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DISTRIBUTION AND REPRODUCTIVE SUCCESS OF
PEREGRINE FALCONS (FALCO PEREGRINUS ANATUM)
IN CALIFORNIA-1975

by

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A Peregrine Falcon With One Young at an Eyrie in Southern California, 1950
(Photo by Jack Hagen, Courtesy of Ray Quigley).

METHODS

Though one eyrie was not visited in 1975, it was included because it was reported active in 1974. Thirty known or suspected peregrine falcon nesting territories were visited between February 1 and July 30, 1975. The sample represents less than 10 percent of approximately 200 known historical peregrine falcon eyries in California. The criterion for inclusion of an area in the sample were: (1) where known peregrine nesting activity occurred subsequent to 1969, or (2) where reported peregrine activity warranted a search during the nesting season.

All visits to eyrie locations where use was suspected were made on foot. To minimize disturbance, observations were made of nesting areas from a distance, aided with the use of a spotting scope. Later, apparently vacant nest cliffs were closely approached to verify the absence of peregrines. Active nest cliffs were not disturbed. However, it was necessary to climb into one eyrie following the failure of a nesting attempt.

Data on clutch size and hatching success are difficult to obtain unless each nesting cliff is climbed. Restrictions placed on climbing into active eyries

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ABSTRACT

Thirty known or suspected active peregrine falcon nesting locations were visited in California during 1975. Pairs were present at eight locations.

At one site a single adult was observed on several occasions. Fourteen young fledged at six sites and young were not produced at two additional sites. A mean of 2.33 young fledged per eyrie with young and 1.75 young fledged per pair observed. This is considered normal fledgling production for peregrines. The known active eyries are widely distributed; five pairs are in the Coast Mountain Ranges, two are on coastal cliffs, and one is in the Cascade Mountain Range. Prairie falcons (Falco mexicanus) were observed at ten of the locations visited which were historically occupied by peregrines.

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RECOMMENDATIONS

As a result of this study of known active peregrine falcon nesting locations in California it is recommended that the Department of Fish and Game:

1. Place under surveillance all known active eyries.
2. Make a yearly check of historical eyries for reoccupation.
3. Check areas suitable for peregrine nesting, but previously unreported.
4. Develop protective management programs to ensure active nesting territories are free from human disturbance.
5. Protect suitable historical nesting locations from destruction and disturbance for natural population expansion and/or reintroduction.

INTRODUCTION

Bond (1946) reported on the status of the peregrine falcon in western North America for the years prior to World War II. He gave no indication of a population decline in progress and considered the peregrine a common nesting species throughout California excepting the arid desert regions.

Herman, et al, (1970) supplemented Bond's data with available nesting reports for the two decades following World War II. They concluded that a previously stable peregrine falcon population in California, estimated to be approximately 100 nesting pairs, declined to less than 10 known pairs by 1969. This alarming reduction greatly exceeded any possible effects attributable to shooting, egg collecting, and the capture of peregrines for falconry.

Evidence of population declines similar to the one documented in California appeared simultaneously over most of the cosmopolitan range of the peregrine falcon (Hickey ed., 1969). Ratcliffe (1967) reported the production of thin-shelled eggs in the failing population of peregrines in Britain. This discovery led to intensive investigations, disclosing a contamination of the food chain of global proportions. Chlorinated hydrocarbon residues introduced into the environment as pesticides shortly after World War II were the primary source of contamination. These pollutants cause the production of abnormally thin-shelled eggs (Porter and Wiemeyer, 1969) resulting in the reproductive failure of several species of raptorial and fish-eating birds (Hickey and Anderson, 1968). Peakall (1974) analyzed peregrine falcon eggs collected on the central coast of California for the presence of DDE, the principle chlorinated hydrocarbon compound believed responsible for subnormal eggshell thickness. Eggs collected prior to the time when extensive uses were made of chlorinated hydrocarbons (pre-1947) showed no trace of DDE. However, eggs collected subsequent to 1947 revealed DDE present in concentrations sufficient to account for eggshell thinning. Earlier, Hickey and Anderson (1968) reported a constant eggshell thickness and index of shell weight until the mid-1940's. Their measurements revealed thin-shelled eggs were first collected in California in 1947 and that most California peregrine falcon eggs collected after 1947 were significantly thinner than pre-1947 eggs.

Bond (1946) predicted an eventual, regional reduction in the peregrine falcon population of western North America resulting from the expansion of human development into once remote areas. But the nature and extent of the decline which characterized the two decades following this forecast greatly exceeded the prediction. The decline resulted in the near extinction of peregrines at rates greatly exceeding the destruction of peregrine habitat, and in vast areas beyond those predicted by Bond. However, his prediction of human related limiting factors may indeed be regulating the remnant peregrine falcon population in California.

This study was conducted to: 1) sample the peregrine falcon fledgling production in California during 1975 and 2) provide management and protection recommendations for conservation of nesting peregrines in California. The study was not designed to systematically visit historical eyries for a temporal comparison with the 1970 peregrine falcon nest survey (Herman, 1971).

prevented this. However, cooperators provided these data for two nesting attempts. Counts of the number of young fledged per eyrie were made at all locations where pairs of peregrines were observed.

A qualitative examination of the physical features at each active eyrie provided data for use in recommendations regarding protection and management. However, existing land uses in relation to peregrine nesting ecology are extremely difficult to interpret. In some cases, the interpretations given here are based on observations made prior to the study period, providing a broader base from which to make recommendations.

Nesting territories are discussed by using code letters for regional areas of the state to prevent revealing specific locations.

Coastal Regions

- | | |
|----------------------------|---|
| North Coast (NC):
(n=8) | Along the coast from the Oregon border 42° N latitude, south to 38° N at the entrance to San Francisco Bay. |
| Mid-Coast (MC):
(n=5) | Along the coast from the 38° N latitude south to 34° N, near the line separating Ventura and Los Angeles counties, and including the Channel Islands. |
| South Coast (SC)
(n=0) | Along the coast from the 34° N latitude south to the Mexican border, 32° 30' N. |

Interior Regions

- | | |
|--------------------------------|---|
| North Interior (NI):
(n=10) | All areas inland (not coastal) south of the Oregon border, 42° latitude, south to 38° N Latitude, and east to 6,096 m. (2,000') elevation on the west side of the Sierra Nevada; includes northwest plateau region. |
| South Interior (SI):
(n=6) | All areas inland south of the 38° N latitude south to the Mexican border and east to 6,096 m. (2,000') elevation on the west slope of the Sierra Nevada. |
| Montane (M):
(n=2) | From the 6,096 m. (2,000') elevation on the west slope of the Sierra Nevada to the Nevada border. |

For convenience, these code letters follow the regional abbreviations used by Herman, et al, (1970) but the eyrie numbers within any region do not correspond between the two studies.

Results

Nesting Territories

Peregrine falcons were present at nine of the 30 nesting territories checked (TABLE I). A tenth location (M2), reported active from 1969 to 1974, was

suspected to be active in 1975 but the site was not visited. In this instance, the specific location was not provided until after any young which may have been produced would have dispersed. An adult female peregrine, observed on three occasions in the vicinity of NC6, was the only unpaired adult observed between March and July. It could not be determined if this was the same adult each time or if it was actually paired and nesting.

A pair reported at MC5 consisted of an adult male and an immature female. There was no evidence to indicate that eggs or young were produced.

Reproduction

Clutches of three eggs each were reported at sites MC2 and NI5. Two young fledged at site MC2. The fate of the third egg is unknown. At site NI5 three eggs were laid and incubation started. Later two eggs disappeared and the third egg was collected after the adults abandoned the site. It contained a two-thirds developed embryo. The egg was retained by the U. S. Fish and Wildlife Service for chemical analysis. No other data on clutch size and hatching success were obtained.

Seven pairs of adult peregrines fledged fourteen young (TABLE II). This is a minimum figure since counts at NI9 and SI6 were made after the young had fledged. Two young were counted at both nesting territories, but it is possible that an additional one or two fledged. Therefore, the eight pairs observed fledged a minimum mean of 1.75 young per pair. Seven pairs of adult peregrines fledged a minimum mean of 2.00 young per pair. The six pairs observed with young fledged a minimum mean of 2.33 young per pair. These figures compare favorably with indices of normal reproduction for peregrines (Hickey, 1942; Cade, 1960).

In 1970, two breeding pairs and two lone peregrines were at four sites in California (Herman, 1971); three young fledged at NI5, one or more young fledged at NI7 and single adult peregrines were at sites NC7 and MC2. During 1975, NI5 and MC2 were active and NC7 was inactive. NI7 may be an alternate site to NI8, which was active in 1975.

Distribution

Clearly, the post-1945 decline of the peregrine falcon breeding population is not limited to certain geographical areas in California. Instead, peregrines were greatly reduced in number throughout the biotic communities they once utilized. Historical data on about 200 nesting locations indicate approximately two-thirds of the known eyries are insular, coastal, or inland less than fifty miles from the Pacific coast. The remainder are generally associated with large bodies of standing water or river canyons typical of the Great Basin region, the Sierra Nevada, and the Cascade Mountain Range (Bond, unpublished; Herman, et al, 1970).

The distribution of one suspected and nine known active areas utilized by peregrines in 1975 indicate the existence of a widely dispersed, remnant population. During the years of severe reproductive failure a small percentage of young were produced annually in some regions, but at levels insufficient to maintain a stable population statewide. This has apparently resulted in the extinction of nesting peregrines in vast areas once supporting peregrines (e.g., the Channel Islands, Ventura, Los Angeles, Riverside, Orange, and San Diego counties).

TABLE I. SUMMARY OF PEREGRINE FALCON ACTIVITY OBSERVED OR SUSPECTED AT A SAMPLE (n=30) OF KNOWN OR SUSPECTED NESTING LOCATIONS IN CALIFORNIA DURING 1975.

Location	Inactive	Pair	Single Adult	Suspected
NC1	X			
NC2	X			
NC3	X			
NC4	X			
NC5	X			
NC6			X	
NC7	X			
NC8	X			
MC1	X			
MC2		X		
MC3	X			
MC4	X			
MC5		X		
SC0 ^{1/}				
NI1	X			
NI2	X			
NI3	X			
NI4		X		
NI5		X		
NI6	X			
NI7	X			
NI8		X		
NI9		X		
NI10	X			
SI1	X			
SI2		X		
SI3	X			
SI4	X			
SI5	X			
SI6		X		
M1	X			
M2				X
Totals	21	8	1	1

^{1/} No nesting territories checked.

TABLE II. PEREGRINE FALCON REPRODUCTION IN CALIFORNIA DURING 1975
WHERE PAIRS WERE OBSERVED (n=8).

Location	No. Visits	No. Young
MC2	5(+)	2
MC5	4	0 ^{1/}
NI4	3	2
NI5	5(+)	0 ^{2/}
NI8	2(+)	2
NI9	3	2
SI2	1(+)	4
SI6	4	2
Total	27(+)	14

^{1/} Adult male with immature female.

^{2/} Three eggs laid; two disappeared, one collected.

(+) Refers to numerous visits made by several observers.

During 1975, only three coastal locations had peregrines present (NC6, MC2, MC5). The Channel Islands were not visited. Of these three coastal sites, two pairs were present at cliffs and at the third a single adult was sighted several times in the vicinity of an historical eyrie. Only one coastal eyrie (MC2) fledged young. Each of the three coastal locations are greater than 120.7 kilometers (75 miles) apart. The areas between them were reported to contain 12-15 pairs annually during the mid-1940's (unpublished data). These three locations were also reportedly active during that era.

The suspected active eyrie (M2) is in the Sierra Nevada, 241.4 kilometers (150 miles) from the nearest known pair. However, the existence of closer, unknown pairs is probable.

Combining the southern and northern interior regions, five of six active eyries are in the Coastal Mountain Ranges less than 80.5 kilometers (50 miles) inland. Figure 1 demonstrates the distance between these pairs. The sixth active interior eyrie (NI9) is in the Cascade Mountain Range, isolated approximately 160.9 kilometers (100 miles) from any other known pair.

Figure 1. Demonstration of Distances Between Five Active Eyries (A-E) in the Coast Mountain Ranges of California During 1975.



Interspecific Competition

Peregrines and prairie falcons (Falco mexicanus) occur sympatrically in the western United States. Porter and White (1973) discussed ecological separation and niche overlap in regions of contact for these species in Utah. A similar situation occurs in the interior of California. The known nesting locations of peregrines are in regions of contact with prairie falcons. However, coastal peregrine eyries, no longer in use, have not been used by prairie falcons since their abandonment. This implies that competition with the prairie falcon had no part in the coastal peregrine decline and that coastal habitats are not used by prairie falcons, at least for nesting.

Herman (1971) mentions nesting prairie falcons occupying three historical peregrine eyries. Prairie falcons were observed at 10 of the 30 locations visited in California during 1975 (TABLE III). Two pairs nested in close proximity to nesting peregrines. At SI2, the two species nested approximately 1.6 kilometers (1 mile) apart. Prairie falcons were suspected nesting near three other active peregrine eyries.

Two locations (SI1 and SI3), where peregrines nested in the late 1960's, had prairie falcons present in 1975. One pair occupied the same nesting ledge used by peregrines in 1949-1950 (R. Quigley, pers. comm.).

Aggressive interactions between peregrines and prairie falcons are not uncommon (Porter and White, 1973; Ogden, 1972; Bond, 1946). During 1975, such encounters occurred at MC2, SI2, and NI5. At NI5, an adult peregrine apparently killed an intruding prairie falcon (B. Walton, pers. comm.).

Other raptor species which were aggressively attacked by nesting peregrines included a red-tailed hawk (Buteo jamaicensis), turkey vultures (Cathartes aura), great horned owl (Bubo virginianus), and a bald eagle (Haliaeetus leucocephalus).

TABLE III. A SUMMARY OF PRAIRIE FALCON OBSERVATIONS AT PEREGRINE FALCON NESTING LOCATIONS IN CALIFORNIA DURING 1975.

Peregrine Falcon Nesting Territory	Prairie Falcon Activity
NI2	Prairie falcons nested in the vicinity of this site in 1974 and 1975.
NI5	No nesting known; individual attacked by peregrine and apparently killed (B. Walton).
NI8	Individuals in vicinity; nesting suspected.
SI1	Pair nesting; reported in vicinity 1974.
SI2	Pair nesting; fledged three young 1975. (Harley Grieman, USFS)
SI3	Pair nesting.
SI4	Several observations of individuals during nesting season. No record of nesting. (J. Hale).
SI5	Single adult observed.
SI6	Pair with fledged young approximately three miles west of peregrine eyrie (B. Walton).
MC2	Lone adult attacked by peregrine. Lone adults observed occasionally 1971-1973. Suspected nesting on nearby inland cliff.

DISCUSSION

Cade (1960) made three assumptions basic to a population study of peregrines: (1) an accurate census of the population of a given area is dependent upon knowing the location of eyries, (2) population trends can be recognized by recording the historical use of these sites, and (3) the degree of permanency is not equal for all eyries and the utilization of cliffs may occur after long periods of vacancy. It is clear that there has been no major change in the status of the peregrine in California since 1970, but the potential for re-occupation of historical eyries may still exist. Intensified searching has revealed pairs at cliffs previously unreported as peregrine eyries, but there is no evidence that pairs were or were not present at these sites historically. At active eyries studied in 1970 and 1975, one which fledged three young in 1970 is the location where three eggs failed to hatch in 1975. In contrast, an eyrie with a lone adult present in 1970 fledged two young in 1975. Such findings limit the prediction of trends, particularly in such a small population.

The production of fledglings during 1975 is encouraging, in contrast to the recent decades of documented nesting failures. Such failures are still prevalent in the declining peregrine population in the Rocky Mountain region where, during 1973, fourteen pairs fledged only three young (Enderson and Craig, 1974). Reduced hatchability and thin-shelled eggs, resulting from pesticide residues, are the suspected causes of these nesting failures.

To what extent a normal rate of reproduction can contribute to an increase in breeding pairs is unknown. Many factors regulate such a population recovery, including: 1) mechanism of eyrie maintenance through recruitment of adults, 2) the wide ecological distribution of active eyries, and 3) the extreme reduction in breeding pairs (90-95%) since the 1950's. These factors may contribute to a continuing decline in spite of the apparent increase in reproduction.

The distribution of the remaining pairs of peregrines indicates the decline was widespread throughout the many habitat types of California. Active eyries are in areas of dense human inhabitation as well as remote, relatively undisturbed areas. However, ecologically there appears to have been a shift toward success at eyries at inland locations (Herman, et al, 1970). Only one coastal eyrie had a pair of adult peregrines present during 1975.

Bond (1946) noted that many areas of western North America, including the Cascade and Sierra Nevada Mountain ranges of California, were not utilized by nesting peregrines despite their seemingly desirable characteristics. An estimate of population size based on the density of known pairs of peregrines is not feasible due to the disjunct distribution resulting from several decades of habitat alteration, particularly pesticide contamination, human encroachment, and watershed manipulation. The number of breeding pairs of peregrines in California is extremely low. This is consistent with the conclusion of a 1970 nesting survey (Herman, 1971). The location of more active nesting territories during 1975 probably does not reflect an increase in breeding pairs, but rather a more detailed survey of the previously suspected remnant population. Based primarily on the sampling method used during 1975, it seems probable that the eight pairs located during 1975 represent more than 25 percent but less than 50 percent of the total population. This suggests there are approximately 15-30 pairs of peregrines in California at the present time.

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