

The decline of the Aplomado Falcon in the United States

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ALTHOUGH THE APLOMADO FALCON (*Falco femoralis*) once nested regularly in parts of Arizona, New Mexico, and Texas, population declines in the early 20th century have essentially eliminated the species from the United States (Bailey 1928; Ligon 1961; Oberholser 1974; Murphy 1978; and Hector 1980). Aplomado Falcons are extremely rare, with a limited distribution in the United States on the gulf-coastal plain of Texas and in the desert grasslands to the west, where many birders search for them annually. Only recently, however, has the status of this species been called to the attention of management-oriented agencies (Bond 1972; Wildlife Habitat Management Staff Group 1975; Murphy 1978; Evans 1982; Millsap 1983; LeFranc and Millsap 1984). LeFranc and Millsap (1984) classified the Aplomado Falcon one of the most "sensitive" of North American raptors.

Reasons for the decline of the Aplomado Falcon are unknown. Ligon (1961:82) says that "considering the permanent source of their food and the abundance of suitable nesting places, the disappearance [of the Aplomado Falcon] from most of its former range remains somewhat of a mystery." He felt that shooting pressure may have been a factor because Aplomado Falcons were very tame. Oberholser (1974: 257), however, says that "... none of the usual causes of bird decimation seem to apply to the Aplomado Falcon."

In 1976 I began a study of the ecology and behavior of the Aplomado Falcon in eastern Mexico. A long-term objective of the project was to provide information which might help to improve the status of the Aplomado Falcon in the United States. Management of any species requires some understanding of its basic ecological relationships and how these relate to any population declines that have occurred. Results of the initial ecological investigations dealing with feeding ecology and habitat selection have been completed (Hector 1981 and 1985). This paper presents a scenario which describes and attempts to explain the decline of the Aplomado Falcon in the United States.

METHODS

I solicited specimen records from 57 museums and private ornithological collectors in the United States and Canada. A total of 43 responded and 29 contained specimens from the United States.

Specimens from the following collections (in order of appearance) are mentioned in this paper: San Diego Natural History Museum (SDNHM), United States National Museum (USNM), Cincinnati Museum of Natural History (CMNH), Museum of Vertebrate Zoology (MVZ), American Museum of Natural History (AMNH),

National Museum of Natural History (NMNH), Virginia Polytechnical State University (VPSU), Western Foundation of Vertebrate Zoology (WFVZ), University of Michigan Museum of Zoology (UMMZ), Oklahoma State University Wildlife Collections (OSU). Nineteen collections contained only specimens collected by F.B. Armstrong (see Discussion) and are not referred to individually.

In addition, I attempted to locate all late 19th and early 20th century references to the Aplomado Falcon, and contact individuals who had seen the species in the United States or Latin America. Although my sample of specimen records and observations is surely incomplete, I have probably garnered collection dates and localities for over 90% of North American specimens of the Aplomado Falcon.

In the remainder of this paper numbers in parentheses (#1-#34) refer to locations on Figure 1.

RESULTS

Early History in New Mexico

In March 1852, Heermann (1854; Brewer 1856) collected the first U.S. Aplomado Falcon (#1) in southwestern New Mexico. Stephens added a third U.S. specimen (SDNHM) in August.

1875, when he shot an adult female (#2) near Silver City, New Mexico (Grant County). Anthony (1892) reported a pair of falcons (#3) near Hachita (Grant County) in June 1886. On the Jornada del Muerto (#4; Dona Ana County), Ligon discovered several nests with young in June 1908 and 1909 (Bailey 1928). In July of the same year, Goldman collected an adult (USNM) at Hachita, and observed a bird in August in the Playas Valley (#5; Hidalgo County; Bailey 1928).

In June 1917, Ligon collected an adult female (USNM) 45 miles north of Alamogordo (#6; Otero County). He observed a pair of adults 25 miles north of Engle (#7; Socorro County, #25) in August (Bailey 1928); and collected a pair of adults (USNM) in September near Nutt (#1; Luna County). In September of the next year, he observed

one bird 20 miles southeast of Silver City (#2; Luna County; Bailey 1928), and in November Ligon (1961) and A.K. Fisher observed a pair of falcons near Engle (#7; Sierra County). In December 1918, Ligon observed a pair of Aplomado Falcons 10 miles north of Engle (#7; Bailey 1928). In May 1919, Ligon shot an adult male (CMNH) 30 miles southeast of Silver City.

In May 1924, Ligon took an adult male (YPM) 15 miles southeast of Cutter (#7; Sierra County). In June, Kellogg collected two adult males (CMNH) and an adult female (MVZ) on the Tadpole Ranch, 4 miles north of Separ #8; Grant County). In September 1924, Ligon collected another falcon (CMNH) southeast of Silver City.

Toomey collected the last skin from New Mexico in October 1939. This was an immature male (CMNH) taken near

Animas (#9; Hidalgo County). Arnold Bayne located the last documented United States nest site in May 1952 near Deming, New Mexico (#1; Luna County; Ligon 1961).

Early History in Arizona

Henshaw (1875) saw Aplomado Falcons several times near Ft. Bowie, Arizona (#10) in 1873-1874. Fourteen years later in April and May, Benson located five nesting pairs (#11) at Ft. Huachuca, Arizona (Cochise County; Bendire 1887). In 1910, Lusk (Visher 1910), observed a bird near Tucson (#12; Pima County), and Willard (1910) saw one in February along the San Pedro River near Fairbanks (#11; Cochise County). Monson spotted a falcon in the Sulphur Springs Valley

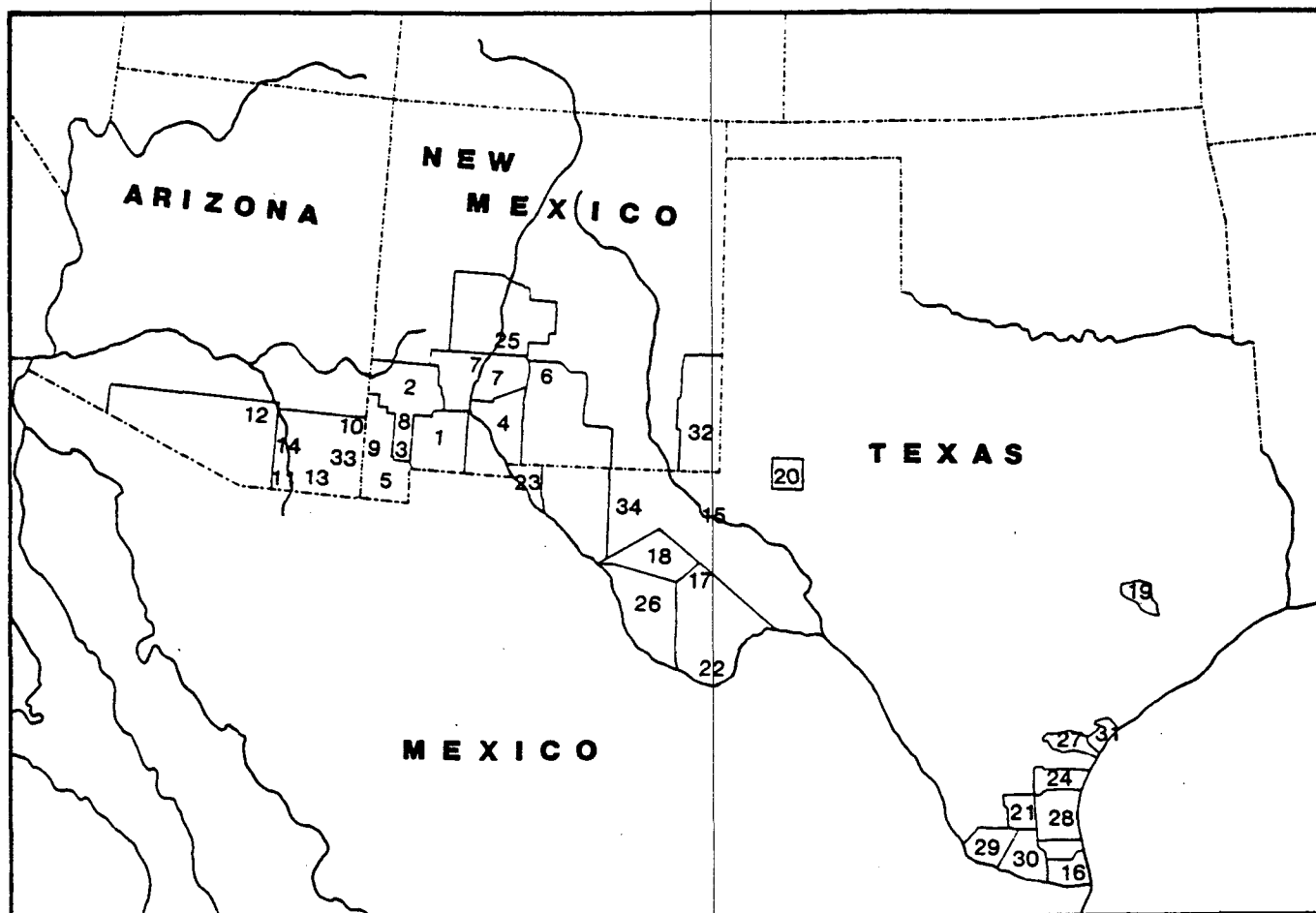


Figure 1. Aplomado Falcon collection and observation localities in the U.S. **NEW MEXICO** localities: #1-Hidalgo Co.; #2-Silver City and Ft. Bayard, Grant Co.; #3-Hachita, Grant Co.; #4-Jornada del Muerto, Dona Ana Co.; #5-Playa Valley, Hidalgo Co.; #6-Alamogordo, Otero Co.; #7-Engle, Sierra Co.; #8-Tadpole Ranch, Grant Co.; #9-Animas, Hidalgo Co.; #25-Socorro Co.; #32-Lea Co. **ARIZONA** localities: #10-Ft. Bowie, Cochise Co.; #11-Ft. Huachuca, Cochise Co.; #12-Tucson, Pima Co.; #13-Sulphur Springs Valley, Cochise Co.; #14-St. David, Cochise Co.; #33-Chiricahua Mtns. **TEXAS** localities: #15-Pecos, Reeves Co.; #16-Brownsville and Pt. Isabel, Cameron Co.; #17-Alpine, Brewster Co.; #18-Jeff Davis Co.; #19-Bellville, Austin Co.; #20-Midland Co.; #21-Brooks Co.; #22-Big Bend National Park, Brewster Co.; #23-El Paso Co.; #24-Riviera, Kleberg Co.; #26-Presidio Co.; #27-Welder WR, San Patricio Co.; #28-North Padre Island, Kenedy Co.; #29-Roma, Starr Co.; #30-Mission, Hidalgo Co.; #31-Aransas NWR, Aransas Co.; #34-Culberson Co.

near McNeal (#13) in November 1939 (Monson 1942). The same year in October, Huey observed an Aplomado Falcon on the San Pedro River near St. David (#14; Phillips *et al.* 1964).

Early History in Texas

About 1860, W.W. Anderson shot an Aplomado Falcon near Pecos (#15; Reeves County; Baird *et al.* 1905). Merrill (1878) observed Aplomado Falcons near Brownsville (Ft. Brown, Cameron County), Texas in 1876 (#16). In May and June of 1877 and 1878, Merrill and Finlay found three active nest sites in Cameron County, Texas. Frasar collected an adult male and female at Pt. Isabel (Cameron County) in February of 1881 (MCZ and AMNH skins).

In July 1890, an immature male (NMNH) was collected at Alpine (#17; Brewster County). In May 1900, Jim and Jo Carroll took a set of eggs (WCH) in Jeff Davis County (#18). In December 1900, an adult male (VPSU) was collected near Bellville (#19; Austin County). In May and June 1904, Burkett and Strecker located three nests (AMNH) in Midland County (#20). In April 1912, Pope collected a set of eggs (WFVZ) near Falfurrias (#21; Brooks County).

About 1890, F.B. Armstrong began a commercial collecting operation based in Brownsville. Between 1890 and 1914, Armstrong and his many assistants collected no fewer than 84 sets of eggs and 27 skins. He collected 7 skins and 33 egg sets in 1890–1899, 3 skins and 48 sets in 1900–1909, and 14 skins and 8 sets in 1910–1914. Armstrong's egg sets account for no less than 67% of all U.S. egg sets of the Aplomado Falcon.

In the 1920s, R.D. Camp took a number of Aplomado Falcons from Palo Alto Prairie in Cameron County. Most of his specimens and perhaps most specimens taken in Cameron County came from the old Pt. Isabel-Brownsville Highway where this road wanders near a row of yucca-covered ridges. He took sets of eggs in April 1923, May 1927, and April 1928 (WFVZ), and collected skins in April 1924 (male falcon; UMMZ), and September 1927 (CMNH).

In May 1935, Sutton and Van Tyne

(1937) sighted an Aplomado Falcon at Johnson Ranch in Big Bend National Park (#22; Brewster County). In August of the same year Kimball collected a falcon near Pt. Isabel (Oberholser 1974). Kirksey observed birds in December 1937 and 1938 near El Paso (#23; El Paso County; Oberholser 1974). In April 1941, Nyc and Peterson (WFVZ) collected the last set of Texas eggs in southern Brooks County (#21). Lehman collected the last U.S. specimen (OSU) in June 1949 near Riviera (#24; Kleberg County).

Temporal Distribution of Collection Activity

By 1900, 44 egg sets and 20 skins had been collected in the United States (Fig. 2). At least 69 egg sets and 9 skins were collected in the next decade. Numbers of collected specimens decreased sharply in 1910–1929. The 11 skins taken after 1914, however, suggest the decline in abundance of egg sets reflects only the cessation of Armstrong's activities (at his death) and not decreasing availability of the species.

Recent Sightings

In December 1950, in Texas, Small *et al.* (A. Small, *pers. comm.*) spotted a pair of adults between Alpine and Valentine (#26; Presidio County). Haller and Koch observed a single falcon at Mariscal Mine in Big Bend National Park in February 1952 (#22; Brewster County; Wauer 1973). Cottam (Oberholser 1974) saw Aplomado Falcons at Welder Wildlife Refuge (#27; San Patricio County) in June 1955 and twice in 1957 (February and July; Oberholser 1974). In the 1950s, L.C. Goldman observed a bird at Laguna Atascosa National Wildlife Refuge (Cameron County, Texas; Oberholser 1974). Meredith observed a falcon on South Padre Island (Cameron County), in January 1954 (Meredith, field notes). Hunt (*pers. comm.*) twice saw the species at Alpine, Texas (Brewster County), during the 1950s. Riddle (*pers. comm.*)

spotted an Aplomado Falcon on North Padre Island in October 1963 (Nueces, Kleberg, or #28, Kenedy County). In September 1971, Wood (Oberholser 1974) watched a pair of falcons soaring over Roma (#29; Starr County). In November of the same year, Fritz observed a falcon at Bullis Gap, Big Bend National Park (Wauer 1973). In 1972, birds were observed at Boca Chica (Cameron County), and Mission (#30; Hidalgo County) by Masthay *et al.* and Donohue (Webster 1972). While Marlatt saw a bird on several occasions in 1973 at Aransas National Wildlife Refuge (#31; Aransas County; Webster 1973). West (*pers. comm.*) observed a single Aplomado near Presidio (#26, Presidio County) along the Rio Grande in 1977. Galucci *et al.* (Williams 1979) reported an Aplomado Falcon from Alpine in October 1978. Joseph J. Hickey (B. de Santos, *pers. comm.*) watched a single falcon at Laguna Atascosa National Wildlife Refuge in spring 1984.

In May 1962, Harris (1964) observed what may have been a breeding pair of adults in Lea County, New Mexico. Nymeyer reported a sighting of the species just west of El Paso (#4; Dona Ana County) in May 1975, while Scholes spotted a single bird near Rodeo (#9; Hidalgo County) in 1977 (Hubbard, *pers. comm.*). Marr observed an immature falcon in Hidalgo County in 1979 (Witzeman *et al.* 1979).

Published records post-1952 from Arizona are limited to a series of sightings of disputed validity made between 1970–75 near Hereford along the San Pedro River (#13; Cochise County; Balch 1975). In addition, I know of two or three unpublished sightings from the vicinity of the Chiricahua Mountains (#33; Cochise County).

The validity of these records and many other unpublished ones is always questioned and usually doubted (Kaufman *et al.* 1980). The important issue, however, is not whether infrequent sightings are legitimate, but whether the species is still able to nest in the United States. Even if only a few "records" are legitimate (and I believe that a few are), it is important to search areas where birds are regularly reported, despite doubts about whether or not a particular sighting is valid. Location of nesting birds would provide a valuable opportunity to learn first-hand about the ecological requirements of the species in the United States.

DISCUSSION

Past Abundance in the United States

Strecker (1930:7) said that he encountered Aplomado Falcons "frequently" during his travels in 1904 through Midland, Brewster, Culberson (#34), and Jeff Davis counties in west Texas. He felt that the species had "... always been a much commoner bird in southern and western Texas..." than had been credited. Smith (1910:103) stated that between Brownsville and Ft. Isabel, Aplomado Falcons were "quite common." Merrill (1878:152) said that the species "... is probably a not very uncommon summer resident..." in Cameron County. Bendire wrote (1887:552) that the Aplomado Falcon "... is fairly common in the vicinity of Ft. Huachuca."

Numbers of collected specimens support the view that the species once regularly inhabited the United States (Fig. 2). Collectors found Aplomado Falcons nesting in the United States each year from 1892–1914, and pairs of birds or nests were found in nearly every season until 1930. For the period between 1890 and 1915, Aplomado Falcon egg sets ($n = 84$) from the lower Texas coast outnumber egg sets of the White-tailed Hawk (*Buteo albicaudatus*; $n = 45$), and Crested Caracara (*Polyborus cheriway*; $n = 66$; WFWZ specimens) collected in the same area. Strecker (1930) found 3 nests of the Aplomado Falcon (on May 8, 15 and 28, 1904), while locating 38 nests of the Swainson's Hawk (*Buteo swainsoni*) in Midland County, Texas. These data suggest that the species once occurred in densities comparable to those reported for some United States populations of the Prairie Falcon (*Falco mexicanus*) and Merlin (*F. columbarius*).

The Specimens of F.B. Armstrong

Some people believe that specimens collected by Frank B. Armstrong were actually taken in Mexico and sold as United States specimens (Oberholser 1974, and Quillen, letter to Pemberton). This has some bearing on estimates of the past status of the Aplomado Falcon because Armstrong collected the majority of United States specimens. Oberholser (1974) believed that Arm-

strong's records were correct. I have discovered (Hector 1981), however, that at least his clutch size data is probably bogus: Armstrong clutches average ($\bar{x} = 3.62$ eggs/clutch, $s = .51$, $n = 84$) almost one egg larger (t -test: $P < .001$) than sets taken by other collectors ($\bar{x} = 2.64$, $s = 1.22$, $n = 28$). Furthermore, Armstrong's clutches show an unnatural uniformity in clutch size ($F = 2.39$, $P < .01$) with nearly every set containing four eggs. Clutches taken by other collectors usually contain 2 or 3 eggs. This same tendency is evident in Armstrong sets of White-tailed Hawk and Crested Caracara eggs (Hector, unpublished data).

Roy Quillen, another south Texas collector stated that Armstrong "... took eggs, and not sets" (1922, letter to Pemberton). This implies that eggs from more than one clutch may have been sold as a single "clutch." If this is the case, then Armstrong's "sets" actually represent more nesting attempts than the number of sets would indicate. If we assume that the true mean clutch size for Aplomado Falcons is 2.64 eggs, then the Armstrong sets actually contain 124 clutches instead of 84.

Quillen maintained that many of Armstrong's Texas specimens were actually collected in Mexico. To what degree these comments stem from professional jealousy is unknown: Quillen complains in the same letter that the glut of Armstrong specimens had driven down the prices of Texas specimens. Doubtless the locality data were partially fabricated, since eggs in one set probably came from more than one nest. Data on the past distribution of coastal prairie, however, supports the view that Armstrong's Aplomado Falcon specimens did come from Texas.

The preferred habitat of the Aplomado Falcon in southern Texas was coastal prairie with widely scattered mesquites and yuccas (Merrill 1878; Smith 1910; Lehmann, *pers. comm.*). Johnston (1963) determined that the greatest expanse of coastal prairie at the time of Armstrong's collecting activities stretched north from Brownsville. The Mexican prairie lying closest to Brownsville was at least 200 kilometers to the south (Johnston 1963). Further supporting this view is the fact that White-tailed Hawks still inhabit the Texas prairies, and were collected regularly in Texas until the 1960s by Armstrong (1890–1910), R.D. Camp (1915–

1930), E.F. Pope (1900–1915), and L.R. Olfe and T.C. Meitzen (1950–1965).

The Decline of the Aplomado Falcon

The Aplomado Falcon may have begun its decline as early as 1905–1909 when Armstrong collected only 27 egg sets. His operation collected 36 sets in 1895–1899, and 42 in 1900–1905. Only 10 sets were collected in 1910–1914. The large number of skins ($n = 35$) taken in 1910–1939 suggests that Aplomado Falcons did not become exceedingly rare until after 1930 (Fig. 2). The active nest located by Bayne (Ligon 1961), and observations made by Lehmann (*pers. comm.*), Meredith (field notes), and others suggest that Aplomado Falcons probably nested in the United States until the late 1950s.

Collecting Pressure

Collecting pressure may have had some local, but temporary effect on Aplomado Falcons. Other birds of prey such as the Peregrine Falcon have shown rapid recoveries in the aftermath of intensive shooting pressure (Ratcliffe 1970). Observations of Aplomado Falcons after the period of greatest collecting pressure imply that stock was available for the recolonization of areas from which the species had been extirpated, yet recovery did not take place.

Rangeland Degradation

In the United States, the species inhabited open grasslands with scattered yuccas and mesquites. Lehmann (*pers. comm.*) said that Aplomado Falcons live in areas where "... scattered tall mesquites and shorter shrubs occurred 0.25 mile or so apart." The deterioration of the desert grasslands and coastal prairies within the former range of the Aplomado Falcon have been much-publicized (Humphrey 1958; Hastings and Turner 1964; Harris 1966; York and Dick-Peddie 1969), and are thought to have accounted for the declines of several other grassland species (Phillips *et al.* 1964; Oberholser 1974). Still, the variety of plant associations inhabited by the Aplomado Falcon suggests that the species is tolerant of habitat disturbance. For example, the species also in-

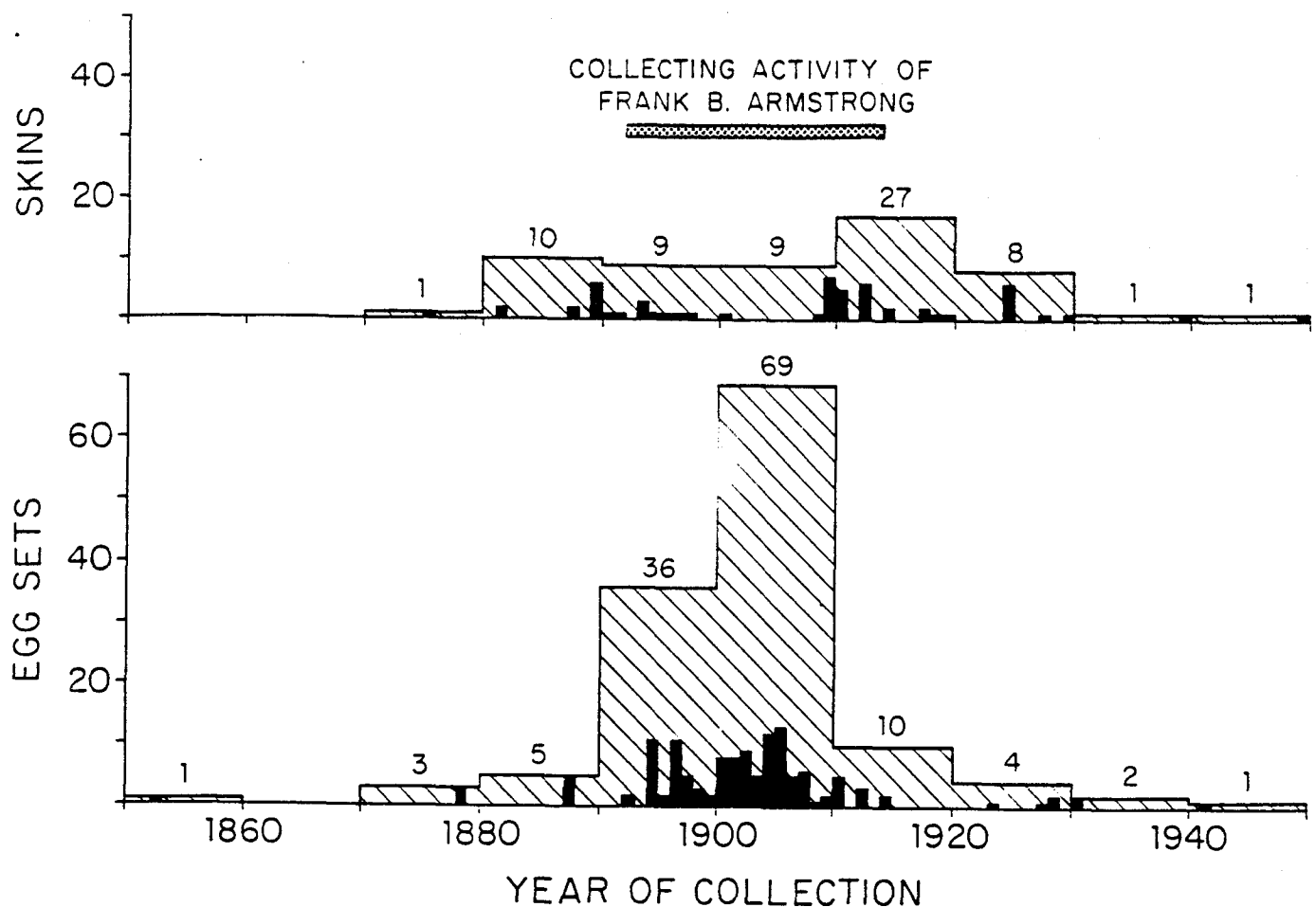


Figure 2. Temporal distribution of U.S. specimens of the Aplomado Falcons. Outlined histogram bars show numbers of eggs or skins collected per decade. Dark bars show numbers of specimens collected per year.

habits oak and pine savannas (Hector 1981, 1985; Howell 1982), open grasslands, coastal deserts (Johnson 1963), riparian woodlands in the midst of desert grassland (Henshaw 1875), and marshes (Hector, *pers. obs.*).

Since the early 1900s much of the lower Rio Grande valley, gulf-coastal plain of Texas, and river floodplains of New Mexico and Arizona have been converted from grassland to farmland—principally cotton, sorghum, citrus, beans and corn. Farming activities have also altered much of the Rio Grande Valley, Texas coastal plain, and portions of New Mexico and Arizona. In addition, brush encroachment has congested much of the semi-open grassland once inhabited by the species (Bogusch 1952; Glendening 1952; Humphrey 1958; Hastings and Turner 1964; Harris 1966; York and Dick-Peddie 1969).

Unregulated grazing by livestock surely accelerated the spread of mesquite by opening up ground cover vegetation and by ingesting, scarifying and dispersing whole seeds (Hastings and

Turner 1964; Harris 1966; York and Dick-Peddie 1969). As in other grasslands, control of range fires, especially on the coastal plain of Texas, probably further accelerated the spread of mesquite (Humphrey 1958).

According to Camp (in Brooks 1933), the area congested by mesquite near Brownsville had increased in coverage and encroached about 5 miles on the coastal prairie in 20 years. Buffington and Herbel (1965) described the brush encroachment on the Jornada del Muerto between 1858–1963; evidently this area contained the highest known nesting densities of Aplomado Falcons outside of south Texas. The Jornada Experimental Range may coincide with the area in which J.S. Ligon found birds nesting in 1908–1909 (Bailey 1928). In 1858, an estimated 83,625 acres of the 144,475 acre study site was free of woody vegetation (mesquite, creosote, or tarbush). By 1915, the grassland acreage had decreased to 35,459 acres, then to 32,833 acres by 1928. In 1963, the study site was completely en-

croached by woody vegetation, mostly mesquite; over one-half of the area was covered by high densities of brush (50–100% coverage).

In Mexico, trees at falcon nest sites averaged 46 meters apart and 9.5 meters in height (Hector 1981). Tree densities averaged 19/40 hectares (19/100 acres; Hector 1981). Ground cover tended to be less than 25 centimeters deep (Hector 1981). Pastures not maintained by burning or clearing rapidly became congested with thorny legumes (mostly *Acacia farnesiana*). Aplomado Falcons tended to abandon nesting territories where grassy ground cover had given way to brush (Hector 1981). When I carried out a statistical comparison of habitat structure measurements for a sample of eastern Mexican nesting territories, I found that although occupied sites tended to have greater overall ground cover density, ground cover at these sites was concentrated below 0.5 meter above the ground (Hector 1981). Abandoned sites tended to be more congested with vegetation between 0.5

and one meter above the ground (Hector 1987). A number of studies have detected a relationship between raptor habitat selection and structure of ground cover vegetation (Howell *et al.* 1978; Bechard 1982; Hector 1987; and reviewed by Janes 1985). Janes (1984), using simple geometric models, has shown how habitat structure should affect prey detection ability and optimal perch heights of raptors. Presumably, capture efficiency should also be affected by vegetation structure.

Although birds are the staple food of the Aplomado Falcon (Hector 1985), the species feeds on a variety of prey including bats, rodents, lizards, and insects (Brooks 1933; Ligon 1961; Mader 1981; Hector 1985). Many prey animals are captured on the ground following high-speed chases begun from vantage posts in trees (Hector 1981, 1985, and 1986). Hunting falcons often force fleeing birds to hide in limited patches of thicker ground cover or in the crowns of isolated trees. Aplomado Falcons, however, are agile enough to corner and capture such grounded prey. With prey in continuous forest, dense brush, or dense, deep grass, however, falcons tended to quickly abandon pursuit.

Although grazing pressure could conceivably have improved hunting success for Aplomado Falcons by making prey more vulnerable to detection and capture, lack of cover probably reduced populations of many prey species by destroying food plants and protected nesting situations (Brown 1900 and 1904). This may account for the declines suffered by the Masked Bobwhite (*Colinus virginianus ridgwayi*) (Brown 1900 and 1904; Ellis *et al.* 1977; Tomlinson 1972), Scaled Quail (*Callipepla squamata*) (Phillips *et al.* 1964), Mearn's Quail (*Cyrtornyx montezumae*) (Brown 1900 and 1904; Phillips *et al.* 1964; Oberholser 1974), and a number of open country fringillids such as McCown's Longspur (*Calcarius mccownii*), and Botteri's Sparrow (*Aimophila botterii*), Rufous-winged Sparrow (*Aimophila rufalis*), and Baird's Sparrow (*Ammodramus bairdii*) (Phillips *et al.* 1964) in 1890–1910.

Populations of the White-tailed Hawk, Black-shouldered Kite (*Elanus leucurus*) (Eisenmann 1971; Pruett-Jones *et al.* 1980; Larson 1980), and Ferruginous Hawk (*Buteo regalis*) (Houston and Bechard 1984) have all declined in portions of their ranges where vegetational change has elimi-

nated open to semi-open grassland. Effects of brush encroachment on hunting success and prey availability probably account in part for these declines. This is significant not only because the Aplomado Falcon shares similar habitat preferences with these species, but also because Aplomado Falcons depend largely on other raptors (as well as corvids) for nesting platforms. In eastern Mexico, most nest platforms were the abandoned nests of the Brown Jay (*Psittorhinus morio*), Black-shouldered Kite, or Roadside Hawk (*Buteo magnirostris*) (Hector 1981). I also found falcons in old nests of the Crested Caracara (*Polyborus plancus*). In the United States, falcons used nests of the Chihuahuan Raven (*Corvus cryptoleucus*) (Bendire 1887), Swainson's Hawk (*Buteo swainsoni*) (Strecker 1930), and probably also those of the Black-shouldered Kite, White-tailed Hawk and Caracara.

Populations of the Black-shouldered Kite and White-tailed Hawk have recovered in coastal Texas. This seems related to intensive brush clearing and the use of prescribed burns to revert rangeland to some semblance of its former openness. Unlike these two rodent-oriented species, however, the Aplomado Falcon has failed to recover despite increased availability of open range.

The Effect of Pesticide Contamination

Aplomado Falcons occupy a feeding niche similar to that occupied by the Peregrine Falcon, a species whose pesticide-related declines have been well-publicized (Ratcliffe 1970). Kiff *et al.* (1981) discovered that post-DDT (post-1947) eggs of Aplomado Falcons from eastern Mexico averaged 25% thinner than pre-DDT eggs of this species. This is a greater degree of thinning than that found in declining populations of the Peregrine (Kiff *et al.* 1981).

Because of their dietary preferences (Hector 1985), and evidence that the species is heavily contaminated in Mexico, it is reasonable to assume that Aplomado Falcons surviving in the United States past the 1940s may have been further decimated by pesticide contamination. According to Lehmann, 5–9 falcons inhabited one 12,000 acre pasture on the northern part of the King Ranch until the early 1950s. These birds disappeared before brush encroachment had an appreciable effect on this pas-

ture. Lehmann believed that pesticide contamination may have caused their disappearance. Furthermore, cotton agriculture dominated most areas—the Texas coast, and desert rivers of Arizona and New Mexico—near areas where Aplomado Falcons once occurred.

An obvious effect of pesticide-induced reproductive problems would be a reduction in the ability of a species to colonize unoccupied patches of habitat. Consequently, although brush clearing activities are rapidly opening up south Texas ranches, Aplomado Falcons may not reoccupy their former range until pesticide use abates in Latin America, or some effort is made to artificially reestablish the species.

ACKNOWLEDGMENTS

My work with the Aplomado Falcon has greatly benefitted from equipment or financial support provided by the following organizations: the Department of Zoology at Brigham Young University, Chihuahuan Desert Research Institute, Hawk Mountain Sanctuary Association, the National Wildlife Federation's Environmental Conservation Fellowship Program, Oklahoma Cooperative Wildlife Research Unit, Frank M. Chapman Memorial Fund, and the Western Foundation of Vertebrate Zoology. In addition, the following individuals deserve special thanks for their help: W.G. Hunt, J.R. Murphy, L.F. Kiff, J. Langford, H. Flanders, J. Hubbard, K.A. Arnold, P. Duval, S.F. Fox, L. Ashford, D. Latham, F.L. Knopf, R. Pratt, V. Lehmann, R. Quigley, H. Snyder, and A.C. Keddy.

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