns collected in 1975 and 1977 were combined and are summarized in Table 1.

The distribution and abundance of fishes in Elkhorn Slough and adjoining Bennett Slough were the subject of concurrent studies by Cailliet et al. (1977) and Antrim (unpubl. data). Fishes were collected from several areas before, during and after terns were collected. Bennett Slough is shallow and was sampled with a small beach seine (15.2 x 1.4 m). The main channel in Elkhorn Slough was sampled at several stations with a small otter trawl having a 4.9 m headrope with 38 mm stretch mesh in the body and a 32 mm stretch mesh liner in the codend.

RESULTS

Forster's Terns were observed foraging over the entire area of the slough, but primarily over mudflats covered at flood tide where the water depth was 1 m or less. Schools of small fish were observed in the clear, shallow water covering the mudflats; when startled, the schools quickly disappeared in one of the many smaller channels which meander through the mudflats. Caspian Terns foraged over the main channel and, to a lesser extent, over the shallows. Both species collected on 11 July 1975 were preying heavily on the same fish, the Shiner Perch, although other fishes were taken as well. Stomachs of all specimens contained identifiable contents. The Shiner Perch was ranked first overall in abundance throughout the slough from August 1974 to June 1976 (Cailliet et al. 1977). Size distributions of Shiner Perch found in the stomachs of both tern species represent opposite ends of the bimodal distribution of Shiner Perch trawled in Elkhorn Slough in July 1975 (Figure 1). Caspian Terns preyed primarily on adult Shiner Perch, whereas Forster's Terns preyed primarily on young-of-the-year. Mean prey lengths (Shiner Perch only) were significantly different between tern species (t-test, 19 d.f., $P < .001$). These differences are probably related to the large differences in predator size.

Specimens collected on 28 July 1977 were not preying as heavily on Shiner Perch, but differences in the size of prey were apparent. Stomachs of two of the Forster's Terns and one of the Caspian Terns did not contain identifiable food items. Forster's Terns preyed on juvenile

Table 1. Summary of stomach contents of Caspian Terns *(Sterna caspia)* and Forster's Terns *(S. forsteri)* collected in Elkhorn Slough, Monterey Co., California, in July of 1975 and 1977.

	CASPIAN TERNS (N=10)			FORSTER'S TERNS (N=15)		
PREY ITEMS	A	B	C	A	B	C
Shiner Perch, *Cymatogaster aggregata*						
adult	20	80.0	80.0	1	1.6	6.7
juvenile	1	4.0	10.0	27	42.2	40.0
Northern Anchovy, *Engraulis mordax*						
adult	4	16.0	20.0	2	3.1	13.3
juvenile				21	32.8	53.3
Night Smelt, *Spirinchus starksi*						
juvenile				1	1.6	6.7
Top Smelt, *Atherinops affinis*						
juvenile				1	1.6	6.7
Arrow Goby, *Clevelandia ios* adult				8	12.5	13.3
Unidentified gobies				3	4.7	13.3
Gill Lice[1] *Lironeca vulgaris*	2		20.0	1		6.7

A=Total number of items in each category.

B=Percentage of total individuals by number.

C=Percent frequency of occurrence of various prey items in stomachs.

1 Gill Lice were probably acquired indirectly from parasitized fishes; they are parasitic on many fishes and range from Washington to Baja California (Schultz 1969); lice are omitted from computation of percentage of total individuals.

Northern Anchovy, juvenile Shiner Perch and Arrow Gobies *(Clevelandia ios)*, whereas Caspian Terns preyed on adult Shiner Perch and adult Northern Anchovy. Size of prey taken in 1977 again reflected the large size difference between the terns; however, measurable prey items in Caspian Terns were too few for statistical testing. Comparisons of prey length in samples comprised of more than one species were deemed inappropriate due to the variety of fish body forms (Swennen and Duiven 1977); therefore, weights were used to compare prey size. Mean weights of all prey taken in 1975 were significantly different (t-test, 22 d.f., $P<.001$, as were combined collections (Figure 2) from 1975 and 1977 on a mean weight basis (t-test, 23 d.f., $P<.001$).

DISCUSSION

The highly significant differences in the sizes of prey taken by the tern species were anticipated, since Salt and Willard (1971) reported that Caspian Terns ". . . consistently captured much larger fish in the same water than any taken by Forster's Tern." However, the almost exclusive predation on different age classes of the same prey species, Shiner Perch

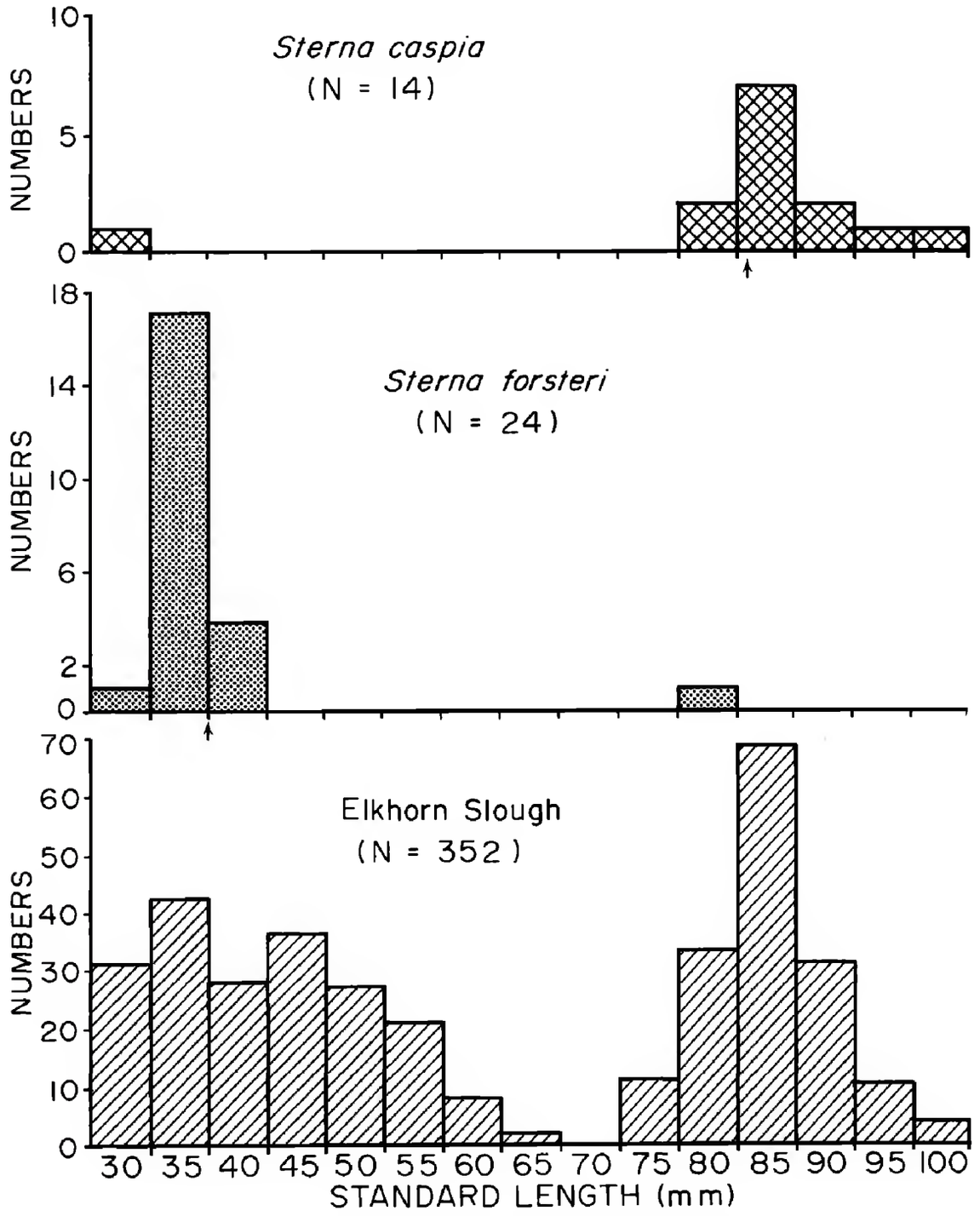

Figure 1. Size distributions of Shiner Perch *(Cymatogaster aggregata)* in the stomach contents of Caspian Terns *(Sterna caspia)* and Forster's Terns *(S. forsteri)* and in Elkhorn Slough. Numbers of Shiner Perch are in parentheses. Mean size taken by terns is indicated by arrow.

and Northern Anchovy, was unexpected. Whether this pattern continues thoughout the stay of both species in the study area is unknown, since the food habits of both terns have not been examined in Elkhorn Slough during months other than July. Notwithstanding the great size differences between the tern species, both species probably respond similarly in an opportunistic manner to the most available prey species. Bent (1921) summarized information which suggests that both Forster's and Caspian terns are opportunistic feeders and may utilize a variety of prey other than fishes; however, Salt and Willard (1971) and Salt (pers. comm.) studied nearby San Francisco Bay area populations of Caspian and Forster's terns which preyed exclusively on fishes while on the study area (April-January).

During a 23-month study of the distribution and abundance of fishes in Elkhorn Slough, the Shiner Perch was ranked first in overall

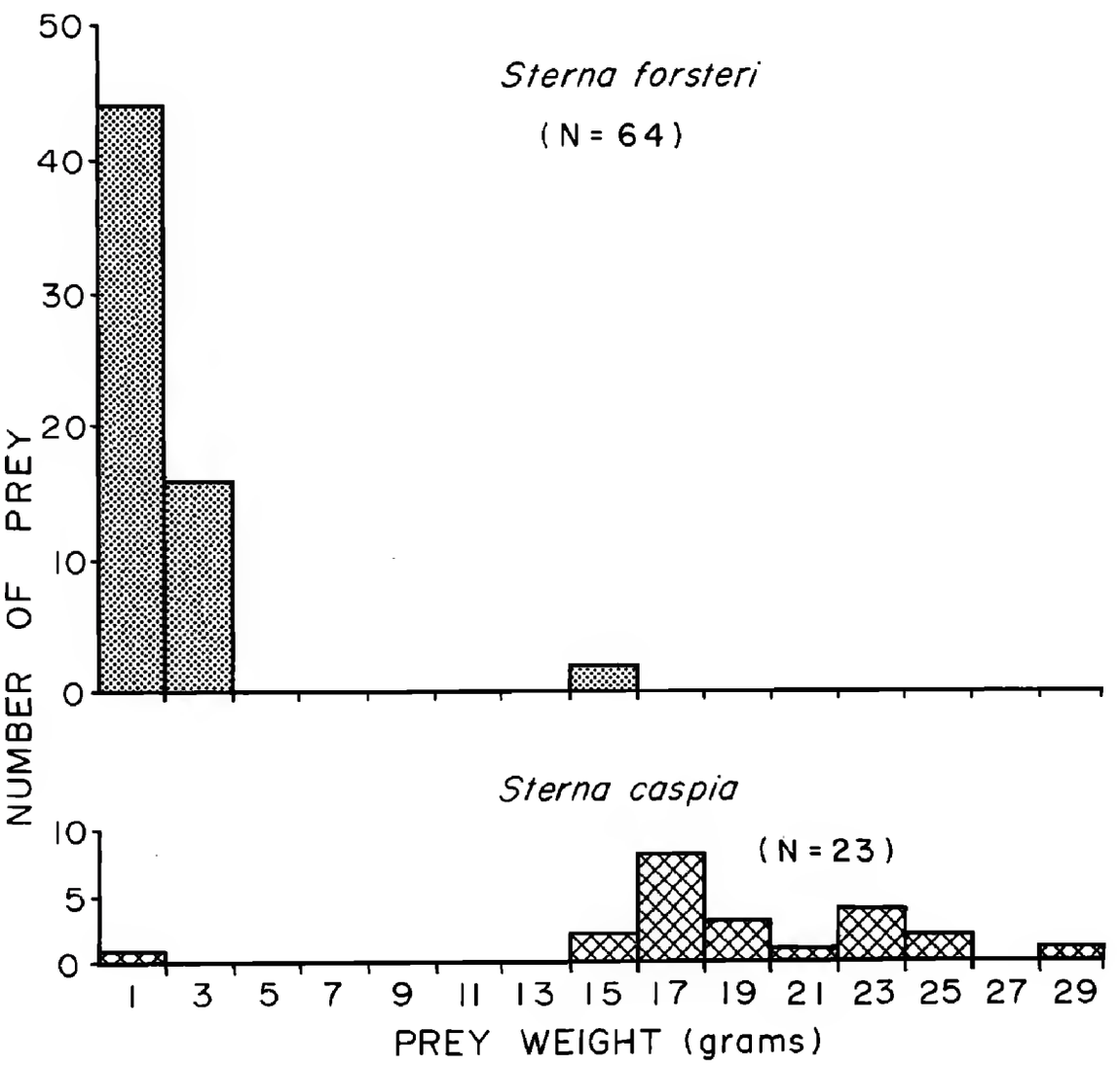

Figure 2. Size distributions by weight of all prey taken by Caspian Terns *(Sterna caspia)* and Forster's Terns *(S. forsteri)* in Elkhorn Slough in 1975 and 1977. Numbers of prey organisms are in parentheses.

abundance, whereas the Arrow Goby was ranked first in Bennett Slough, similar to the mudflat habitat in Elkhorn Slough (Cailliet et al. 1977). The size distribution of Shiner Perch in the 1975 trawl catch was bimodal (Figure 1) due to the presence of numerous young-of-the-year and five older age classes.

The Shiner Perch is viviparous and females give birth from early May through late June, with young ranging from 26 to 36 mm SL; young-of-the-year reach peak abundance in July in Elkhorn Slough (Antrim unpubl. data). The importance of Shiner Perch in the diets of Caspian and Forster's terns reflects their abundance in the slough. Shiner Perch have also been found to be important prey of other seabirds and dominate many marine and estuarine habitats on the Pacific coast (Martini 1964, Sealy 1972, Gill 1976).

Presence of otoliths from a juvenile Shiner Perch in the stomach contents of a Caspian Tern was probably due to predation on a pregnant female Shiner Perch. Cannibalism by Shiner Perch is an unlikely explanation, since adults are not piscivorous (Antrim unpubl. data). Alternatively, inexperienced terns might be expected to take prey of unusual size (Buckley and Buckley 1974); however, the tern in question was an adult. Inexperience might also account for the two largest fishes taken by Forster's Terns.

Salt and Willard (1971) found that the mean size of fishes taken by Forster's Terns declined from spring to fall and that Forster's Terns preyed most effectively on fishes of 75 mm total length (TL) or longer. They suggested that the observed decline in mean prey size was due to the passage of an age class begond the range of vulnerability. Our data support their suggestion. Shiner Perch were present in their study area and were probably important prey. Age one-plus Shiner Perch in the 75 mm TL (58 mm SL) size range constituted a minor portion of the population in Elkhorn Slough in July 1975 (Figure 1). Information on the growth rate of the one-plus age class is lacking for the Elkhorn Slough population, but individuals in the Navarro River Estuary grow from a mean of 83.7 mm TL (72.6 mm SL) in early April to a mean of 98.4 mm TL (85.5 mm SL) in late July and early August (Varoujean pers. comm.). The maximum size of prey that Forster's Terns have been observed to take is about 87 mm TL (75.6 mm SL) (Salt and Willard 1971). Assuming that growth rates are similar in both populations, it appears that the one-plus age class is much less vulnerable to attack by Forster's Terns by early summer. The decline in mean prey size observed by Salt and Willard (1971) is probably the result of the increasing availability of young-of-the-year and the declining abundance and increasing cost in handling time of age one-plus Shiner Perch. Other piscivorous birds prefer prey slightly smaller than half the maximum size manageable (Swennen and Duiven 1977). This suggests that Forster's Terns are quite capable of

preying on fishes much larger than the mean size taken in this study (37.5 mm SL).

The occurrence of Northern Anchovy was sporadic throughout the study, as was the occurrence of lesser prey species. The unidentified gobies recovered from Forster's Terns in 1975 were possibly Arrow Gobies; however, five other species of gobies occur in Elkhorn Slough (Brothers 1975, Cailliet et al. 1977). The Arrow Goby was the most abundant fish in beach seine catches in the extensive mudflat area of Bennett Slough throughout most of the year and is probably the most abundant fish on mudflats throughout the sloughs, but mudflats in Elkhorn Slough were not sampled.

The shallowness and clarity of the water over the mudflats probably enable terns to track their prey more effectively than is possible over deeper waters. Small fishes such as gobies are particularly vulnerable in shallow water to attack by Forster's Terns which can capture prey to a maximum depth of 30 cm below the surface (Salt and Willard 1971). Forster's Terns forage extensively over covered mudflats where small prey are abundant and more vulnerable. Caspian Terns also forage over covered mudflats, but concentrate their activity over deeper channels where larger prey are more abundant.

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POST-HATCHING MOVEMENTS OF YOUNG ANCIENT MURRELETS

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Precocial development in truly marine birds is exhibited by only four species, all alcids. Other species in the family are semi-precocial or exhibit a developmental pattern intermediate between these two (Ricklefs 1973, Sealy 1973, Birkhead 1977). The movement of newly hatched murrelets away from the colonies permits them to use what appears to be a patchily distributed food supply at sea (Lack 1968, Sealy 1975a, 1975b, 1976). The young of most other marine birds that exploit patchily distributed food or distant food resources develop slowly in their nest sites because they are fed infrequently (Ashmole 1971).

COMPOSITION OF FAMILY GROUPS

Most Ancient Murrelet *(Synthliboramphus antiquus)* family groups consist of two adults with two young (Table 1). Adults of both Craveri's Murrelet *(Endomychura craveri)* and Xantus' Murrelet *(E. hypoleuca)* accompany their two chicks at sea (De Weese and Anderson 1976, George L. Hunt pers. comm.). Single young of Common Murres *(Uria aalge)*, which leave the nest site at 3 weeks of age, are accompanied usually by the adult male (Scott 1973).

MOVEMENTS OF FAMILY GROUPS

Little is known of the behavior and movements of precocial murrelets during their post-hatching development. Two-day-old Ancient Murrelets leave their concealed nest burrows at night, often in great numbers (Willett 1915, Guiguet 1953a, Sealy pers. obs.), and are gone by sun-up from the colonies and surrounding waters. This exodus occurs from late May to late June on Langara Island, Queen Charlotte Islands, British Columbia (Sealy 1976). During this period in 1970 and 1971, Sealy never saw Ancient Murrelet family groups within the 15-20 km radius off Langara Island that he regularly covered. Discussions with fishermen who had fished that area for many years revealed that only an occasional family group was seen, usually west of Langara Island and north of Frederick Island. Charles J. Guiguet (pers. comm.) believes, based on many years of at-sea observations in British Columbia, that these family groups move directly to offshore waters where the young grow. He saw adults and downy young only once nearshore, on 1 June 1959 (Table 1). Bartonek and Gibson (1972) saw families with downy young from 30 to over 40 miles from shore off the Alaska Peninsula. George L. Hunt (pers. comm.) radio-tracked a Xantus' Murrelet with brood from its nesting site on Santa Barbara Island, California, and lost contact 16 km offshore.

The dearth of sight records of Ancient Murrelet family groups is puzzling. Vermeer and Vermeer (1975) indicated that 190,000 pairs of Ancient Murrelets nest in British Columbia at 22 colonies (the number of known nesting colonies is now 30 with the completion of the British Columbia Provincial Museum west coast seabird colony survey). Sightings of family groups are very few despite the thousands that must be at sea in June and July each year. Therefore these groups probably disperse widely after leaving the colonies. As well as moving offshore, some family groups move southward (see observations off Vancouver Island, Table 1) to areas where Ancient Murrelets are not known to nest. The Vancouver Island sightings were made 2-6 weeks after young on Langara Island have started to leave the colony. Ancient Murrelets gradually build up in numbers in Barkley Sound, Vancouver Island, beginning in mid-July (Hatler et al. 1978). The southward movement continues in late fall and winter until they reach northern and central California (Grinnell and Miller 1944, Ainley 1976).

In mid-July many young Ancient Murrelets, now about adult size and in juvenal plumage, begin moving back to inshore waters. Sealy first saw such young near Langara Island on 10 July 1971, and their numbers increased after that time. Eight such young averaged 208 g in weight (extremes, 183.9 and 220.3 g) and were similar to breeding adults (Sealy 1976). Except for one observation on 18 July 1971 (Table 1), these young were not accompanied by adults. The adults possibly stay offshore in mid-July and molt.

Table 1. Location and composition of Ancient Murrelet family groups observed at sea.

AREA	DATE	FAMILY GROUP[1]	OBSERVERS
ALASKA			
Between Forester and Dall islands	21 July 1920	2A, 2Y	Willett (1920)
Bristol Bay	20-26 July 1969	8A, 8DY	Bartonek and Gibson (1972)
QUEEN CHARLOTTE ISLANDS			
S.W. Moresby I. (1.6 km offshore)	1 June 1959	1A, 2DY	Drent and Guiguet (1961)
Egeria Bay, Langara I.	18 July 1971	1A, 2Y	Sealy (1976)
Hecate Strait	16 June 1972	2A, 1Y	P. W. Martin
Hecate Strait	22 July 1973	2A, 1Y	P. W. Martin

Table 1 (Cont.)

AREA	DATE	FAMILY GROUP[1]	OBSERVERS
BRITISH COLUMBIA MAINLAND COAST			
28-32 km W. Goose I.	13 June 1945	2A, 2DY	Guiguet (1953b)
Goose I. Banks	8 June 1947	several	Martin and Myres (1969)
Goose I. Banks	6, 8 June 1972	2A, 1Y	P. W. Martin
Goose I. Banks	30 June 1972	2A, 1Y	P. W. Martin
Off Blackney I.	19 June 1976	2A, 1Y	R. W. Campbell, M. S. Rodway
Off Goose I.	21 June 1976	7A, 4DY	R. W. Campbell, M. S. Rodway
Off Simonds Group	21 June 1976	2A, 1DY	R. W. Campbell, M. S. Rodway
W. Limit I.	21 June 1976	1A, 1DY	H. R. Carter, K. Taylor
Moore Island	25 June 1976	4A, 2DY	R. W. Campbell, M. S. Rodway
VANCOUVER ISLAND[2]			
Triangle Island	24-30 June 1949	2A, 2Y	G. C. Carl, C. J. Guiguet
Quatsino Sound	16 July 1949	2Y	Martin and Myres (1969)
Quatsino Sound	31 July 1949	increasing no. of imms.	Martin and Myres (1969)
Triangle Island	29 June 1972	4A, 4DY	C. J. Guiguet[3]
Triangle Island	16 June 1974	3A, 1Y	K. R. Summers
Triangle Island	2 July 1974	2A, 1Y	Vermeer et al. (1976)
	TOTALS[4]	49A, 37(DY & Y)	

1 A: adult; DY: downy young; Y: young in juvenal plumage.

2 Observations off Vancouver Island, where Ancient Murrelets do not nest, indicate that the presence of family groups does not imply that nesting occurred nearby (but see Vermeer et al. 1976).

3 Two downy young collected (British Columbia Provincial Museum 11899, 11900).

4 Data include 49 adults, 37 young (young without adults not included), 21 adult-chick groups. Young per adult=1.3; young per group=1.8.

Evidence indicates that Ancient Murrelets prefer colder waters. Ainley (1976) found that they arrived in northern California in November coincident with the decrease in surface temperatures. Also, the species was present in greatest numbers off California during winters of low water temperature (9°C-10°C). Departure from California occurs suddenly in March (Ainley 1976), when adults begin returning to the vicinity of nesting colonies on the Queen Charlotte Islands (Sealy 1976). Water temperatures near Langara Island average 7°C in March and rise to 11°C in June (Dodimead et al. 1963), when family groups are moving away from the colonies.

DISCUSSION

Why are vulnerable, downy young Ancient Murrelets moved out to sea away from the protection of burrows in the nesting colonies? The answer appears to lie in the use by this species of available food resources. All other alcids, except murrelets of the genus *Endomychura*, rear their young in nest sites and bring them food from the sea, at least during their first few weeks. The Ancient Murrelet's breeding strategy differs from that of semi-precocial alcids in that its incubation shifts are 72 hours (long for an alcid) and young are not fed during their 2 days in the nest (Sealy 1972, 1976). Long incubation shifts and the eventual long intervals between chick feedings suggest that food is either far from the colonies, as happens with many procellariiforms (see Ashmole 1971), or is patchily distributed and requires much time to locate. Evidence indicates the latter situation exists with Xantus' Murrelet (Eppley and Schwartz 1976). Also, the precocial murrelets lack specialized morphological apparatus, seen in plankton-feeding auklets (Bédard 1969a, Speich and Manuwal 1974) and fish-feeders (Bédard 1969b), which would facilitate the transport of economically feasible amounts of food to the two young in the nest.

Scott (1973) postulated that the number of Common Murre parents that accompany their single chicks varies with the availability of food. Presence of the usual family group, with the male accompanying the young, reveals normal feeding conditions in which only one parent is needed to obtain enough food for the developing young. The adult female murre possibly spends more time protecting the chick on the open cliff ledge or feeding it during its 3-week period in the nest (see Birkhead 1977). It may be advantageous for adult males and their fledglings to move away from the colonies, thereby reducing competition with females for food. Two Ancient Murrelet parents, however, may be needed to locate and obtain enough food for both young.

The observations in Table 1 suggest that family groups are isolated from one another and are dispersed widely at sea. This isolation contrasts with the gregarious habits of Ancient Murrelets in winter and at

breeding colonies. In a precocial species such as the Ancient Murrelet, if the food supply is uniformly distributed, adults and their young should remain rather evenly spaced throughout their environment. Avoidance of other groups would have the advantage of not attracting predators. Capture rates should average higher if another group has not foraged recently over the same area. On the other hand, when food is highly clumped, distribution of adults and young should reflect the uneven distribution of the food supply (Lack 1968, Orians 1971).

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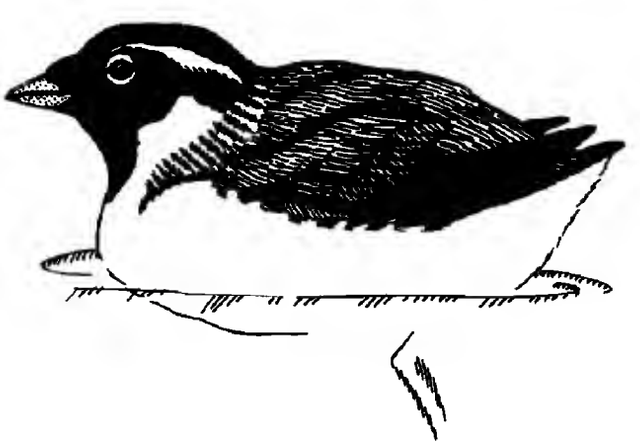

Ancient Murrelet

Sketch by Narca Moore

INCREASING POPULATIONS OF RING-BILLED AND CALIFORNIA GULLS IN WASHINGTON STATE

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The number of breeding Ring-billed Gulls *(Larus delawarensis)* has been rapidly growing in at least one region of their broad range, that of the Great Lakes (Ludwig 1974). Several factors have been proposed to account for this increase, including greater availability of nesting sites, introductions of exotic fish, increased utilization of insects by the gulls and decreased human predation (Ludwig 1974, Jarvis and Southern 1976). In this report we examine the status of the Ring-billed Gull in the State of Washington, comparing current and past records of breeding colonies in the state. We also provide similar information on the California Gull *(L. californicus)* which often occupies colony sites with the Ring-billed Gull.

At the turn of the century the Ring-billed Gull was considered an infrequent visitor in Washington State and a sighting was considered worth reporting (Dawson and Bowles 1909). The first breeding record in Washington was apparently Kitchin's (1930) sighting at Moses Lake. Slightly later, Decker and Bowles (1932) reported a colony of California Gulls nesting on the Columbia River, somewhere in Benton County. The distributional list of Hudson and Yocom (1954) mentioned four colonies: on Moses Lake (both species), Sprague Lake (Ring-billed Gull), Twelve-mile Slough (Ring-billed Gull) and the Columbia River near Pasco (Ring-billed Gull). By 1954 the Moses Lake colony apparently had been abandoned, and a new colony started on the sand-dune islands of the Potholes Reservoir, immediately south of Moses Lake (Johnsgard 1954). In 1956 two new mixed-species colonies were established on the Columbia River at Ringold and Coyote Rapids, presumably from the abandonment of the Pasco colony (Hanson 1963). That same year another colony consisting entirely of Ring-billed Gulls was found on the Columbia River near Boardman, Oregon (Broadbooks 1961). Hence by the late 1950s at least five, and perhaps six, active colonies existed in the state. Unfortunately, data on colony sizes are available for only three of the colonies, the Boardman colony containing 300 breeding adults

(Broadbooks 1961), Ringold colony 2,072 (Hanson 1963) and the Coyote Rapids colony 2,310 (Hanson 1963) averaging 1,561 per colony. Table 1 lists all former known Ring-billed and California gull colonies in the state that are now abandoned.

To obtain data on the current population, we surveyed the Ring-billed and California gulls in the State of Washington and along the adjacent Columbia River during the 1976 and 1977 breeding seasons. The number of breeding birds was determined by a direct count of nests in all but one colony (Three-mile Canyon colony) where the number of nests was estimated using a strip census method. Location, number of breeding adults, and year of first establishment for 11 currently active colonies are presented in Table 2. During our survey we located nine active Ring-billed and California gull colonies ranging in size from 254 to 8,760 breeding adults and averaging 2,942 per colony. In addition, Penland and Jeffries (1977) reported that 44 Ring-billed Gulls nested in two areas along the Washington coast. Altogether at least 17,468 Ring-billed and 9,052 California gulls nested in the state in 1977. Conceivably the present colonies are smaller in size than previously; however, the average number of breeding adults per colony calculated from our counts is above the largest of the three late-1950 colonies where numbers were reported. Indications are, therefore, that the total breeding population in the state has continued to rise during the last 2 decades.

Notably, of the 11 current colonies, only the colonies on Sprague Lake and Potholes Reservoir were mentioned by earlier authors. Moreover, 8 of 10 colonies existing earlier than the mid-1960s have since been abandoned. Evidently Ring-billed and California gulls shift colony sites frequently.

Ring-billed Gulls also are expanding their breeding range in the Northwest. In recent years they have started breeding along the Washington coast (Penland and Jeffries 1977) and in British Columbia (Merilees 1974). Also, in 1976 and 1977, we observed 20-40 Ring-billed Gulls unsuccessfully attempting to nest in northern Idaho on a small, periodically-flooded island in Lake Coeur D'Alene.

We can only speculate on the factors underlying the population increase of Ring-billed and California gulls in Washington since the early 1900s. Ludwig (1974) suggested that a similar population explosion of Ring-billed Gulls in the Great Lakes region resulted from a period of lowering water levels, which increased the nesting habitat, and from the establishment of alewives in the Great Lakes, which increased the gulls' food resources. It is unlikely that either of these reasons can account for the increase of Ring-billed and California gulls in Washington. In most parts of the state nesting habitat has been reduced because of the damming of the rivers. There also has been no introduction of exotic fish which could have substantially increased the food available to gulls.

Table 1. Ring-billed and California gull colonies in Washington State that are now abandoned.

NAME AND LOCATION OF COLONY	SPECIES PRESENT	YEAR COLONY ESTABLISHED	YEAR COLONY ABANDONED	SOURCE
Boardman Colony – On the Columbia River 1 km upstream from Boardman, Oregon.	Ring-billed	Before 1956	Unknown	Broadbooks 1961
Peninsula Colony – On the Columbia River at the McNary National Wildlife Refuge.	Ring-billed	Late 1950s	1-2 years later	D. M. Litzenberger (pers. comm.)
Pasco Colony – On the Columbia River near Pasco.	Ring-billed California	Before 1954	1955-1956	Hudson and Yocom 1954, Hanson 1963
Ringold Colony – On the Columbia River near Ringold.	Ring-billed California	1956	1971	Hanson 1963, D. E. Miller (pers. comm.)
Coyote Rapids Colony – On the Columbia River 33 km upstream from the Ringold Colony.	Ring-billed California	1956	1975 (approx.)	Hanson 1963, R. E. Fitzner (pers. comm.)
Moses Lake Colony – On Moses Lake.	Ring-billed	Before 1930	1951-1952	Kitchin 1930, Harris and Yocom 1952
Lenore Lake Colony – On Lake Lenore.	Ring-billed California	Mid-1960s	1969 (approx.)	D. S. Galbreath (pers. comm.)
Twelve-mile Slough Colony – 12 km northeast of Benji.	Ring-billed	Before 1954	Unknown	Hudson and Yocom 1954

Table 2. Ring-billed and California gull colonies in Washington State during the 1977 breeding season.

NAME AND LOCATION OF COLONY	SPECIES AND NUMBER OF BREEDING ADULTS		YEAR COLONY ESTABLISHED
Little Memaloose Island Colony– On the Columbia River 5 km upstream from the Dalles Dam.	California	856	Unknown
Miller Rocks Colony– On the Columbia River 3 km upstream from the Deschutes River.	Ring-billed	960	Unknown
	California	60	
Three-mile Canyon Colony– On the Columbia River between Arlington and Boardman, Oregon.	Ring-billed	4380	After 1968
	California	4380	
Richland Colony– On the Columbia River by the municipal boat ramp in Richland.	Ring-billed	678	1970
	California	772	
Island 18 Colony– On the Columbia River 4-5 km upstream from the Richland colony.	Ring-billed	1726	1971
	California	426	
Cabin Island Colony– On the Columbia River 1 km upstream from Priest Rapids.	Ring-billed	250	Early 1970s
	California	4	
Banks Lake Colony– On the southern end of Banks Lake.	Ring-billed	5436	Early 1970s
	California	1690	
Sprague Lake Colony– On the western end of Sprague Lake.	Ring-billed	1702	Late 1940s
	California	428	
Potholes Reservoir– On several sand dune islands in the Potholes Reservoir.	Ring-billed	2292	1952-1953
	California	436	
Whitcomb Island Colony– In Grays Harbor (Penland and Jeffries 1977).	Ring-billed	4	1976
Willapa Bay Colony– In Willapa Bay (Penland and Jeffries 1977).	Ring-billed	40	First located in 1976

Table 3. Population, total cropland acreage, and irrigated cropland acreage in eastern Washington since 1900.

YEAR	HUMAN POPULATION	TOTAL CROPLAND	IRRIGATED CROPLAND
1900	191,513	–	–
1920	437,191	5,578,307	–
1940	509,845	6,361,946	–
1950	695,553	6,832,541	716,340
1960	813,857	4,033,226	1,093,709
1970	839,018	7,339,039	1,189,361

Jarvis and Southern (1976) have suggested that feeding on insects, particularly air-borne ones, is a recent innovation by the Ring-billed Gull that, in part, explains the population increase in the Great Lakes region. However, the taking of insects may not be a recent phenomenon because Bent (1921) reported that Ring-billed Gulls commonly feed on worms and insects, and Baird et al. (1884) reported an observation of this species hawking insects.

We consider the increase in Washington more likely to have resulted from decreased human predation on gulls and their eggs, and, probably more importantly, from increased food resources brought about by man's activities. Both farming and garbage depositories probably have dramatically increased the food resources available for these two gull species, which feed in both aquatic and terrestrial habitats. In addition, the creation of many reservoirs and irrigation canals has increased the total area of aquatic habitats, perhaps increasing some of the fish and aquatic insect populations on which these gulls feed.

Farming, especially irrigated farming, also has increased greatly in Washington during the past 50 years (Table 3), and some farming practices expose rodents, worms, insects and other prey that otherwise would remain concealed or inaccessible. Our observations of gulls following farm implements indicate that these gulls feed in cultivated fields and may be more adapted to do so than other birds which have more localized feeding areas. The social behavior and foraging strategies of gulls are adapted for obtaining food resources, such as fish schools, that are abundant in localized clumps but temporally unpredictable as to location. The sudden appearance of plentiful prey in variously located fields would correspond to this type of distributional pattern.

The human population in eastern Washington has also increased over the last 50 years (Table 3), and several of the current colonies in the state are located near towns or cities with municipal garbage dumps. Our observations of gulls congregated at dump sites and of food items delivered by adults to their young indicate that man-processed food at least supplements the natural diet and for some individuals may be a primary food source.

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CATTLE EGRET IN COLORADO

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The ancestral breeding range of Cattle Egrets *(Bubulcus ibis)* probably was Africa where the species evolved to exploit a foraging niche in the terrestrial-aquatic ecotone, later entering into its well known association with large ungulates (Siegfried 1978). The species' ability to colonize new areas and its range extension through the western hemisphere have been well documented (Blaker 1971, Browder 1973, Crosby 1972, Davis 1960, Hancock and Elliott 1978, Lint 1962, Meyerriecks 1960, Siegfried 1978). Cattle Egrets were first noted in the continental United States in the 1940s (Palmer 1962) and generally have extended their range inland from coastal regions (Ogden 1978). Our observations plus those of others who have reported sightings of Cattle Egrets in Colorado to the Colorado Field Ornithologists have allowed us to summarize, on a smaller scale, the range extension of this species along the four major river drainages of the state, from the first reported sighting to its present status as a breeding bird (Kingery and Graul 1978). The Arkansas, Colorado, Platte (South Platte), and Rio Grande rivers have at least a large part of their origins within Colorado.

EARLY RECORDS

As shown in Table 1, the first recorded sighting of a Cattle Egret in Colorado took place in 1964 near the South Platte River at Denver (Bailey and Niedrach 1965). The next record confirmed by the Colorado Field Ornithologists Official Records Committee was from the Animas River, a tributary of the Colorado, in April 1968. Cattle Egrets were first confirmed on the Arkansas River drainage in 1968 also, seen on different parts of the river in April and May. In May 1973 the first record from the Rio Grande drainage occurred (Reddall 1976). Nearly 9 years had elapsed between the first sighting and confirmed sightings on all of Colorado's major river systems.

Of 43 Cattle Egrets seen prior to 1977 (26 records), only 8 (3 records) occurred between 1 June and 1 September when nesting residents would be expected, and no evidence of nesting was found. Two nesting season records were of single individuals seen on one occasion each. The third was of a group numbering as many as 6, seen on several occasions between mid-August and late September 1975 at Lower Latham Reservoir on the South Platte drainage. Herman J. Griese studied that site intensively in 1975-76 and found no evidence of Cattle Egrets nesting. Thirty-one of 43 egrets seen prior to 1977 (16 of 26 records) were on the South Platte drainage, but that drainage was probably more intensively observed than the others.

Table 1. Number of Cattle Egrets *(Bubulcus ibis)* recorded in Colorado, 1964-1978, listed by drainage and year. Superscript indicates observations not reported to Colorado Field Ornithologists Official Records Committee.

	Year													
Drainage	1964	65-67	68	69	70	71	72	73	74	75	76	77	78	Total
Arkansas			2		1		3		1		1	1	10[b]	19
Colorado			2							1[a]		2	2[c]	7
Rio Grande								1				1	4	6
South Platte	1					2	4		9	8	7	8	29[d]	68
Total	1	0	4	0	1	2	7	1	10	9	8	12	45	100

a By Gustav A. Swanson, 21 May 1975 near Craig, Moffat County.
b By Bryant Will, 27 April 1978, about 15 km southwest of Campo, Baca County.
c By Warner P. Gorenzel, 23 May 1978, Brown's Park, Moffat County.
d Includes sighting of 23 by Warner P. Gorenzel, 18 August 1975, Weld County.

NESTING AND RECENT RECORDS

In 1977 the first known nesting of a pair of Cattle Egrets in Colorado was observed at Pelican Island (40°20'N, 104°16'W, elevation 1472 m), Riverside Reservoir, near the South Platte River in Weld County (Miller 1978). The area, which received little human use and was nearly surrounded by cattle grazing lands, had been studied intensively by Miller in 1976, and visited yearly since 1962 by Ryder and Colorado Division of Wildlife personnel (Ryder and Torres 1974), and Cattle Egrets had not been seen before. Ranchers of the area expressed interest in the egrets and readily noticed them in 1977, but stated they had not seen them before. We believe, therefore, that 1977 was the first year in which Cattle Egrets nested at Riverside Reservoir.

As shown in Table 1, Cattle Egrets were seen in all drainages in 1977. Those sightings on the Arkansas and Colorado were made prior to 1 June, and might be considered migrants. On 6 June Miller saw six in alternate plumage at Milton Reservoir (South Platte drainage), about 30 km southwest of Riverside Reservoir. On 25 June Ryder and Mark Strong captured and banded an individual in basic plumage at Adams Lake on the Rio Grande drainage. This was the first Cattle Egret banded in the state.

Cattle Egrets nested on the Rio Grande drainage of Colorado in 1977, but the fact was not revealed until 1978. In 1977 a nestling egret was banded and identified as a Snowy Egret *(Egretta thula)* during the annual banding of young in a large colony of Snowy Egrets and Black-crowned Night Herons *(Nycticorax nycticorax)* at Russell Lakes, Saguache County. The bird, recovered in 1978, was a Cattle Egret (specimen in collections of the Department of Fishery and Wildlife Biology, Colorado State University, Fort Collins).

In 1978 at least two pairs of Cattle Egrets nested at Riverside Reservoir. Miller saw two adults in alternate plumage in a stand of flooded willows *(Salix* sp.*)* on 29 May, and Ryder found two nests at the same site on 11 July 1978. On 26 July those nests contained seven young Cattle Egrets. One dead adult in alternate plumage was found near one nest.

Cattle Egrets may have nested in the Lower Latham or Milton Reservoir area of the South Platte in 1978. Records on 30 May and 2 July by Robert Andrews and others were from Lower Latham, and on 18 August Warner P. Gorenzel saw 23 Cattle Egrets, at least 6 of which were immatures, at a point between the two reservoirs. Lower Latham and Milton reservoirs are about 10 km apart, and both are 30 km from Riverside. Both reservoirs are fairly inaccessible to humans, contain colonies of ardeids, and are adjacent to cattle grazing areas.

As shown in Table 1, Cattle Egrets were seen on all drainages in 1978. In addition to the South Platte observations previously mentioned, egrets were seen on the Arkansas drainage (10 in late April), the Colorado drainage (2 in late May), and the Rio Grande drainage (1 in late April, 1 in early June). The nesting status of Cattle Egrets on the Rio Grande in 1978 was not verified although at least one adult was seen in a Snowy Egret nesting colony (Walter Graul pers. comm.).

EXTENSION OF KNOWN BREEDING RANGE

Prior to nesting at Pelican Island in 1977, Cattle Egrets had not been known to nest along the 750 km of Platte River drainage between Riverside Reservoir and its confluence with the Missouri River. They have been seen fairly regularly as far west as Crescent Lake National Wildlife Refuge in Nebraska (Anonymous 1978) and have nested on the Missouri drainage as far west as J. Clark Salyer and Lone Lake National Wildlife Refuges in North Dakota (Rodney Schmitt pers. comm.).

Prior to nesting at Russell Lakes in 1977, the northernmost known limit of nesting Cattle Egrets on the Rio Grande drainage was Elephant Butte Lake, New Mexico, first noted in 1975 (Witzeman et al. 1975). The Russell Lakes record represents an inland range extension of 550 km.

Although still not known to nest on the Arkansas and Colorado drainages in Colorado, Cattle Egrets nest near these rivers outside the state. In 1974 they nested as far west on the Arkansas drainage as Cheyenne Bottoms, Kansas, 330 km downstream from the Colorado border (Martinez and Schwilling 1974). In the vicinity of the Colorado River drainage, they have nested as far inland as the north end of the Salton Sea in California (Kelso 1979).

SUMMARY

The first confirmed sighting of a Cattle Egret in Colorado occurred in 1964, but nearly 9 years elapsed before they were recorded on all of the

major river systems of the state. In 1977, 12 nesting seasons after the initial sighting, they were first confirmed as nesting in the state, doing so on the South Platte and Rio Grande drainages. Cattle Egrets again nested on the South Platte in 1978, but their status on the Rio Grande was not ascertained, and Cattle Egrets were still not known to nest on the Arkansas and Colorado River drainages. Between September 1964 and September 1978, 100 Cattle Egrets were noted in 39 Colorado records.

The observation of nesting at Riverside Reservoir in 1977 was the first known for Cattle Egrets on the entire Platte River system from its confluence with the Missouri River and represents a known breeding range extension of 750 km inland. The Russell Lakes nesting represented a 550 km inland extension of known breeding range along the Rio Grande drainage. Cattle Egrets nest on the Arkansas River drainage in Kansas and near the Colorado River in California, and we may expect their breeding range extension to continue upstream to Colorado in the future.

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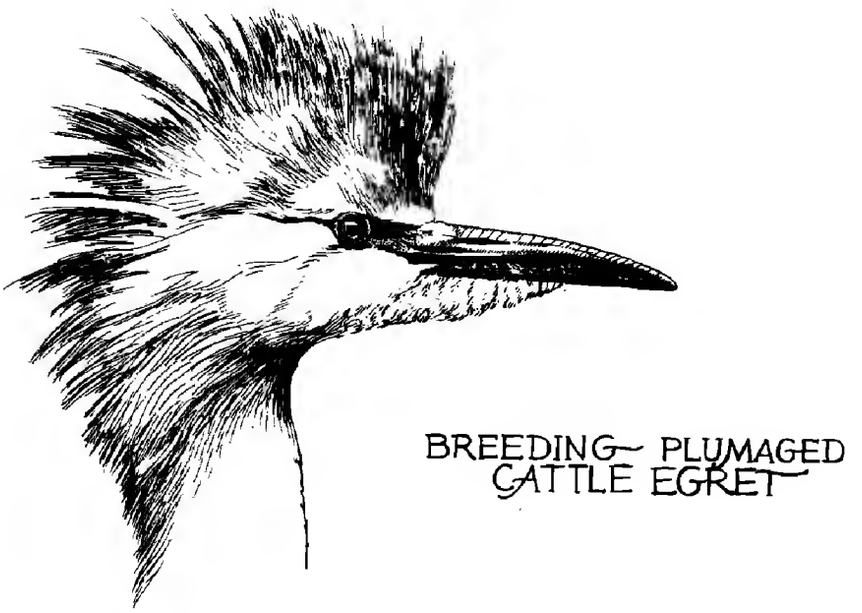

Sketch by Narca Moore

Ring-billed Gull (*Larus delawarensis*), San Diego, California, April 1979. Yashica T. L. Electro "X", Vivitar 70-150 Zoom, 1/500th sec. at f8.

Photo by Bill Millington

NOTES

ROBBERY OF NESTING MATERIALS BY THE CALLIOPE HUMMINGBIRD

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On 27 May 1978, while looking for birds in the White Mountains near Tollhouse Springs, Inyo County, California, I located an active Blue-gray Gnatcatcher *(Polioptila caerulea)* nest which was placed approximately 1 m high near the top of a low sagebrush *(Artemesia tridentata)* shrub. While Judy Atwood, Thomas LaRoque and I were observing the female gnatcatcher on the nest, we were rather startled to see a female Calliope Hummingbird *(Stellula calliope)* fly to the gnatcatcher nest and, while hovering, remove nesting material from the outside of the nest cup. Although the female gnatcatcher appeared to watch the pilfering hummingbird during the several seconds it was present at the nest, the gnatcatcher continued to incubate and made no effort to drive the hummingbird away. The male Blue-gray Gnatcatcher was not observed near the nest until several minutes after the hummingbird had departed. We flushed the female gnatcatcher from her nest and found three eggs in it.

The Calliope Hummingbird's direct, unhesitating flight to the gnatcatcher nest, despite our presence within 1 m of the site, suggests that the hummingbird had previously made similar piratic visits. Both species use similar materials in the construction of their nests (Harrison 1978). Considering the energy expenditure involved in gathering nest-building materials, it is perhaps not surprising that the hummingbird would make repeated thefts from this concentrated and apparently poorly defended source of nesting materials.

Welty (1962) summarized a number of examples of intraspecific robbery of nesting materials, and cited this behavior as being quite common among colonially nesting birds such as penguins, cormorants, pelicans, storks and Rooks *(Corvus frugilegus)*. Brown (1963) noted frequent intraspecific nest robbing in cooperatively breeding Mexican Jays *(Aphelocoma ultramarina)*, and Biaggi (1955) observed similar behavior in Bananaquits *(Coereba flaveola)*. Bent (1940) did not mention any such piratic behavior by North American hummingbird species. However, Wagner (1945) regularly observed a Mexican hummingbird, the Green Violetear *(Colibri thalassinus)*, constructing its nest with material stolen from active, but unattended, nests of the White-eared Hummingbird *(Hylocharis leucotis)*; sometimes such behavior completely destroyed the latter species' nest.

In summary, intraspecific robbing of nesting materials has been reported relatively frequently, and instances of intrafamilial (Trochilidae) theft have also been observed. The robbery of nesting materials from an active Blue-gray Gnatcatcher nest by a female Calliope Hummingbird represents an interordinal (Apodiformes and Passeriformes) example of such behavior.

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Accepted 19 April 1979

RAPTOR RESEARCH FOUNDATION ANNUAL MEETING

The annual meeting of the Raptor Research Foundation will be held 9-12 November 1979 at U.C. Davis Tennis Club, Davis, California. The meeting will include a two-day symposium on California raptors, a day of workshops, and two days of general papers and invited lecturers. Non-members wishing to receive registration and agenda information can write to David L. Harlow, U.S. Fish and Wildlife Service, Sacramento Endangered Species Office, 2800 Cottage Way Room W-2527, Sacramento, CA 95825.

COLOR-MARKED CANADA GEESE

Plastic neck collars have been put on 1000 Canada Geese on their breeding grounds in northeastern California to more accurately determine the relationship between local breeding areas and wintering grounds. The collars are red with black numerals, a K followed by three digits. Any reports of these collared birds, whether or not the numbers can be read, will be appreciated. Please send reports to: California Department of Fish and Game, 1416 Ninth St., Sacramento, CA 95814 (916-445-6896) or P. O. Box 758, Gridley, CA 95948 (916-846-3569). All reports will be acknowledged.

WFO ANNUAL MEETING

16 - 18 February 1980

Santa Barbara Natural History Museum, Santa Barbara, California

Don't miss it!

FIRST RECORDS OF THE RACE *SCOTTII* OF THE RUFOUS-CROWNED SPARROW IN CALIFORNIA

J. V. REMSEN, JR., Museum of Zoology, Louisiana State University, Baton Rouge, Louisiana 70893

STEVEN CARDIFF, San Bernardino County Museum, 2024 Orange Tree Lane, Redlands, California 92373

On 22 May 1976 Remsen heard a singing Rufous-crowned Sparrow *(Aimophila ruficeps)* at 6000 ft (1825 m) in Live Oak Canyon, New York Mountains, northeastern San Bernardino County, California, about 19 km from the Nevada border. Attempts to see the bird failed. On 28 and 29 July 1976 Remsen returned to the area and again located a Rufous-crowned Sparrow, singing from the same slope as in the May observation. This time the bird was seen and studied in detail (McCaskie 1976). In late May 1977 at least three singing birds were found in the Keystone Canyon-Live Oak Canyon area of the New York Mountains by Stephen F. and Karen L. Bailey, Cardiff and Remsen. The authors found one still present on 20 June 1977, when Cardiff succeeded in obtaining a specimen (male with enlarged testes; San Bernardino County Museum 30001). It was subsequently identified as *A. r. scottii* by Ned K. Johnson and Remsen by comparison with the large series of North American races of this sparrow at the Museum of Vertebrate Zoology. The dates of occurrence and consistent presence of singing birds at a single locality indicate local nesting, although no direct evidence was obtained.

This is the first record from California of *A. r. scottii*, which breeds from northwestern and north-central Arizona and southwestern New Mexico south to south-central Arizona, northeastern Sonora, and northwestern Chihuahua (AOU Check-list 1957; Phillips, Marshall and Monson 1964). Small populations of *scottii* have also been found in the Zion area of southwestern Utah (Wauer 1965, Hayward et al. 1976), and there are several sight records from southern Nevada (C. S. Lawson pers. comm.), presumably of *scottii*. There have been two previous sight and one photographic record of Rufous-crowned Sparrows from east of the Sierra Nevada in California: one photographed on 25 Nov. 1972 by E. H. and Donna Johnson on the trail to Crystal Spring (about 43 km southwest of Live Oak Canyon) near the headquarters of Mitchell Caverns State Park, Providence Mountains, San Bernardino Co. (photos on file at San Bernardino Co. Museum); two in a canyon just north of the headquarters of Mitchell Caverns State Park on 25 March 1975 by Steve Forsell (McCaskie 1976); and one at Scotty's Castle, Death Valley National Monument, Inyo Co., on 8 May 1974 by Richard Stallcup (McCaskie 1974). The subspecies involved in these sightings is unknown, but *scottii* is the most likely. The other races occurring in California *(ruficeps, canescens* and *obscura)* are highly sedentary and have never been recorded east of the Sierra (Grinnell and Miller 1944). The race *rupicola*, a southwestern Arizona form darker and grayer than *scottii*, could also potentially occur in California.

In the Live Oak Canyon-Keystone Canyon area, Rufous-crowned Sparrows were found singing from 5440 to 6000 ft (1650 to 1825 m) on steep slopes with open Singleleaf Pinyon *(Pinus monophylla)* woodland, scattered, small, rock outcrops, and open areas with patches of grass 30-100 cm in height. A sparse layer of small shrubs was irregularly distributed on the slopes. In the gullies at the foot of the slopes were dense thickets of Scrub Oak *(Quercus dumosa)*, Canyon Live Oak *(Quercus chrysolepis)*, Desert Almond *(Prunus fasciculata)*, and Ashy Silk-tassel *(Garrya flavescens)*. Most observations were on south-facing slopes. Permanent water was found within 1 km at Keystone Spring and Live Oak Spring. The most common breeding birds at this locality were (in approximate descending order of abundance): Bewick's Wren *(Thryo-*

manes bewickii), Blue-gray Gnatcatcher *(Polioptila caerulea)*, Plain Titmouse *(Parus inornatus)*, Bushtit *(Psaltriparus minimus)*, Gray Vireo *(Vireo vicinior)*, Black-throated Gray Warbler *(Dendroica nigrescens)* and Scrub Jay *(Aphelocoma coerulescens)*. We have spent hundreds of hours in other areas of the New York Mountains and the adjacent Mid Hills without finding Rufous-crowned Sparrows. R. Kent Johnson (pers. comm.) spent over 3 months in the nearby Granite Mountains and did not see this species, nor have moderate amounts of field work in the Clark and Kingston ranges to the north of the New York Mountains by Ned K. Johnson, the authors, and many others produced any records. Thus we are reasonably certain that the Rufous-crowned Sparrow is not present, or at least not widespread, elsewhere in the region, although little information is available from the Providence Mountains, the location of two of the previous records.

Two possible explanations for the apparent restriction of Rufous-crowned Sparrows to the Live Oak Canyon-Keystone Canyon area are: (1) this is the only area suitable for this species, and (2) this species has only recently begun to colonize the region. We do not favor the first hypothesis. Habitat seemingly identical to that on the slopes of these canyons is widespread throughout the mountain ranges mentioned above as well as elsewhere in the New Yorks. Many of these localities have water permanently available at springs. Live Oak and Keystone canyons do have extensive patches of oaks, which are not present at most other localities; however, other canyons with oaks, such as Sagamore, Caruthers and Fourth of July, all in the New York Mountains, lack Rufous-crowned Sparrows. Furthermore, this species was never noted in the oaks themselves.

Recent colonization seems to be a more plausible explanation. Cardiff had visited this area during May and June several times during the previous 10 years without noting this species. Several other species of southwestern birds are currently in the process of extending their ranges northward and westward (Johnson and Garrett 1974), and the Rufous-crowned Sparrow may be part of this general pattern. Perhaps it is not coincidental that the Live Oak Canyon-Keystone Canyon area is at the extreme eastern edge of the New York Mountains, making it the closest locality in California to source populations in Arizona.

We thank Ned K. Johnson for aid in subspecific identification of the specimen, and we are grateful to H. Douglas Pratt and Alan M. Craig for comments on the manuscript. Field work in northeastern San Bernardino County was funded by the Bureau of Land Management through Kristin H. Berry.

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REVIEW

The Complete Outfitting & Source Book For Birdwatching. Michael Scofield. 1978. 192 p. The Great Outdoors Trading Company, Marshall, California. $6.95 paper; $12.95 hardcover.

This good basic source book covers six major categories: history, equipment, publications (books and periodicals), clubs and organizations, best birding sites and tours and expeditions. Its appendices list zoos and natural history museums, rare bird alert phone numbers, birds' favorite plants, a birdlist based on the AOU check-list and specifications for building bird houses. Its casual, conversational style is entertaining, and it is amply illustrated with black-and-white photographs and etchings.

One of the book's more valuable features is its basic equipment section which covers binoculars, scopes, telephoto lenses, tripods, tape recorders and microphones. Explanations of criteria used in comparing different models are very lucid and helpful. Internal workings of binoculars, scopes and lenses are briefly explained. Buying tips are offered.

Birders traveling in North America and abroad will be pleased with the list of bird-related organizations, which details activities and publications of each group as well as giving a local contact person, address and phone number. Covered are 38 states, 8 Canadian provinces and 23 foreign countries representing all continents. Also for the traveling birder, the tour and expedition section discusses how to choose a tour and lists in detail tours to all continents.

Unfortunately, this otherwise excellent book is marred by a few glaring instances of misleading statements and misinformation: e.g., "song birds and hawks attack owls in the daytime – they know he can't see." Omissions also occur (though the compilers made every effort to be complete), usually because organizations failed to respond to queries. However, I would hope that a next edition includes such listings as Robbins' field guide *Birds of North America*, Pentax telephoto lenses, Denver Museum of Natural History under museums, and groups such as Colorado Field Ornithologists.

The section on birding sites is good for its scope. Addresses and phone numbers are listed for further information on each site, and reference books are given for those desiring greater coverage. Unfortunately, this section could also benefit from more thorough research. The description of Aransas Refuge in Texas alerts the birder to watch for Sandhill Cranes, but makes no mention of Aransas' star attraction, the Whooping Crane. Also most visitors to Hawaii Volcanoes National Park will be interested in other birds than the Cardinal and House Finch, two of the three species listed.

Occasional omissions and misinformation aside, *The Complete Outfitting & Source Book for Birdwatching* is the most complete source book available and is a valuable reference addition to birders' libraries. I particularly commend its ethical and responsible attitude. The book points out that playing a tape near nesting birds may cause the parents to desert, mentions bits of birding etiquette, and generally fosters concern and respect for birds and our mutual environment. – *Narca A. Moore*

TREASURER'S REPORT

WESTERN FIELD ORNITHOLOGISTS
Cash Flow Statement 1 January 1978 to 31 December 1978

Cash on hand 1 January 1978		$10,927.87
Gibralter Savings & Loan (savings)	$3,846.92	
Crocker National Bank (checking)	7,080.95	
RECEIPTS		
Membership	$9,008.47	
Boat Trips	7,144.50	
Annual Meeting – 1978	1,431.05	
Special Publications (1)	1,000.00	
Back Issues	931.76	
Reprints	764.84	
Interest	469.33	
Advertising	70.00	
Sales Tax Received	52.12	
Donations	25.00	$20,897.07
		$31,824.94
DISBURSEMENTS		
Western Birds (2)	$6,590.85	
Boat Trips	5,438.33	
Annual Meeting – 1978	1,689.27	
Annual Meeting – 1979	220.00	
Postage (3)	808.02	
Reprints	626.56	
Special Publications (1)	557.99	
Miscellaneous	220.67	
Promotion	144.22	
Sales Tax Paid	62.88	
Bird Records Committee	40.91	$16,399.70
		$15,425.24
Cash on hand 31 December 1978		
Gibralter Savings & Loan (savings)	$13,550.28	
Crocker National Bank (checking)	1,874.96	

(prepared without audit)

(1) California Department of Fish & Game Report: "Species of Special Concern"
(2) Includes Journal mailing costs
(3) Other than Journal mailing

Philip P. Schaeffer, *Treasurer*

Volume 10, Number 1, 1979

Manuscripts should be sent to Alan M. Craig, 3532 Winston Way, Carmichael, CA 95608. For matters of style consult *Suggestions to Contributors to Western Birds*, 16 pp. mimeo available at no cost from the Editor; and *Council of Biology Editors Style Manual*, 4th edition, 1978 (available from 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, and 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.

Authors are provided 50 free reprints of each paper. Additional 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, should be submitted to Stephen A. Laymon, 3290 Arkley Road, Lakeport, CA 95453.