

Distribution, Abundance, and notes on the Breeding Biology of Gyrfalcons *Falco rusticolus* in Alaska

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INTRODUCTION

There have been several studies of Gyrfalcons (*Falco rusticolus*) in Alaska. Cade (1960) summarized what was known of Gyrfalcon ecology in Alaska, including his own work along the Colville River on the North Slope. White and Cade (1971) further discussed the biology of Gyrfalcons nesting along the Colville River, emphasizing relationships with other cliff-nesting raptors. Roseneau (1972) studied their distribution, numbers, and diet during nesting on the Seward Peninsula in western Alaska. Bente (1981) analyzed Gyrfalcon nesting behaviour and hunting activity in the Alaska Range in south-central Alaska.

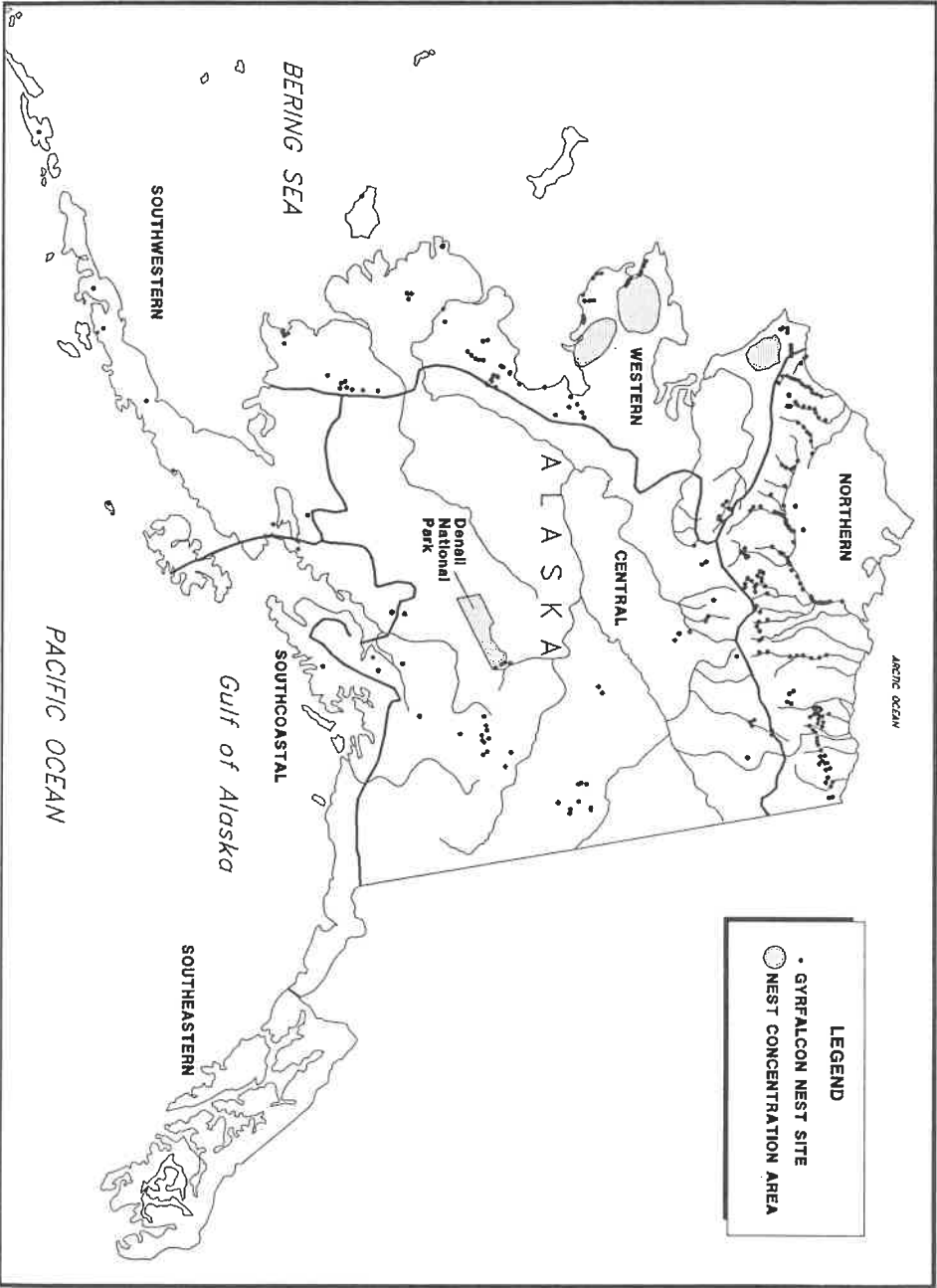
More recent observations of Gyrfalcons have expanded our knowledge of their distribution and breeding biology in Alaska. In this paper, we have provided an updated summary of information on the distribution and abundance of Gyrfalcons. Information was collected from published literature, unpublished government agency reports, discussions with field ornithologists and biologists, and field investigations of the authors. Rather than searching for every known nesting location, we focused our attention on areas where Gyrfalcons are known to breed regularly and, therefore, our search may have overlooked areas where Gyrfalcons breed irregularly or at low densities.

We also have reported on variations in productivity and population size in selected areas in northern and central Alaska. These areas (Colville River and Denali National Park & Preserve) have been surveyed regularly by the leading authors. Finally, we have briefly discussed the status of Gyrfalcons in Alaska.

REGIONAL DISTRIBUTION AND ABUNDANCE

Kessel and Gibson (1978) divided Alaska into six biogeographic regions (Figure 1). These regions are useful for characterizing the distribution and abundance of Gyrfalcons in Alaska

Figure 1. Gyr Falcon Nest Sites in Alaska



because habitat and prey availability varies greatly among them. Individual nest sites and concentrations of nest sites are shown in Figure 1. A brief description of these regions and a discussion of the distribution of Gyrfalcons in them follows.

Keep in mind that the accuracy of our Gyrfalcon estimates was compromised by several factors, including: survey technique (both aircraft and ground surveys were conducted); survey timing (many surveys were conducted late in the breeding cycle); and intensity. Additionally, pairs with active nests are more easily detected during short visits to territories than non-breeding or failed pairs. As a result, these surveys often underestimated the total number of pairs actually occupying territories.

Northern: This region encompasses the mountains and foothills of the north slope of the Brooks Range and the arctic coastal plain. The foothills and coastal plain are limited in extent in the eastern portion of this region, but are much more expansive in the central and western portions. Arctic and alpine tundra predominate. The climate is cold and relatively dry, being influenced by the Arctic Ocean to the north.

The availability of cliff nesting sites varies within this region. In the mountains of the Brooks Range, cliffs are numerous and are not confined to river and stream drainages. In the northern foothills, isolated outcrops occur, but most cliffs occur along streams and rivers. At the northern edge of the foothills and on the coastal plain, cliffs are almost exclusively formed by stream erosion. In the northern portions of this region, therefore, the distribution of nesting Gyrfalcons tends to be linear. Gyrfalcon densities appear to decrease above 1000 m in the Brooks Range, although nests have been found up to 1400 m (Roseneau 1974).

Although Gyrfalcons nest on the south slope of the Brooks Range, most known sites are on the north slope. Concentrations have been found on the northern edge of the mountains, such as in the Arctic National Wildlife Refuge (Arctic Refuge), and along the southern border of the Colville River drainage. A survey in 1989 in the Brooks Range in the Arctic Refuge (the Sadlerochit and Shublik Mountains and the north side of the Franklin, Romanzof, and British Mountains) located 42 occupied territories in an area of about 7600 km², for an average of about one pair/181 km². It appeared that ptarmigan (*Lagopus* spp.) numbers were high during 1989, so the number of pairs with active nests may have reflected the relative abundance of prey. The density of one pair/181 km² compares to one pair/125 km² found in the Kilgavik area of the Northwest Territories (Poole 1987), one pair/175 km² in the Ogilvie Mountains in the Yukon (Barichello 1983), and one pair/113 km² in Iceland (Nielsen 1986). Many areas in the Brooks Range and higher foothills have not been thoroughly surveyed, so our lack of knowledge of these areas does not indicate an absence of Gyrfalcons.

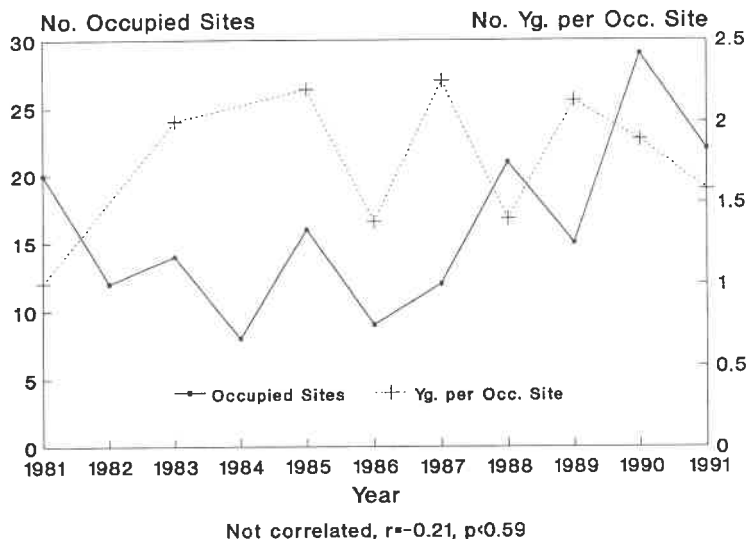
Large numbers of Gyrfalcons nest along the major rivers in this region, including the Colville River (> 30 pairs in some years), the Kokolik River (11 pairs), the Kukpowruk River (12 pairs), and the Utokok drainage (8 pairs). Gyrfalcons will nest in fairly dense clusters along stretches of these rivers where cliffs are abundant: nine pairs in 38 km of the Colville; seven pairs in 40 km of the Kokolik; and nine pairs in 56 km of the Kukpowruk.

The lower foothills and coastal plain have been more thoroughly surveyed (Ritchie 1978a) than the Brooks Range and higher foothills. Suitable nesting sites are scarce in some areas, and the abundance of Gyrfalcons is limited by the number of suitable nesting cliffs. A large area in the central portion of the coastal plain is devoid of cliffs and, consequently, nesting Gyrfalcons.

Since 1981, surveys have been conducted annually on the Colville River along a 345 km section of the river between the mouth of the Etivluk River and Ocean Point. All surveys consisted of at least two boat trips through the study area, one during June, when Gyrfalcon young are 1-5 weeks of age, and a second trip during late July, when Gyrfalcons range in age from nearly fledged to competent flyers. It occasionally was impossible to determine whether territories were occupied by single Gyrfalcons or by failed or non-breeding pairs, so territories were considered occupied if at least one Gyrfalcon showed an affinity to an area. The number of occupied territories may have been undercounted, as non-breeding and failed pairs can be difficult to detect by June and July. Additionally, many young fledged before the second nest visit and were difficult to count. As a result, production was expressed as the number of young reaching banding age, usually 3-6 weeks of age.

Gyrfalcons occupied 40 distinct territories between 1981 and 1991. The number of territories

Figure 2. Gyrfalcon Population Size and Productivity Colville River, Northern Alaska



occupied each year ranged from 8 to 29, averaging about 16 (Figure 2). Twenty percent of the territories were occupied only one out of 11 years, and only 40% were occupied during 6 or more of the 11 years. Short distance movement between cliffs or territories is common in Gyrfalcons (Roseneau 1972; Poole 1987), and probably is in response to the changing availability of suitable stick nests.

The number of young reaching banding age varied from about 5 to at least 56. This variation can be partially attributed to a difference in the percent of territorial Gyrfalcons that raised young to banding age, which varied from 33 to 80% (mean of 60.5%).

The number of young produced per occupied site also varied considerably, from about 1.0 to a maximum of 2.3 (Figure 2). An increase in the number of occupied territories did not coincide with an increase in the number of young produced per occupied site. Studies in Iceland (Nielsen 1986) and the Northwest Territories (Poole 1987) showed that the number of ptarmigan in spring was the major factor affecting the number of Gyrfalcons that bred, but spring weather conditions determined the productivity of those that did breed. The lack of a correlation between population size and breeding performance on the Colville (Figure 2) may be explained by a similar phenomenon.

During previous studies (Roseneau 1972; Poole 1987), non-breeding or failed Gyrfalcons were rarely encountered at nesting territories; however, pairs occupying territories but without active nests were regularly seen on the Colville. At 151 sites determined to be occupied during the first visit to a territory, 39 (25.8%) of these sites were occupied by birds that had no active nest. In most cases it was impossible to determine whether these were non-breeders or failed breeders. Pairs that definitely attempted nesting but failed in late June or early July, however, tended to be absent from territories during a visit in late July; Gyrfalcons were seen during one of 14 (7%) visits to territories where nest attempts had previously failed.

West: This region comprises an area along the western edge of Alaska, from south of the Brooks Range to the north side of the Alaska Peninsula. The region includes mountains up to 1365 m, rolling foothills, and flat, open lowlands. Arctic tundra is the predominant vegetation, although some small stands of boreal forest occur in the eastern portions of the region. The climate is warmer and wetter than the northern region due to the influence of the Chukchi and Bering Seas. Cliffs are relatively abundant in some mountainous areas and in some portions of the Seward Peninsula, but are rare or absent in other large portions of this region.

Several concentrations of Gyrfalcons occur in the western region. Several dozen pairs nest on the Lisburne Peninsula on sea cliffs, river cliffs, and isolated outcrops in the Delong Mountains. Another local population, numbering about 70 pairs, nests on the Seward Peninsula (Roseneau 1972). The density of Gyrfalcons on the Seward Peninsula varies from one pair/176 km² in areas where cliffs are abundant to one pair/1000 km² where cliffs are few (Roseneau 1972). The average density on the entire 43,500 km² peninsula was estimated to be one pair/622 km² (Roseneau 1972).

Gyrfalcons also nest along tributaries of the lower Yukon and Kuskokwim Rivers (White and Boyce 1978; Mindell and Dotson 1980). Between one and five pairs nest along several rivers, but the total in this area is no more than a few dozen pairs. Cliffs are rare in the Yukon-Kuskokwim Delta, but Gyrfalcons have been found on the few suitable cliffs. A few nests have been found on a small series of volcanic extrusions in the delta near the coast (B. McCaffery and C. White, pers. comm.), and one was found in the Askinuk Mountains (White and Springer 1965). Several nest sites were reported from the Goodnews Bay area, but it is unknown how many are occupied simultaneously (Bull in Cade 1960).

Gyrfalcons have been seen on several islands in the Bering Sea (Gabrielson and Lincoln 1959). They are most frequently seen during fall and winter, occurring on islands and on the pack ice (Johnson and Herter 1989). There is one reliable nest record from Nunivak Island (Ritchie 1978b).

Southwest: This region is comprised of the Alaska Peninsula and the Aleutian Islands. Tundra predominates. The climate is wet due to the influence of the Pacific Ocean to the south.

Gyrfalcons nest in southwest Alaska, although in small numbers. Ptarmigan and Arctic Ground Squirrels (*Spermophilus parryi*) occur on the Alaska Peninsula and on several of the Aleutian Islands, and nesting sites are common in at least some areas. Although wet summer weather may limit Gyrfalcon reproduction in this region, Gyrfalcons are common during the fall and winter. Apparently a considerable number of Gyrfalcons concentrate along the Alaska Peninsula during October and November, and some may migrate westward through the Aleutians (see discussion of band recoveries, below).

We located only four nest records from the Aleutians, two from Unalaska (D. Gibson, pers. comm.; L. Merrick, pers. comm.) and two from Umnak Island (C. White, pers. comm.). Probably a few dozen pairs nest along the Alaska Peninsula, but survey coverage has been limited. Two nests have been found on Tugidak Island to the west of Kodiak Island.

Central: The central region is the largest region within the state. The region contains numerous mountainous areas, including the Alaska Range, southern slope of the Brooks Range and part of the Wrangell Mountains, as well as large expanses of boreal forest and lowlands. Winters are long and cold and summers tend to be warmer and dryer than in other regions of the state.

Gyrfalcons occur mainly in the mountainous portions of this region. They nest from treeline, which usually occurs at about 700 m, to about 1200 m, although nests have been found as high as 1630 m (Frank Bird, pers. comm.). A large portion of the Alaska Range and Wrangell Mountains lies above the elevational limit of Gyrfalcons.

In the Alaska Range, the most extensive surveys have been conducted in Denali National Park and Preserve (Denali Park). In 1991, 26 pairs of Gyrfalcons occupied territories in a 5,500 km² area in Denali Park, for an average density of one pair/212 km². This density is only slightly lower than those found in the Arctic Refuge and in portions of the Seward Peninsula. Several pairs are also known to nest east of Denali Park along the Denali Highway, but extensive aerial surveys have not been conducted in this area. Most of the Alaska Range has not been surveyed, so it is unknown if the densities seen in Denali Park and along the Denali Highway are typical for the Alaska Range.

A few Gyrfalcons nest in the Yukon-Tanana Uplands, the White Mountains, the Talkeetna Mountains (T. Sell, pers. comm.), and along the south slope of the Brooks Range. However, much of this country remains unsurveyed.

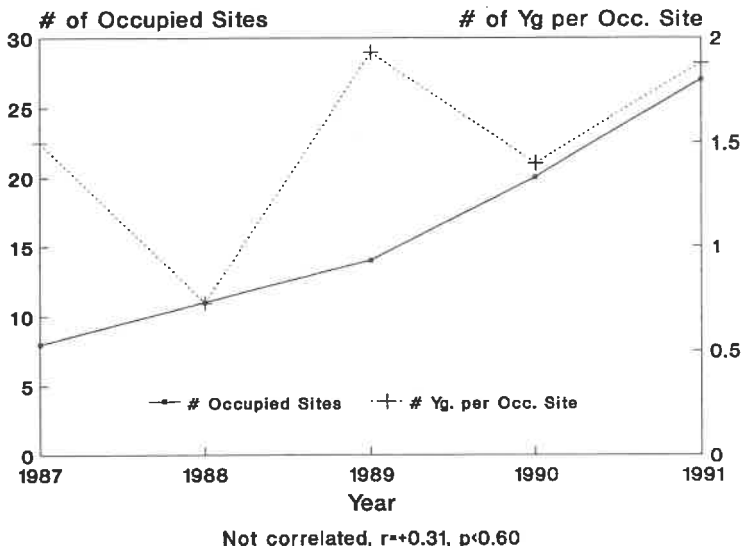
Early observations of Gyrfalcons in Denali in the north central Alaska Range were recorded by Dixon (1932) and Murie (1963). More recently, observations were made from 1987 to 1991 during Golden Eagle (*Aquila chrysaetos*) surveys. Surveys were conducted from helicopters. A first check of cliffs was made in mid-May when Gyrfalcon nests contain eggs or small young, and a second check was made in late June and early July, when young are generally 4-6 weeks old.

Some territories were also visited on the ground during July. Since counts of fledglings were not possible, production is reported as the number of young reaching banding age, usually 3-6 weeks old.

Thirty-six nests have been found in Denali. Twenty-three (64%) were in nests originally built by Golden Eagles, 10 (28%) nests were on rock ledges with no sticks, and 3 (8%) were in nests built by Northern Ravens (*Corvus corax*). Among years, switching of nests between Gyrfalcons and Golden Eagles was noted 18 times. One renesting effort was observed. Gyrfalcons tended to use sites that have a southerly exposure. Twenty-seven (75%) faced either southeast, south, or southwest. Elevations of nest sites ranged from 750 m to 1350 m ($n=36$, $\bar{x}=1070$).

The number of Gyrfalcons found breeding increased during the study period (See Figure 3), a result probably of both an increase in the size of the breeding population and an increase in survey efficiency as the observer became more familiar with the study area. The number of young reaching banding age per occupied territory varied from 0.73 to 1.93. As was found on the Colville River, variation in the number of occupied territories was not correlated with the number of young produced per occupied territory.

Figure 3. Gyrfalcon Population Size and Productivity Denali Park, Central Alaska



Southcoastal and Southeast: These two regions border the Gulf of Alaska and Pacific Ocean. Most of the region is forested, but some open country occurs in alpine areas, coastal flats, and river deltas. The climate in these regions is more temperate, and coastal areas are extremely wet.

Gyrfalcons are very uncommon nesters throughout the Southcoastal and Southeastern regions. A few nest sites are known from the Chugach Mountains (T. Sell, pers. comm.), but probably no more than a few dozen pairs nest throughout both regions. Gyrfalcons are seen regularly in several coastal areas during the fall and winter, and from 1-3 Gyrfalcons usually winter in Anchorage, feeding on feral rock doves and waterfowl.

Banding Recoveries: To date, 458 Gyrfalcons have been banded in Alaska. Five banded Gyrfalcons have been recovered, providing information about movements within and out of the state: two were recovered within a few months of banding within 50 km of the banding location; one banded as a nestling on the Kivalina River in northwestern Alaska was recovered in December of the same year on the Beaufort Sea coast 40 km northwest of Prudhoe Bay; one banded as a nestling at Summit Lake in the Alaska Range was recovered in winter 1 1/2 years later at Kamloops,

British Columbia; and one banded as a nestling on the Seward Peninsula was recovered in January of its first winter on the Kamchatka Peninsula in Asia. In addition, one banded as a nestling in the Yukon Territory, Canada was recovered near Kotzebue, Alaska, during August of the following year.

SUMMARY AND CONCLUSIONS

In summary, Gyrfalcons are most common in northern Alaska, in portions of the western region, most notably the Seward and Lisburne Peninsulas, and in the Alaska Range. Densities up to about one pair/200 km² have been found in each of these areas. However, densities are much lower throughout most of the Gyrfalcon's range in Alaska, and Gyrfalcons are absent as nesters from large areas of the state.

Cade (1960) originally estimated the Alaska population at 200-300 pairs, and Roseneau (1974) later revised that estimate upwards to 300-500 pairs. Since then, it has been found that densities are higher in the northern foothills of the Brooks Range and in the Alaska Range than was previously thought. Based upon current knowledge, we now believe that between 375 and 635 pairs of Gyrfalcons nest in Alaska. This compares to an estimate of 700 to 800 breeding pairs in the neighbouring Yukon Territory (Bromley 1987; Mossop this volume).

Studies aimed at detecting long-term changes in the status of Alaska's Gyrfalcons have not been conducted. However, most of the Gyrfalcon's range in Alaska remains unaltered by man, and no factors significantly affecting their status have been identified. Exposure to organochlorine pesticides was limited, and reproduction was apparently never affected (Cade *et al.* 1971; Walker 1977). Harvest of Gyrfalcons by falconers is restricted to Alaska residents only, and the annual harvest has been fewer than ten nestlings. Exploration and development of petroleum and other resources have intruded into some Gyrfalcon nesting areas, but at least in some cases, this intrusion has benefited Gyrfalcons by providing nesting substrates. Gyrfalcons have been found nesting on a variety of man-made structures, including the trans-Alaska oil pipeline (Ritchie 1991), gold dredges, and sluice boxes (White and Roseneau 1970). Development is often accompanied by new roads, however, increasing access to remote areas. This increases the potential for disturbance of Gyrfalcons during the nesting season. Additionally, increased contact with humans may result in slightly greater mortality from shooting, trapping, collision with automobiles, etc. At this time, however, Gyrfalcon numbers in Alaska are presumably stable, and there have been no imminent threats identified.

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