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FORK-TAILED STORM-PETREL RECORDS FROM INLAND ALASKA

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The Fork-tailed Storm-Petrel (*Oceanodroma furcata*) has been recorded from interior Alaska (Nelson 1887, Geist 1939), but Palmer (1962) and AOU (1983) rejected these unsubstantiated inland records. After seeing three of these birds in the interior of Alaska, I investigated the rarity of their inland occurrence and where they had originated. From University of Alaska Museum records, I found that my inland sightings were not unique and possibly were associated with four other sightings. This note examines present distribution, historic records, weather patterns, and recent inland records of these storm-petrels in Alaska.

Fork-tailed Storm-Petrels breed abundantly on the islands off the Alaska Peninsula and the Aleutian Islands (Sowls et al. 1978). They forage in the southern Bering Sea, but are uncommon north of 58°N and on the Bering Sea Continental Shelf (Divoky 1978, Gould et al. 1982). I know of no evidence that they nest north of the Aleutians. Nelson (1887) obtained several specimens from Saint Michael (63°29′N) on Norton Sound and one 120 km above the mouth of the Tanana River in November, but the specimen was lost. Geist (1939) recorded storm-blown individuals at Curry Station (62°37′N, 150°00′W) in November, 1932; however, no specimens were saved.

Recent records of the storm-petrel from inland Alaska have all concerned live birds, except one which was collected as fresh prey from a Peregrine Falcon (*Falco peregrinus*) eyrie and another that was found dead below electrical wires in Palmer (Table 1). R. Baxter (pers. comm.) found the Napakiak bird after a big storm; the storm-petrel observed by B. F. King (*in litt*) occurred after a severe storm, and the Palmer bird was picked up following a 3.8 cm rainfall (J. Dearborn, pers. comm.). I found three storm-petrels flying low over the Yukon and Koyukuk rivers after a large storm with winds up to 80 kmph on 21 September 1982. Almost all the records, including Nelson's and Geist's, have occurred from July to November when storms that originate south of the Alaska Peninsula and move northward are common. I examined surface isobar maps for August–September, 1982, for storm intensity and storm origination to find possible pelagic sources of the storm-petrels. Preceding the 20 August 1982 sighting, no major storms or intense low pressure centers affected the Kuskokwim drainage. Isobar maps for the period 13–22 September 1982 showed six separate major low pressure cells (850 mb or lower) moving northward from the Pacific Ocean between 160° and 165°W. I do not know whether the seven storm-petrels recorded in September, 1982, came from a common flock or were individually blown inland during separate storms. The last storm, which originated south of the Alaska Peninsula (Fig. 1) on 20 September, was the most intense (720 mb low) and was probably the storm responsible for the birds I found.

I examined 11 Fork-tailed Storm-Petrel specimens at the University of Alaska Museum (including the Napakiak bird on loan) to determine their ages. When I used Willet's description of the juvenal plumage (Palmer 1962) and Harris' (1974) primary molt sequence, I could not distinguish ages. Willet (*in* Palmer 1962) described juvenile birds as having the tail not as deeply forked, white patch on throat streaked with gray, forehead dark gray instead of brownish, and general coloration darker. Harris (1974) described two schedules of primary molt in adults: a fall-winter molt and a summer molt, which he attributed to non- or unsuccessful breeders. Primary molt was not a

TABLE 1. Recent inland records* of Fork-tailed Storm-Petrels in Alaska.

Date	Location	Major river	Observer	Comments
19 June 1967	Naknek Lake outlet (58°40′N, 156°26′W)	Naknek River	D. D. Gibson	Sight record
15 Sept. 1972	Napakiak (60°42′N, 161°57′W)	Kuskokwim	R. Baxter	Specimen at USFWS Bethel, AK
5 Aug. 1976	Naknek Lake (58°38′N, 155°52′W)	Naknek River	B. F. King	Sight record
19 Sept. 1980	Palmer Agriculture Ex. Sta. (61°36′N, 149°06′W)	Matanuska River	C. Dearborn	Specimen at University of Alaska Museum, Fairbanks
15 Aug. 1981	Kogrukluk River (60°50′N, 157°50′W)	Kuskokwim	R. Baxter	Specimen at University of Alaska Museum, Fairbanks
20 Aug. 1982	Holitna mouth (61°40′N, 157°10′W)	Kuskokwim	M. Rearden	Sight record
16 Sept. 1982	Curry (62°37′N, 150°00′W)	Susitna River	P. Hessing	Sight record
17 Sept. 1982	Aniak (61°34′N, 159°31′W)	Kuskokwim River	R. Baxter	Sight record
19 Sept. 1982	25 miles above Aniak (61°32′N, 158°48′W)	Kuskokwim River	R. Baxter	Sight record
22 Sept. 1982	Mile 18 Koyukuk River (65°02′N, 157°31′W)	Koyukuk River	T. O. Osborne	Specimen at University of Alaska Museum, Fairbanks
22 Sept. 1982	Bishop Rock (64°49′N, 157°22′W)	Yukon River	T. O. Osborne	Sight record
20 July 1983	Cement Hill (62°27′N, 160°05′W)	Yukon River	P. Bente D. G. Roseneau	Prey remain from peregrine eyrie

* The records for 19 September 1982 and for 22 September, Koyukuk River, are for two individuals each. All the others are for single birds.

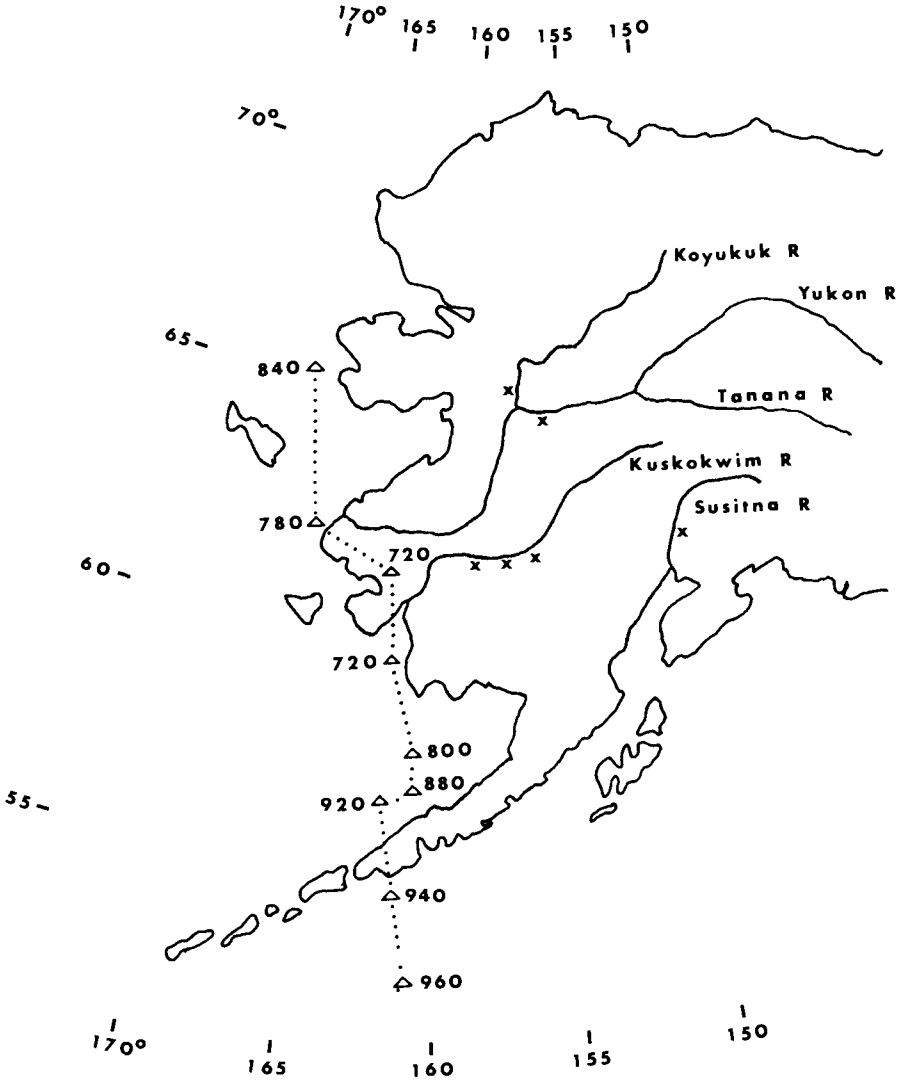

FIGURE 1. Track of storm across Alaska from 06:00 GMT, 20 September 1982 to 06:00 GMT, 22 September 1982. Triangular symbols show epicenter of low at 6-h intervals and millibar reading. Sightings of Fork-tailed Storm-Petrels in 1982 are marked by Xs.

useful criterion for aging the inland birds unless they were nonbreeding adults, since both breeding adults and juveniles would not show signs of molting. None of the birds examined showed signs of molt. In some Hydrobatidae (*Oceanodroma castro, Hydrobates* sp., and *Oceanites* sp.), the outer primary is pointed in juveniles and rounded in adults (Cramp and Simmons 1977). I found no such difference in any of the birds examined.

Four specimens with a darker gray wash to the forehead and crown were presumed to be breeding adults because they had been collected from Alaskan breeding locations before July. Seven other specimens all had a distinctly paler gray forehead and crown. I measured the fork length of the tail in the two sets of specimens and found no differences; however, I found a subtle notch, or "v," at the terminus of the second and third outer rectrices in the darker-headed birds. The apex of the "v" was at the tip of the rachis. The birds with the paler heads all had a more or less square-tipped rectrix, with the tip of the rachis extending approximately 0.5 mm beyond the vanes.

I contacted four museums to find out if they had juvenile-age specimens and to determine whether the characteristics I had found were consistent. The museums had 48 specimens suitable for age or plumage determination. Only one bird was collected as a juvenile from a burrow. It had been collected by Willet; it did not match its description (Palmer 1962) of a juvenile, but it had a bit of down on the chest and head. The ends of the rectrices were straight, without either a small extension of rachis or "v." Five other specimens of unknown age but with either bright or pale plumages, collected from August to November, had the small tip present. The remaining 42 individuals, some of which were collected as adults off eggs, had subtle to distinct "v"s.

The "v" characteristic appears to be consistent in birds which are probably adults (i.e., collected early in the breeding season). The small tip of rachis or absence of the "v" may be an indicator of juvenile birds. Although the "v" and the small tip characteristics are the reverse of criteria used to age waterfowl and game birds, I used them to classify storm-petrels into juveniles and adults.

No definite ages are known for any of the inland Fork-tailed Storm-Petrels found in Alaska, but based on plumage characteristics, I believe that most of the birds are juveniles. In late August and September, Fork-tailed Storm-Petrels fledge at breeding colonies along the Alaska Peninsula (Boersma et al. 1980), and juvenile storm-petrels are especially susceptible to storm "wrecks" (Palmer 1962).

Sowls et al. (1978) reported large colonies (ca. 200,000) of storm-petrels between 160°W and 165°W; the birds I found on the Koyukuk River may have originated 1,000 km south, in the vicinity of those colonies.

Rivers are the only surface transportation corridors throughout most of interior Alaska, and observations are most numerous during September, the main hunting season. All the inland birds found have been on bodies of water, except Geist's (1939) birds, which were found dead 200 m from the Susitna River and the Dearborn specimen from Palmer. The Kogrukluk River specimen was feeding on insects from the water's surface. The specimen I collected was actively "feeding," but the crop contained only grass seeds that had been gathered off the river's surface. I did not examine the skull sutures for ossification, but there was no gonodal activity and no fat deposits. The second bird was seen later in the day, 2 km upstream from the first. These observations indicate that the storm-petrels on these rivers may seek "natural" habitat and attempt to find food.

I do not know of any inland records of Fork-tailed Storm-Petrels anywhere from North America (AOU 1983). For Leach's Storm-Petrel (*O. leucorhoa*), however, there are numerous coastal and inland records of storm-driven "wrecked" birds in North America and Europe (Palmer 1962). I believe that this disparity is because the northern Pacific distribution of the Fork-tailed Storm-Petrel places storm-driven birds in areas with fewer observers.

Based on recent records of inland Alaskan occurrences of the Fork-tailed Storm-Petrel, I believe that Nelson's and Geist's records should be accepted.

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DOUBLE BROODING BY AMERICAN KESTRELS IN CENTRAL MISSOURI

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Nearly all temperate-zone raptors raise only one brood per year; the time required for the complete breeding cycle occupies most of the period of suitable conditions (Newton 1977). Double brooding has been reported, however, for several species in extreme southern latitudes of the continental United States, including: the Harris' Hawk (*Parabuteo unicinctus*) in southern Arizona (Mader 1975), Common Caracara (*Caracara cheriway*; Bent 1937), Black-shouldered Kite (*Elanus caeruleus*; Pickwell 1930), Common Barn-Owl (*Tyto alba*; Marti 1968), and American Kestrel (*Falco sparverius*; Howell 1932) in Florida.

American Kestrels have successfully raised two broods in captivity (Porter and Wiemeyer 1970, 1972), but in the wild, this has been documented only in Florida (Howell 1932). Although Enderson (1960) reported a successful renesting in Illinois, he did not indicate whether or not the first nesting was successful. Stahlecker and Griese (1977) gave circumstantial evidence for a possible double brooding in a pair of kestrels in Colorado, while Black (1979) and Sutton (1979) speculated on the possibility that kestrels might double brood in Oklahoma.

Documentation of double brooding for temperate-latitude raptors would be of significance to wildlife researchers and managers, as it would augment information on annual productivity and nesting phenology. This paper reports the occurrence of double broods in a color-marked, wild population of American Kestrels in central Missouri. Clutch size, hatchability, nesting success, and behavioral differences between first and second nestings are analyzed.

STUDY AREA AND METHODS

The study area was 194 km² in central Boone County, Missouri. The area included the city of Columbia and suburbs (30 km²), as well as farmland interspersed with woodlots, old fields, meadows, streams, and lakes.