

# Ecological Aspects of Distribution for Saker Falcons *Falco cherrug* and Altai Gyrfalcons *F. altaicus* in the Russian Altai

Valeri Moseikin and David H. Ellis

## ABSTRACT

In annual expeditions beginning in 1991, we found that during the nesting period, Altai Gyrfalcons *Falco altaicus* and Saker Falcons *F. cherrug* occupy divergent ecological niches and their ranges generally do not overlap. Altai Gyrfalcons were never seen in flat-steppe and forest-steppe biotopes, which are occupied only by Sakers. In mountain areas, Sakers occupy forest-steppe and semi-desert sites of the southern foothills of the mountains and montane steppe up to the zone of perennial snowfields. Nesting Altai Gyrfalcons are found in the zone of wet mountain taiga and adjoining areas of wet tundra and bogs, habitats which Sakers avoid. The only zone where Sakers and Altai Gyrfalcons meet is the area of cold, montane steppe (at elevations above 2000m), but the number of Sakers in this biotope is much higher than that of the Altai Gyrfalcons. Here there are even mixed pairs and individuals with mixed attributes (i.e. hybrids). In autumn, Sakers migrate from the high elevation nesting areas whereas most Altai Gyrfalcons remain in the Altai Mountains and winter under the severe conditions found there. We advance criteria for distinguishing Sakers and Altai Gyrfalcons.

## INTRODUCTION

In this paper, we explore the evidence for the existence and breeding of a large Gyrfalcon-like (*F. rusticolus*) bird in the mountains of Central Asia separate from the Saker populations that surround and inhabit the same mountains. Although several biologists have explored this questions over the course of nearly two centuries (beginning with Pallas 1811), none have convincingly shown that there is anything more than a clinal relationship

between the Sakers and the most Gyrfalcon-like birds inhabiting the region. A century ago, the experts on Asian falcons tried to distinguish not one but two separate species of Gyrfalcon-like birds (i.e. *F. lorentzi* and *F. altaicus*) from southern Siberia/Central Asia (Menzbier 1891, 1901; Sushkin 1938). However, the existence of an uninterrupted continuum in morphological traits from pure Sakers to the dark Gyrfalcon-like birds, all from the same region, led eventually to the conclusion that the Altai Gyrfalcon does not exist as a separate entity (Dementiev & Shagdarsuren 1964; Brown & Amadon 1968; Baumgart 1978). Even today many who are familiar with the large falcons of the Altai Mountains conclude either that the darkest birds are merely a dark colour morph of the Saker (Kuchin & Zubakina 2001) or that the darkest birds are Sakers but that a gray Gyrfalcon (with pale venter) also exists in the Altai Mountains (Moseikin 2001). We argue here that there is strong Gyrfalcon influence in both the gray Gyrfalcon-like birds and the darkest birds. The difficulty in understanding phylogeny is compounded by the likelihood, as advanced by Cade (1982), that Sakers and Gyrfalcons are sibling species, allopatric populations of the same species.

From two recent, detailed studies of museum specimens and a few live birds came several novel observations. First, that some of the birds identified as Altai Gyrfalcons were in fact true Gyrfalcons, early arrivals from the north (Ellis 1995). Second, that all of the most Gyrfalcon-like birds taken in the breeding season were not, as previously reported (Dementiev 1935; Stephnyan 1990), from a broad swathe of mountain habitat extending across most of Central Asia, but rather from a relatively restricted region including only the Altai (Altai herein refers to the Russian Altai Mountains to the exclusion of the Mongolian Altai and Gobi Altai further south) and neighboring Sayan Mountains (Ellis 1995). Third, these Gyrfalcon-like birds were not larger than the average Gyrfalcon as reported by Dementiev (1951:21) and Brown and Amadon (1968:840, 843) but rather within the range of linear measurements reported for eastern Saker populations, also inhabiting the Altai Mountain region (Ellis 1995). Fourth, after the most detailed morphometric study (including Gyrfalcons, Altai Gyrfalcons and western [*F. c. cherrug*] and eastern Saker Falcons [*F. c. milvipes*] for colour, wing and toe length, tarsal feathering, and many other features), Eastham (2000 unpubl. Eastham *et al.* 2001) found no morphological trait that separated the Altai Gyrfalcon from neighbouring Saker Falcon populations. Even a comparison of genetic material has been made (Siebold *et al.* 1993) with the surprising suggestion that the Saker has, in the prehistoric past, undergone a major hybridization event, not with the Gyrfalcon but with the Peregrine Falcon *F. peregrinus*.

## THE STUDY AREA

Our searches included portions of the Russian Altai Mountains lying within the Altai Republic (south-central Siberian Russia), Kazakhstan and Mongolia. Also adjacent forest-steppe and steppe habitats to the north and south of the Altai were searched. The Russian Altai are unique geographically and ecologically. This range divides the wet taiga of Siberia from the extensive steppes of Kazakhstan and Mongolia. Because it joins various phytogeographic

regions and consists of a huge massif rising to over 4000m, the Russian Altai has a wide variety of climatic regions. Some of these are very wet, both in summer and winter. Others (like the Great Mongolian Desert) lie in the “rain shadow” of the lofty peaks. With this broad array of weather patterns comes a great diversity of biota. Many forms of animals and plants are endemic to the Russian Altai, found nowhere else. For example, there is an endemic lynx, the largest race in the world. There was also an endemic tiger. The area not only serves as a cradle for speciation, it also acts as a barrier to gene flow between related species/subspecies such as the large falcons (as we propose) and between the Long-legged Buzzard *Buteo rufinus* to the west and the Upland Buzzard *B. hemilasius* to the east (Pfander 1994; Ellis *et al.* 1999). The area still acts as a refugium where arctic/subarctic species survive in isolation from larger distribution zones far to the north. There are relict populations of reindeer (*Rangifer tarandus*) and, more pertinent to the Gyrfalcon question, populations of Willow Ptarmigan *Lagopus lagopus* and Rock Ptarmigan *L. mutus*. The importance of this area as a bridge between biotic regions and a refugium for northern species can hardly be overstated. The Altai Gyrfalcon question gains importance because it appears to be another example of the accelerated evolutionary processes (hybridization and divergence) that characterize the region.

## METHODS

Low budget surveys for large falcons of the Altai Region began in 1991 (with a brief search of the central Altai), continued with field work on the Russian-Mongolian border in 1994, and focused in earnest on the Altai Gyrfalcon beginning in 1996. Expeditions continued through 2002. These expeditions were timed to gather data in all seasons and all habitat types, including the flat areas north and south of the Altai range as well as the ridges and valleys of the mountains.

During these surveys, we identified more than 400 free-flying falcons. Falcons confiscated from poachers, museum specimens, and live birds in breeding colonies were also examined. Finally, we gathered some information on the distribution of the colour morphs from local biologists and persons involved in forestry and hunting.

Fundamental to the delineation of habitat used by the Altai Gyrfalcon are criteria for the accurate separation of Sakers and Altai Gyrfalcons in the field. Moseikin (2000) introduces behavioural differences, but here we discuss five plumage characters that serve to separate dark Altai Gyrfalcons from all but the most confusing birds (*i.e.*, those that are believed to be natural hybrids). Our criteria are much like those presented by Pfander (1994), but differ from Ellis’s (1995) criteria by the exclusion of all red-barred birds (which we now believe to be hybrids [if head is dark] or Sakers [if head is pale]). For our purposes here and for purposes of molecular genetics and morphometric studies in the future, we also recommend the inclusion of pale-breasted, gray-backed birds (*e.g.*, Sushkin’s adult male: see photo in Ellis 1995) that are virtually identical to gray morph northern Gyrfalcons and which, although resembling gray *milvipes* Sakers, differ by having extensive gray flecking in pale zones on the dorsum

and especially on the tail. However, if the Altai Gyrfalcon did evolve into a dark gray-brown bird in a moist summer environment (Gloger's Rule), as we propose later in this paper, then, prior to the current era of hybridization with the Saker, it was probably monomorphic and such birds probably best represent the unique Altai Gyrfalcon type. Even if the Altai Gyrfalcon were not monomorphic (i.e., if, as we suspect, there were also a tundra/montane-steppe inhabiting, light gray morph like Sushkin's [1938] adult male and one of his daughters [Ellis 1995:18, Fig. C, F] and like gray Gyrfalcons from northern Siberia), our best chance for identifying unique features (morphometric, genetic, behavioural or ecological) would still come from comparing the most unique (i.e., dark gray brown) specimens with those Sakers not showing Gyrfalcon-like traits. Such dark Altai Gyrfalcons are distinguished as follows:

1. Dark adult Altai Gyrfalcons are extensively bluish gray, dark gray, or blackish gray above and below. Gray morph adult eastern Sakers have an extensive patch of pale bluish gray on the lower back and rump, but for dark adult Altai Gyrfalcons, the rump is dark blue-gray, blackish gray, or gray-brown and this color continues across the back and upper wing.
2. In the adult and juvenile Saker, the top of the head is consistently lighter than the back. For Altai Gyrfalcons, the top of the head is as dark as the back. Facial features (e.g., malar stripe, cheek, and superciliary line) are likewise broader for Altai Gyrfalcons than Sakers (Ellis 1995). Juveniles can also be separated by this trait.
3. The sides of the head of the adult Altai Gyrfalcon are dark, as dark as elsewhere on the dorsum. No Saker Falcons display this dark helmet. Juvenile Altai Gyrfalcons are not always so completely helmeted but, unlike Sakers, have dark streaks in the supercilium, cheek, and malar regions where even dark Sakers are very pale.
4. When viewed in the field from below, dark adult (and to a lesser degree juvenile) Altai Gyrfalcons have dark tails with pale bars often inconspicuous. Sakers have more translucent tails.
5. Dark Altai Gyrfalcons, and this trait once again excludes those that are pale below like gray Gyrfalcons, are heavily marked ventrally. Note: some adult Sakers are heavily streaked below with dark brown and many dark morph juvenile Sakers are mostly chocolate brown below. In juvenile Altai Gyrfalcons, however, the ventral dark marks consist of broad streaks with only the margins of the feathers pale, and in adult Altai Gyrfalcons the dark marks on flanks, legs, and undertail coverts become bold transverse bars. Sometimes these dark bars are so extensive that pale coloration is reduced to small buff spots.

When deciding the morph of a bird observed in the field, the first three criteria are considered diagnostic. Pfander (1994) claimed that the presence of dark bars on the undertail coverts was alone diagnostic of the Altai Gyrfalcon. While we believe he is correct, that dark Sakers often have a clear (i.e., unstreaked and unbarred) buff crissum, we are not yet sure that all Sakers far from the Altai region have unmarked undertail coverts.

During the nesting season, surveys were made on foot and from automobiles. Nesting pairs were identified as to morph and assigned one of

eight different habitat types: forest-steppe, dry steppe (or open steppe), desert, montane-taiga (a wet subalpine complex of spruce, larch and birch) with or without bogs, montane-steppe (cold steppe), and alpine-tundra with and without scree zones.

## RESULTS

In the Altai Mountain region, *F. c. cherrug*, the western race of the Saker, was found nesting in the open steppe and forest-steppe to the north and west. Altai Gyrfalcons have never been reported during the nesting season from these habitat types. This rule holds not only for our study, but it is also based on accounts in the literature and based on the unpublished work of local biologists. In the lower reaches of the Altai Mountains, only Sakers were found in the mountain valleys and exposed montane-steppe up to 1000m. On the southern (drier) slopes of the Russian Altai, montane-steppe continues up into the zone of perennial snow. In this open habitat, only the more heavily barred *F. c. milvipes* Sakers regularly breed. However, in the recent past Altai Gyrfalcons (at least those of the pale gray morph) have occasionally bred here.

It was in such habitat that Sushkin (1938) collected a breeding male, light morph Gyrfalcon (see photographs in Ellis 1995). This bird was very unlike the deep gray-brown birds that we consider to be most representative of the pure Altai Gyrfalcon type. The adult female escaped wounded, but judging by her five offspring, she was probably a "red-backed Saker" or a red-backed Saker x Altai Gyrfalcon hybrid. The male and three of his daughters are very significant to the question of Altai Gyrfalcon affinities, because they presented a link between *F. lorentzi*, *F. altaicus*, and *F. cherrug*. More specifically, the adult male and one of his daughters, when in adult plumage, look like gray morph Gyrfalcons from the north (i.e. like birds described as *F. lorentzi*). Another daughter, when adult, was intermediate between a gray morph northern Gyrfalcon and a dark Altai Gyrfalcon. The third daughter is red-backed and very like many eastern Sakers.

The primary habitats used by the dark Altai Gyrfalcon include the most elevated expanses of wet taiga between 1200 and 2000m, especially the ecotone joining taiga and wet tundra. Altai Gyrfalcons, although rare everywhere, appear most common in taiga mixed with grassy meadows where herbaceous cover, reaching 2-3m in height, is interspersed with scree. These zones form unique microclimatic islands of high precipitation in the western and northern Altai. We have never seen Sakers in such habitat. Another, somewhat similar habitat used by dark Altai Gyrfalcons is composed of high-mountain lakes and bogs bordered by taiga and with a dense understory of herbaceous and shrubby cover. In such areas, Altai Gyrfalcons are sometimes found perched within forest groves. Local biologists, who have worked in the area for decades, sometimes note that here the Altai Gyrfalcon occupies the habitat and perhaps the ecological niche of the Goshawk *Accipiter gentilis* and seems to have supplanted the Goshawk from such areas.

For our study, only five nests of Altai Gyrfalcons were available. All were located in small rocky outcrops located within forest groves, all more than a kilometre from forest openings in wet montane-taiga habitat. Dark Altai

Gyrfalcons appear never to occupy dry-steppe habitat, the most expansive biotope around the Altai Mountains south, east, and west. Although dry-open steppes and forest-steppes offer the advantage of large colonies of ground squirrels *Citellus erythrogenis* and *C. undullatus*, here only Sakers are frequent breeders.

There is one habitat type shared by both Sakers and Altai Gyrfalcons. In the south-eastern portion of the Russian Altai, there are areas of extensive cold steppe above 2000m. Here it is possible to find mixed pairs of Altai Gyrfalcons and Sakers. Here it is also normal to find birds with attributes of both morphs (i.e. presumably natural hybrids).

There are major differences between Altai Gyrfalcons and Sakers in migratory tendencies. Sakers by and large leave the Altai Mountains in winter. Altai Gyrfalcons (especially adults) by and large remain in the mountains despite the harsh Siberian winters and deep snows. For the month following fledging, young Sakers and Altai Gyrfalcons remain near the nesting areas, but between mid-August and mid-September most Sakers move out of the Altai Mountains onto open-steppe habitats. By early October, nearly all Sakers are gone from the lower mountains and, by 1 November, from higher elevations. Their departure coincides with the onset of ground squirrel hibernation (which occurs later at higher elevations) (Kuchin & Zubakina 2001). With the first cold snap, the Altai Gyrfalcons also move to wintering areas where their prey concentrates but still within the Altai Mountains.

October surveys yielded the following:

1. On flat steppes, neither Sakers nor Altai Gyrfalcons were found.
2. In 16 survey days in the Altai foothills and hilly steppes north of the Altai Mountains, we found 34 large falcons of which 14 were Sakers and 20 (60%) were Altai Gyrfalcons.
3. In the mountains of the Central Altai in eight survey days, we found nine Sakers and four Altai Gyrfalcons.
4. In the high mountains of the south-eastern Altai, in 22 survey days, we encountered 68 large falcons of which only 6 (9%) were Altai Gyrfalcons.

In winter, Altai Gyrfalcons are sometimes encountered where pigeons (Rock Dove *Columba livia* and Hill Pigeon *C. rupestris*) concentrate (i.e. in agricultural fields and near settlements in the northern, western and central Altai) (see Kuchin & Zubakina 2001). Such places are visited by the Altai Gyrfalcons primarily after periods of very rainy weather with low clouds and poor visibility. During such conditions, Altai Gyrfalcons sometimes attack domestic chickens and even domestic geese. When fair weather returns, the falcons disappear (presumably they return to the surrounding mountains). Our searches showed that in deep winter Altai Gyrfalcons concentrate near flocks of willow grouse and ptarmigan and at unfrozen lakes with sizeable waterfowl populations. In the Central Altai, it was possible each winter to observe Altai Gyrfalcons foraging in the nearly snow-free zones on the southern exposure of mountain ridges.

## CONCLUSIONS

With all the recent interest in the Altai Gyrfalcons and with so much pointing

to the conclusion that the Altai Gyrfalcon is merely a Saker Falcon (Cade 1982; Baumgart 2001) and that each supposed Altai Gyrfalcon morph has a corresponding Saker Falcon morph (Dementiev & Shagdarsuren 1964; Eastham 2000 unpubl.), why would any scientist continue insisting that the Altai Gyrfalcon is distinct? The answer to this question is the focus of this paper. Although we agree with Eastham's (2000 unpubl.) and even Dementiev's (Dementiev & Shagdarsuren 1964) final conclusions that the Altai Gyrfalcon grades smoothly along a continuum into the Saker, we point out the flaw in the logic that the "continuum observation" leads to a sole and sure conclusion that the Altai Gyrfalcon is not a distinguishable taxon (especially not a separate species). Considered carefully, the existence of an uninterrupted bridge between the Saker and Altai Gyrfalcon does not mean that the two ends of the bridge are not separable, even at the species level. Recall that the Gyrfalcon and the Saker are treated as species even though hybrids are fertile and all back crosses are fertile (Eastham 2000 unpubl.). It therefore should come as no surprise that the Gyrfalcon-like Altai Gyrfalcon is interfertile with the Saker and that hybrid offspring are intermediate. Having made this point, we quickly add that if the only consistent differences between the Saker and the Altai Gyrfalcon were general colour of the various morphs, we too would have long ago abandoned hope of trying to identify a separate Altai Gyrfalcon type. But, as this paper reveals, there are ecological/behavioural differences between the Altai Gyrfalcon and its Saker Falcon neighbours. The differences we present here are so striking that, if they hold true on further investigation, the logical conclusion will be not only that the Altai Gyrfalcon is a species separate from the Saker but also that Cade's (1982) supposition that the Gyrfalcon and Saker are allopatric populations of the same species is very much in question. In other words, it may be that the behavioural/ecological differences between the Altai Gyrfalcon and sympatric Sakers constitute the best evidence that the Saker and Gyrfalcon are truly separate species.

We admit that our persistence in pursuing ecological differences is derived in part from our impressions from observing and handling some of the Altai Gyrfalcon specimens. Simply put, there is a unique Gyrfalcon gestalt. From our experience observing hundreds of Sakers and some Altai Gyrfalcons in the wild and handling hundreds of specimens of Sakers and Gyrfalcons and lesser numbers of Altai Gyrfalcons in museums, we feel certain that some examples of the Altai Gyrfalcon (and we propose that such individuals are the ones least influenced by hybridization with the Saker) are so Gyrfalcon-like (dark flecking in pale zones and the bold flecked patterns of wing and tail barring are some of the most convincing traits) and so unlike Sakers from zones far from the Altai region, that we are left to conclude that, all morphometric evidence to the contrary, this bird is a Gyrfalcon. As you consider our observations about the ecology of the Altai Gyrfalcon and as you review published photographs of the Altai Gyrfalcon (e.g., Sushkin 1938; Ellis 1995), perhaps you will form this same conclusion, a conclusion long espoused by falconers (Dementiev 1933, 1951). Here we wish to acknowledge two authors who, despite all of the "continuum" evidence to the contrary, came to our same conclusion. Pfander (1994), after noting that Altai Gyrfalcon-like birds have been found mixed in

Saker populations at least as far south-west as the Tien Shan and as far north-east as the Minusinsk Depression (to the north-east of the Altai Region), still held to the conclusion that the most Gyrfalcon-like birds were separable from Sakers. Although Dementiev, who worked only with museum specimens, eventually abandoned the view that the Altai Gyrfalcon was distinct from the Saker (Dementiev & Shagdarsuren 1964), Sushkin, who worked with living birds, held, to the very end, the view that the Altai Gyrfalcon was not a Saker.

However, the Altai Gyrfalcon is vulnerable to genetic swamping because of its restricted range (and therefore small population size) and its close proximity to sizeable Saker populations. That the Altai Gyrfalcon exists today as a phenotypically distinct morph (i.e. that it has not long ago ceased to exist due to swamping by Saker populations on all sides) is evidence that it is different enough to warrant a separate, species-level taxonomic epithet. (See review of biological species concept and phylogenetic species concept in Eastham 1999.)

In answering the question, "What is the Altai Gyrfalcon?" we submit that it is most improbable that the Altai Gyrfalcon is merely the product of natural hybridization between Gyrfalcons and Sakers. If such were the case, we would expect that most Altai Gyrfalcons would look intermediate between Sakers and gray morph Gyrfalcons from northern Siberia. Instead, we find that the Altai Gyrfalcon has Gyrfalcon-like plumage features but the darkest birds look most like the Labrador Gyrfalcon *F. r. obsoletus*, found a hemisphere away. Various explanations for the existence of a Gyrfalcon-like bird in Central Asia have been offered (Ellis 1995, 1996). The most ecologically-meteorologically acceptable was that offered by Pfander (1994). He suggested that in an era of post-glacial warming, a relict population of Gyrfalcons was left isolated in the mountains of Central Asia. These birds persisted as other Gyrfalcon populations retreated northward. This relict population was also isolated from surrounding Saker populations by extensive forests. With further warming, these forests retreated into the mountains, and Sakers invaded the exposed, treeless slopes until they contacted the relict Gyrfalcons which, by then, had transformed (evolved) into a dark mountain form (Gloger's Rule), the Altai Gyrfalcon. We propose that the widespread "fixing" of alleles for dark gray plumage (not known to be evident in any Gyrfalcon population in northern Siberia) provides evidence that the separation between the Altai Gyrfalcon and the northern Gyrfalcon occurred thousands of years ago.

If the Altay-Sayan Region once held only Altai Gyrfalcons, what has changed of late to promote contact with and hybridization with the Saker? According to T. D. Modina (pers. comm.), warming of the Altai Mountains during the last 30 years has resulted in the altitudinal extension of woodlands 60m upward and 500-600m horizontally. Rains and winter temperatures have significantly increased and glaciers have extensively thawed with tundra habitat rapidly decreasing. Coincident with these climatic changes, Kuchin (1968) documented the expansion of Saker distribution northward into the Siberian steppes.

Our data on habitat use support the conclusion that the Altai Gyrfalcon is distinct from the Saker. The two species are largely allopatric within the Altai Mountains. Although some birds appear intermediate (probably hybrids) and

although some pairs appear to be mixed, our data so far indicate that mixed and hybrid pairs are found only in the zone of habitat overlap. There are still areas within the heart of the Altai Mountains where Sakers are excluded and only Altai Gyrfalcons persist. These are wet zones surrounded by drier and more open habitat occupied by Sakers.

These habitat/ecological distinctions can be identified as follows.

1. Saker breeding areas are always associated with treeless patches of steppe or desert. To support Sakers, such places must also have sizeable populations of small rodents; in the Altai Mountains these prey are mainly ground squirrels.
2. Altai Gyrfalcons, by contrast, are primarily associated with the upper reaches of wet mountain taiga, especially the forest-tundra ecotone. Such areas probably provide the physiological requirements of the Altai Gyrfalcon: namely, cool temperature, high humidity, and shady forest groves. Our observations lead us to believe that Sakers avoid such habitat. Although prey preferences of the Altai Gyrfalcon are still poorly known, we do know that birds (especially *Lagopus* sp.) and picas (*Ochotona alpina*) are important.

The differences in migratory tendency and winter habitat use place in doubt the conclusion by many recent writers that the Altai Gyrfalcon is merely a colour morph of the Saker (Cade 1982). This conclusion is excusable because of three factors. First, nowhere is there an adequate series of Altai Gyrfalcon specimens. Second, many of the museum specimens labelled as Altai Gyrfalcons are either intermediate (i.e. birds we believe are hybrids between Altai Gyrfalcons and Sakers) or Sakers or even Gyrfalcons (see Fig. 5 of Ellis 1995). Third, until this study, there was little or no ecological evidence for niche separation (summer or winter) between Sakers and Altai Gyrfalcons. With evidence derived from future food-habits studies, we expect clarification of our niche-separation theory and, if the data warrant, acceptance of a separate Altai Gyrfalcon taxonomic category.

Inasmuch as Altai Gyrfalcons and Sakers appear able to produce fertile hybrids in the wild and Gyrfalcons and Sakers are able to produce fertile hybrids in captivity (Eastham 2000 unpubl.), the whole group could be considered conspecific. But two facts argue strongly for recognition of the three taxa as sibling species within a *Falco rusticolus/altaicus/cherrug* superspecies. First, the Altai Gyrfalcon, a supposed intermediate between the Gyrfalcon and Saker, has persisted for centuries, and second, the most unique Altai Gyrfalcons occupy a foraging, breeding, and wintering niche largely separate from that of the Saker. If further study substantiates our claim that the Altai Gyrfalcon truly fills a niche separate from the Saker, the Altai Gyrfalcon merits a separate scientific name. Molecular genetics work will then be necessary to determine if the binomial, *F. altaicus*, or the trinomial *F. rusticolus altaicus* is more appropriate.

The present day ecological isolation of these dark Gyrfalcon-like birds suggests that the taxon has not lost its genetic identity and provides hope that it may not be too late to rescue the bird. However, following the collapse of the Soviet Union a decade ago, "legal" and illegal exploitation of populations of

large falcons across the range of the Saker and Gyrfalcon for Arab falconry has exceeded the sustainability of many wild populations. For example, the Saker population in Kazakhstan is believed to be less than 10% of its size ten years ago (Levin 2000). Even more ominous for the Altai Gyrfalcon, the glutting of falcon markets with large numbers of Sakers has caused a drop in Saker prices, but the price for the rare, dark Altai Gyrfalcon remains high. In the Middle East, a very dark bird, like many of the Altai Gyrfalcons, is called Sinjari and commands a price exceeding the lifetime salary of a wildlife agent in Central Asia. This condition is fuelling the selective removal of dark birds beyond that which has decimated Saker populations. R. Kenward (pers. comm.) stated that by November 1995 the dark falcons (referring to Altai Gyrfalcons) had been totally removed from Kazakhstan. That Mongolia and Russia are also allowing a harvest may spell doom for the species. During the last few years, there has been a selective effort to legally and illegally capture Altai Gyrfalcons from the Altai and Sayan Mountains. This harvest is so intensive that the complete disappearance of the Altai Gyrfalcon is not only probable, but very likely within the next 10 years. Unless this removal is stopped very quickly, extinction may result even before we have time to adequately investigate the ecology of the species.

## ACKNOWLEDGMENTS

We express gratitude to the Institute of Ecology (Russia) for logistical support, to the National Avian Research Center (UAE) for partial funding of field studies from 1996-2001, to the Russian branch of World Wildlife Fund (especially Mrs. N. Zubakina) for funding, to scientists of the Altai University (especially Professor A. Kuchin and Dr. N. Malkov) for endorsing our work, to Prof. A. Kuchin for providing unpublished data, and also to Victor Kaymin and Yuri Lukaynov, both of the Wildlife Service of the Altai Republic, for technical support. Preliminary fieldwork in Russia in 1991 was financed by the Institute for Raptor Studies (IRS). The work in Mongolia in 1994 was financed by USGS Patuxent Wildlife Research Center and the National Aeronautics and Space Administration. Fieldwork in 2002 was again supported in part by the IRS.

## REFERENCES

- BAUMGART, W. 1978. Über Gefiedermerkmale, Existenzbedingungen und Züge der Brutbiologie östlicher sakerfalken (*Falco cherrug milvipes*). *Mitt. Zool. Mus. Berl.*, Bd. 54, Suppl.:145-166.
- BAUMGART, W. 2001. Reflections on Kleinschmidt's raptor work. *Falco* 18:4-6.
- BROWN, L. & D. AMADON 1968. *Eagles, Hawks and Falcons of the World*. McGraw-Hill Book Co., New York, NY, USA.
- CADE, T. J. 1982. *The Falcons of the World*. Comstock/Cornell Univ. Press, Ithaca, NY, USA.
- DEMENTIEV, G. 1933. Le gerfaut d'Altai. Essai D'Une Monographie Systematique. *Alauda* 2:132-166.
- DEMENTIEV, G. 1935 [or 1933]. Systema avium rossicarum. I. Accipitres. *Oiseau Rev. Fr. Ornithol.* 3[1]:457-518 (466-467 [10-11] focus on the Altai Gyrfalcon)..
- DEMENTIEV, G. 1951. *Falcons (Gyrfalcons)*. [In Russian.] Moscow Soc. Exper. Scientists: Nature, Moscow, Russia.
- DEMENTIEV, G. & A. SHAGDARSUREN 1964. On the Mongolian Saker Falcon and the taxonomic position of the Altai Gyrfalcon. [In Russian.] *Arch. Zool. Mus. Univ. Moscow* 9:3-37.
- EASTHAM, C. 1999. Species concepts and their relevance to the taxonomy of the desert falcons. *Falco* 13:18-20.

- EASTHAM, C. P. 2000 unpubl.** Morphological studies of taxonomy of the Saker (*Falco cherrug*—Gray 1833) and closely allied species. *Ph.D. Dissertation*, University of Kent, Canterbury. 301pp.
- EASTHAM, C. P., M. K. NICHOLLS & N. C. FOX 2001.** Morphological variation of the Saker (*Falco cherrug*) and the implications for conservation. *Biodiversity and Conservation* 11: 305-325.
- ELLIS, D. H. 1995.** What is *Falco altaicus* Menzbier? *J. Raptor Res.* 29:15-25.
- ELLIS, D. H. 1996.** The Altay Falcon: origin, morphology, and distribution. Pages 143-168 in *Proc. 1995 Specialist Workshop, Middle East Falcon Research Group, Abu Dhabi, U.A.E.*
- ELLIS, D. H. N. WOFFINDEN, P. L. WHITLOCK & P. TSENTEG 1999.** Pronounced variation in tarsal and foot feathering in the Upland Buzzard (*Buteo hemilasius*) in Mongolia. *J. Raptor Res.* 33:323-325.
- KUCHIN, A. 1968.** Observations of the Siberian Saker at the headwaters of the Ob River. [In Russian.] *Ornithology* 9:103-108.
- KUCHIN, A. P. & N. A. ZUBAKINA 2001.** Saker Falcon in Altay and adjoining plains. In S. Banzragch, O. Shagdarsuren, D. Sumiya, S. Gombobaatar, N. Fox, E. Potapov, F. Launay, T. Shiirevdamba & D. Shijirmaa (Eds.) *Proc. II International Conference on the Saker Falcon and Houbara Bustard, Mongolia.*
- LEVIN, A. S 2000.** Problems of Saker Falcon conservation in Kazakhstan. *Falco* 16:8-9.
- MENZBIER, M. A. 1891 (1888-1893).** *Ornithologie du Turkestan et des pays adjacents (Partie No. -O. de la Mongolie, steppes Kirghiz, contree Aralo-Caspienne, partie superieure du bassin d'Oxus, Pamir).* Vol. 12. Publiee par l'Auteur, Moscow, Russia.
- MENZBIER, M. A. 1901.** [No title.] *Bull. Br. Ornithol. Club* 11:3-4.
- MOSEIKIN, V. 2000.** Saker Falcons of the Russian Altai. *Falco* 16:5-8.
- MOSEIKIN, V. 2001.** Altay Falcon: myth or reality? In S. Banzragch, O. Shagdarsuren, D. Sumiya, S. Gombobaatar, N. Fox, E. Potapov, F. Launay, T. Shiirevdamba & D. Shijirmaa (Eds.) *Proc. II International Conference on the Saker Falcon and Houbara Bustard, Mongolia.*
- PALLAS, P. 1811.** *Zoographia Rosso-Asaitica, sistens omnium animalium in extenso Imperio Rossico et adjacentibus maribus observatorum recensionem, domicilia, mores et descriptiones, anatomem atque icones plurimorum.* Academiae Scientiarum, Petropoli, Russia.
- PFANDER, P. V. 1994.** More [once again] about the Altai Gyrfalcon. *Selevinia* 2:5-9.
- SIEBOLD, I., A. J. HELBIG & M. WINK 1993.** Molecular systematics of falcons (Family Falconidae). *Naturwissenschaften* 80:87-90.
- STEPHNYAN, L. S. 1990.** *Conspectus of the Ornithological Fauna of the USSR.* [In Russian.] Nauka, Moscow, Russia.
- SUSHKIN, P. P. 1938.** *Birds of the Soviet Altai and Adjacent Parts of North-western Mongolia.* Vol. 1. [In Russian.] Academy of Science of USSR Press, Moscow, Russia.
- WINK, M. 1996.** Molecular phylogeny of the Saker (*Falco cherrug*) and other desert falcons. In *Proc. Specialist Workshop, Middle East Falcon Research Group, Abu Dhabi, UAE.*

Valeri Moseikin  
 Russian Bird Conservation Union  
 Poltavskaya 40-A,  
 Engels, 413121 Russia

David H. Ellis  
 USGS Southwest Biological Science Center  
 Sonoran Desert Field Station  
 HC 1 Box 4420  
 Oracle, AZ 85623  
 U.S.A.