

Past and Present Status of the Saker Falcon, *Falco cherrug* (Aves: Falconidae) in Bulgaria

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Abstract: Evidence for the presence of sakers in Bulgaria dates from 1500-3000 years ago. The first documented records of breeding sakers go back to the 13th century. We collected 337 breeding records of sakers in Bulgaria (1860-2013), comprising 176 locations (52 *Confirmed*, 16 *Probable* and 108 *Possible*). Our study suggests that in the 19th century the species was scarce and/or localised in its distribution range, with a declining population. The decline has continued through 20th and 21st Centuries. Recently, 94% of the total number of the known breeding locations were surveyed (N=165; including all *Probable* and *Confirmed* locations and 90% of the *Possible* locations). The survey covered 31,000 km² (c. 28% of Bulgarian territory) and revealed more than 33% of the known breeding populations of Long-legged Buzzard, Peregrine Falcon, Golden Eagle, Imperial Eagle and Egyptian Vulture. Only 3 sakers (single birds) were recorded in 2011, 2012 and 2013, with no further confirmation for the breeding. The last documented *Confirmed* breeding records were in 1997 (a successfully fledged young) and 1998 (the nest failed during the nestling period). The restoration of the saker breeding population requires an integrated approach, by operating at various scales from the landscape to the species level.

Key words: Saker Falcon, *Falco cherrug*, status, distribution, decline, restoration

Introduction

The Saker Falcon, *Falco cherrug* (hereafter saker) breeds over a wide distribution range across the Palaearctic from Central Europe to Eastern Asia. Throughout this large range, sakers are phenotypically polymorphic, exhibiting clinal variation from smaller, dorsally uniform individuals in the west to larger, dorsally barred individuals in the east, though no geographically distinct subspecies occur (EASTHAM *et al.* 2002) This clinal variation has further been demonstrated by genetic analysis

(NITTINGER *et al.* 2007). Over the last century, the breeding distribution range has become fragmented, especially in the west, as a consequence of wide scale population declines (DIXON *et al.* 2009). The saker is categorised as globally endangered in the IUCN Red List of Threatened Species, with an estimated global population of 6,400-15,400 (median 10,900) breeding pairs, which is thought to have declined by 2-75% (median 47%) over three generations to 2012 (BIRDLIFE INTERNATIONAL 2013). The wide range of

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values for these population estimates and trends reflects the fact that currently the most breeding sakers occur in extensive, remote and poorly surveyed regions of Central Asia, with only 1.9% to 4.4% (median 2.8%) of the global saker population breeding in the European Union countries. The majority of those sakers occur in Hungary (estimated at 241-245 breeding pairs in 2012; M. Prommer, personal communication). Bulgaria is one of the EU countries within the saker range, being located at the southwest boundary of the global breeding distribution range of the species. In the Bulgarian Red Data Book, the saker is categorised as Critically Endangered (DOMUSCHIEV *et al.* 2011).

Quantitative data and analysis of bird populations and their distribution is the scientific basis for setting priorities for conservation actions at a European scale (BIRDLIFE INTERNATIONAL 2004a). Knowledge of the size or density of a population is often a vital prerequisite to manage it effectively (SINCLAIR *et al.* 2006), whilst the population status is often used to gauge the success of conservation activities. The population estimates for sakers in Bulgaria are uncertain and no specific large scale surveys of the species were undertaken until recently. Even the recent specific saker surveys have provided a confused picture as to the true status of the species, partly because of the differing methodologies used to estimate the population size. Accurate information on population status and trends is essential to inform decision making processes for saker conservation in order to put the national priorities in a European context, to maximise the effectiveness of the national conservation measures (BIRDLIFE INTERNATIONAL 2004b), and contribute to a better understanding of the casual factors responsible for the decline of the species in Bulgaria.

Here we have undertaken a literature review in order to obtain the past population estimates and population trends for the saker in Bulgaria. Furthermore, we present results of the wide-scale targeted surveys undertaken over an 8-year period from 2006 till 2013 for ascertaining the present breeding status of the species in Bulgaria.

Methods

Literature review

We did a literature review of the published information related to the saker in Bulgaria, and established a database to comprise the data from museum specimens, published observations of the species and the unpublished records made directly from observers,

which include our own observations.

All the breeding season records in the database were classified according to three basic categories – *Possible*, *Probable* and *Confirmed* breeding (Table 1). This evidence scale is widely used in breeding bird atlases (*e.g.*, SHARROCK 1976, YEATMAN 1976, HAGEMEIJER, BLAIR 1997). We defined the breeding season of the saker as the period from March to June inclusive (CRAMP, SIMMONS 1980). July is a period of post-fledging dispersal of most young sakers in Europe; the satellite-tracked juveniles from nest sites in Hungary, Slovakia, Romania and Ukraine can disperse hundreds of kilometres away from their natal sites (see <http://sakerlife.mme.hu/intro.html>). We have also assessed the records of juveniles observed in July, which could potentially include locally-bred birds, not necessarily „recently-fledged young“, but still within their natal area during the post-fledging dependence period, which lasts *ca.* one and a half months after fledging (PROMMER *et al.* 2012). Consequently, we have classified all sightings of juveniles in July as *Possible* breeding. In cases where two adult birds were seen together in February or July they were considered as a sign of *Possible* breeding.

We delineated breeding locations as the area of a circle with a radius of 1.5 km. If two or more breeding locations partially overlapped they were considered to be one *breeding location* except in cases where two or more *Confirmed* breeding records were reported within overlapping breeding locations during the same year. Every breeding location was classified according to its highest categorisation: *Confirmed* > *Probable* > *Possible*.

We obtained a measure of the temporal increase in ornithological research activity in Bulgaria based on the number of ornithological publications per annum derived from reference lists in MIRKOV (2009), PATEV (1950), SIMEONOV (1990), IANKOV (2007) and GOLEMANSKI (2011). We quantified ornithological references in these publications dating from 1860 to 1959, then for each 20-year period we divided the number of saker breeding locations (*Confirmed*, *Probable* and *Possible*) identified in our literature search by the number of ornithological publications, to provide a „Reporting Index“ in relation to the level of ornithological activity in Bulgaria.

Field survey

During the literature review (1860-2013), we identified 176 breeding locations comprising 52 *Confirmed*, 16 *Probable* and 108 *Possible* breeding locations. The location of a further 9 breeding season records could not be identified.

Table 1. Codes used to define the breeding status of sakers in literature review and field surveys, following those adopted by the British Trust for Ornithology/ Irish Wildbird Conservancy (BTO/IWC) and European Ornithological Atlas Committee (EOAC)

BTO/IWC CODES	EOAC CODES
	Grade A 0 Observed in breeding season
Possible breeding Observed in breeding season in possible nesting habitat	Grade B 1 Observed in breeding season in possible nesting habitat 2 Breeding call heard in breeding season
Probable breeding S Breeding calls heard on more than one date in same place T Bird or pair apparently holding territory D Courtship and display; or agitated behaviour or anxiety calls from adults, suggesting probably presence of nest or young nearby N Visiting probable nest site	Grade C 3 Pair observed in breeding season in suitable nesting habitat 4 Permanent territory presumed through registration of territorial behaviour on at least two different days a week or more apart 5 Courtship and display 6 Visiting probable nest site 7 Agitated behaviour or anxiety calls from adults
Confirmed breeding UN Used nest found FL Recently fledged young ON Adult entering or leaving nest site in circumstances indicating occupied nest FY Adult with food for young NE Nest and eggs, or bird sitting and not disturbed, or eggshells found away from nest NY Nest with young	Grade C 11 Used nest or eggshells found 12 Recently fledged young 13 Adults entering or leaving nest-site in circumstances indicating occupied nest 14 Adult carrying food for young 15 Nest containing eggs 16 Nest with young seen or heard

Field surveys were conducted from March to July inclusive, in each year over the period 2006-2013. Targeted survey areas comprised: (i) *Confirmed*, *Probable* and *Possible* breeding locations; (ii) sites with recent observations and (iii) other apparently suitable breeding habitats (*i.e.*, habitats that appeared similar to those occupied in Croatia, Hungary, Moldova, Romania, Serbia, Ukraine and Turkey).

Field expeditions were carried out by 1 to 6 researchers and observations at potential nesting sites ranged from 1 to 14 hours. All observations were made using a telescope (SWAROVSKI STS 20-60X80 and LEICA APO-TELEVID 20-60X77) from a distance of >100 m to reduce potential disturbance. During observation we recorded the presence, behaviour and breeding status of other key species that share similar breeding habitats with sakers, *i.e.*, Long-legged Buzzard *Buteo rufinus*, Peregrine Falcon *Falco peregrinus*, Golden Eagle *Aquila chrysaetos*, Imperial Eagle *Aquila heliaca*, Egyptian

Vulture *Neophron percnopterus*, Raven *Corvus corax* and Black Stork *Ciconia nigra*. Furthermore, breeding sakers typically occupy the stick nests built by some of these species (CRAMP, SIMMONS 1980). Traces that large falcons leave when they inhabit given area (*e.g.*, “whitewash” mute stains on rocks) were also recorded.

Results

Literature review: status and distribution

Evidence for the presence of sakers in Bulgaria dates from 1500-3000 years ago, based on a femur found during excavations in Kabile, Central Bulgaria (BOEV, RIBAROV 1993). However, it is possible that this was from a captive falconry bird rather than a wild bird. The first documented records of breeding sakers date from the 13th century, when feudal lords established special restricted areas called „hatcheries“ to protect breeding birds of prey for use in falconry. One of

these hatcheries was a forest near Duganovo (Kapitan Petko Vojvoda, Yambol district) where many sakers were nesting (ARABADZHIEV 1962).

The first attempt at cataloguing the Bulgarian avifauna was made by FINSCH (1859), but he did not record sakers in his checklist. Nevertheless, sakers were reported shortly after in Dobrudzha, within the present day provinces of Dobrich and Silistra in north-eastern Bulgaria. Simpson described how a female was shot off its nest near the Danube River in April 1860, but as this was the only pair he saw during a fortnight of hunting and collecting in southern Dobrudzha, he concluded that the species was rare (SIMMONS 1860, 1861). This contrasted with the situation in Dobrudzha, part of it within present-day Romania, where in some localities the saker was regarded as a common bird (ELWES, BUCKLEY 1870, SINTENIS 1877). By the early 20th century, sakers were still considered to be abundant in northern Dobrudzha, particularly in the Danube Delta and surrounding hill forests (LODGE 1908, FLOERICKE 1918, KIRKE SWANN, MCNEILE 1925).

In the 19th century, sakers were also found south of Dobrudzha, in the present-day provinces of Ruse, Razgrad, Shumen and Varna, where it was considered to be „by no means a very rare bird“ (FARMAN 1868). However, the saker was not documented in northern Bulgaria by RADAKOFF (1879), who, during the war between Russia and Turkey (1877-1878), made observations of birds from the Danube River to the northern foothills of the Central Balkans in the present day provinces of Ruse, Pleven, Veliko Turnovo, Turgovishte, and Razgrad. Sakers were recorded neither among the species observed in the Sofia region (ANDERSEN 1903, 1905), nor in the list of the Bulgarian birds produced by HARRISON, PATEFF (1933). This status of rarity was supported by PATEV (1950) in his book „The Birds of Bulgaria“, in which no nest or breeding season record was reported as a result of 30 years of fieldwork to 1950. The species was consequently regarded primarily as a passage migrant and winter visitor to Bulgaria (MOUNTFORD, FERGUSON-LEES 1961), though birds were reported from the Baltata Forest in Dobrich province, and were found breeding in Dobrudzha (PETROV, ZLATANOV 1955).

Ornithological activity in Bulgaria increased over the century from 1860-1959, though the number of the publications decreased during the war periods in 1914-1918 and 1939-1945. Over the same time period, saker breeding records were reported by various authors (FARMAN 1868, ELWES, BUCKLEY 1870, LORENZ-LIBURNAU 1893, REISER 1894, PATEV 1950, PETROV, ZLATANOV 1955, PASPALLEVA-ANTONOVA 1961,

1964, PROSTOV 1964, BAUMGART 1966, ARABADZHIEV 1976) as well as in the collections of the National Museum of Natural History. The number of records decreased despite the increase in the ornithological activity. Consequently, the „Reporting Index“ for breeding sakers exhibited a marked decline over the period 1860-1959 (Fig. 1). The distribution of the breeding records during that time was concentrated mainly in the Dobrudzha Plain, Ludogorie Plateau and the Danube River, with some others in the Thracian Plain and foothills of the Eastern Balkan Mountains (Fig. 2).

In the 1960s breeding sakers were discovered in the Balkan Mountains as well as in other parts of the country (BAUMGART 1966, 1971). At the beginning of the 1970s, the population size was believed to be *c.* 30 pairs (no more than 50 pairs), located mainly in low mountains and highlands (BAUMGART 1977, 1991), but by the mid-1980s it was believed that the numbers in Bulgaria had declined to less than 15 breeding pairs (MICHEV 1985). However, the coverage of the country and knowledge of the diurnal birds of prey was poor (MICHEV 1982). By 2004, the consensus among the specialists on raptors in Bulgaria was that the saker population had further declined and numbered 4-12 breeding pairs (NANKINOV *et al.* 2004, NAGY, DEMETER 2006). However, these may have been optimistic assessments since in 2002-2004, a national saker survey, undertaken as a part of a conservation project by the Birds of Prey Protection Society (BPPS), found no breeding pairs (BPPS *in litt.*). The early years of the 21st century marked an increase in the ornithological survey activity in Bulgaria with the designation and monitoring of NATURA 2000 sites (KOSTADINOVA, MIHAYLOV 2002, KOSTADINOVA, GRAMATIKOV 2007), the preparation of the Red Data Book (GOLEMANSKI 2011) and the Atlas of Breeding Birds in Bulgaria

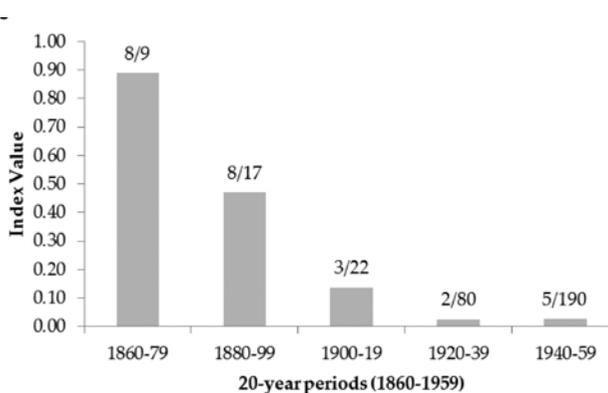


Fig. 1. Reporting Index of breeding sakers in Bulgaria. Values above columns are the number of breeding locations/ number of ornithological publications



Fig. 2. Distribution of the saker breeding locations in Bulgaria. ■ = 1860-1959, ▲ = 1960-1999. *Confirmed* breeding = filled symbols, *Probable* breeding = open symbols. Data obtained from FARMAN 1868, REISER 1894, LORENZ-LIBURNAU 1893, ARABADZHIEV 1976, BAUMGART 1966, PETROV, ZLATANOV 1955, UNDZHIAN, BRAUN 1984, DZHUNINSKI 1980, ROBEL *ET AL.* 1978, STOYANOV 2001, ERNST 1978, BAUMGART 1971, SIMEONOV 1986, KONIGSTEDT, ROBEL 1977, PETROV 1981, PETROV 1980, SHURULINKOV *et al.* 2003, STOYCHEV *et al.* 2008, MILCHEV 2007, GEORGIEV 1993, DONCHEV 1977, STOYANOV *et al.* 2001, MICHEV, PETROV 1995, PROFIROV, NYAGOLOV 1984; and authors' unpublished records and records made by various researchers: T. MICHEV, P. RACHEV, V. KOYCHEV, M. PASPALLEVA, H. HRISTOV, C. PETROV, I. VATEV, I. ANGELOV, L. PROFIROV, B. BORISOV and Z. SPIRIDONOV

(IANKOV 2007). Since 2006, the Bulgarian Society for the Protection of Birds (BSPB) has implemented surveys and targeted conservation effort for the saker (SPASOV *et al.* 2012), yet despite this increased activity no saker nest has been found (IANKOV, GRADARINOV 2012). The last documented successful breeding record was in 1997 when a pair successfully raised two chicks in the Western Balkan Mountains (STOYANOV 2001). The nest was robbed by poachers, but they were trapped by the police and one of the nestlings was returned to the nest and successfully fledged (*per.* D. DOMUSCHIEV). In 1998, a pair in the Central Balkan Mountains produced chicks but they later disappeared (*per.* D. DOMUSCHIEV).

In total, we collated 337 breeding records of sakers in Bulgaria, comprising 52 *Confirmed*, 16 *Probable* and 108 *Possible* locations. For the period 1960-1999, we located records of 35 *Confirmed* and 14 *Probable* breeding locations (Fig. 2).

Field surveys 2006-2013

We recorded 176 saker locations during the breeding season for the period 1860-2013. Of these, 68 were *Confirmed* and *Probable* locations, and all of them were surveyed, whilst 108 were classified as *Possible* locations and 97 (90%) of them were surveyed. The total area surveyed was 31,000 km² (*c.*

28% of Bulgarian territory; Fig. 3), but only three single sakers were recorded during these surveys without any further confirmation for breeding.

During the survey work, we found 239 breeding sites of Long-legged Buzzard, 60 of Peregrine Falcon, 66 of Golden Eagle, 23 of Imperial Eagle and 27 of Egyptian Vulture. Nests were discovered at most of these sites (N=238), but some were categorised as *Probable* breeding records (N=177).

Discussion

Past population status

There has been neither a nationwide survey of sakers in Bulgaria, nor any systematic sample survey to provide a statistically robust population estimate based on extrapolation and/or modelling. All saker population estimates for Bulgaria are based on expert opinions with varying levels of evidential support (*e.g.*, BAUMGART 1977, MICHEV 1985, MICHEV, PETROV 1985, STOYANOV, KOUZMANOV 1998, NANKINOV *et al.* 2004, IANKOV 2007, DOMUSCHIEV *et al.* 2011). Consequently, there has always been some degree of uncertainty over the population status of sakers in Bulgaria, but this uncertainty has now become a matter of controversy in relation to deter-



Fig. 3. Areas surveyed during the period 2006-2013

mining the most appropriate measures for the conservation of the species (RAGYOV *et al.* 2010, IANKOV, GRADARINOV 2012).

The absence of the saker in the first catalogue of Bulgarian birds (FINSCH 1859) suggests that the species was scarce and/or localised in its distribution in the 19th century. Contemporary records suggest that the sakers bred in northeast Bulgaria in the provinces of Dobrich, Silistra, Ruse, Razgrad, Shumen, and Varna, where they were found in open, undulating landscapes with occasional trees (FARMAN 1868, REISER 1894), and they continued to breed in Dobrudzha at least until the 1950s (PETROV, ZLATANOV 1955). Nevertheless, despite the increase in the ornithological activity in Bulgaria over the century (1860-1959), the Reporting Index of breeding sakers declined, suggesting that the number of the breeding sakers also declined. This period witnessed major changes in the Bulgarian landscape through the drainage of wetlands, conversion of steppe to agricultural land, intensification of agricultural practices and increased development of human settlements and their associated infrastructure (BOEV, MICHEV 1982). Such changes are likely to have had a detrimental impact on sakers and their prey, whilst a more direct threat to the species resulted from direct persecution and the introduction of chemical pesticides in the 20th century (MICHEV 1982, BOEV 1990).

The discovery of breeding sakers in the 1960s in the previously poorly covered uplands of the Central Balkans led to the first quantitative assessment of the Bulgarian breeding population of

c. 30 pairs, with a maximum of 50 breeding pairs (BAUMGART 1977). By the 1980s it was believed that the number of breeding pairs had halved (MICHEV 1985). Elsewhere in Europe, declining saker populations, such as in Hungary from 1940 to 1980, were also recorded. The causes of this were postulated to be the low breeding productivity arising from nest robbery, nest collapse and recreational disturbance, combined with the high mortality due to persecution and electrocution (TAPFER 1968, BAGYURA *et al.* 2004).

The impact of organochlorine pesticides on sakers is not well documented, but population declines were reported in Peregrines in Eastern Europe from the mid-1950s through to the 1970s (SIELICKI, MIZERA 2009). In Bulgaria DDT was used regularly in the period 1950-1965. Other organochlorine pesticides, such as Aldrin, Dieldrin, Heptaclor and Toxaphene were imported and used in the early 1960s. The use of DDT, Aldrin and Dieldrin was banned in 1969, Toxaphene was banned in 1985 but Heptaclor was used up to 1991 (MOEW 2006). However, DDT was exceptionally used again in the period 1969-1980 in the control of malaria disease (MOEW, BRCEEP 2005). Obsolete pesticides of the types mentioned above were still found in storage places in various parts of the country up to 2000 (MOEW 2012).

In the 1970s there was a resurgence of falconry in Europe, which was accompanied by an increased demand for falcons (ROCKENBAUCH 2002). Falcons were needed not just for falconry but to stock the newly established breeding centres that were being created to meet the demand for falcons from European

falconers. The 1970s and 1980s saw sakers and peregrines being taken from many nests in central and eastern Europe (SCHEGLMANN 1983), which reduced the breeding success of wild populations that had already been badly affected by pesticides.

The loss of the saker as a breeding species in Bulgaria in the late 20th century has been attributed to the low breeding productivity caused by nest robbery, together with some factors affecting the breeding habitats and nest sites (IANKOV, GRADARINOV 2012). In the 1990s major political and social changes took place in Bulgaria resulting in a period of economic instability combined with lax enforcement of conservation legislation. This led to an increase in the illegal, commercial exploitation of wild sakers (RUSKOV 1995, 1998, STOYANOV 2001). The socio-economic changes of the 1990s also caused a decline in the crop and livestock production. Large areas of pastures were abandoned and intrusion of shrubs and trees into the grassland took place (BACHEV 2008a, BACHEV 2008b, LERMAN 2000), thus reducing the habitats suitable for saker. Pastoralism further decreased recently with more pasture areas transformed into cultivated land, and the application of chemicals expanded with 68% (BACHEV 2008c, ILIEVA 2006). These changes impacted on the favoured prey species of the saker, such as the European Sousek *Spermophilus citellus* (KOSHEV 2008).

Present population status

Our field surveys recorded three single sakers – one bird in the Sredna Gora Mountains (central Bulgaria) in 2011, a second in the Ihtiman Valley (southwest Bulgaria) in 2012, and a third in the Sakar Mountains (southeast Bulgaria) in 2013. We received incidental reports of the species from other researchers during the breeding season (2006-2013) as well. In total, we obtained 52 records from 39 localities and all of them were observations of single birds. Based on the national population estimates in IANKOV (2007), we found 33-37% of the Long-legged Buzzard breeding population, 33-50% of Bulgarian Peregrines, 39-44% of Golden Eagles, 77-92% of Imperial Eagles and 34-68% of Egyptian Vultures during the field surveys. Consequently, we would have expected to have found at least 30% of the Bulgarian saker population, especially since our surveys were targeted at known former sites, suggesting that very few, if any pairs, currently breed in Bulgaria.

Independently, BSPB reported additional records of sakers during the breeding season in the

period 2006-2010 (N=186; IANKOV, GRADARINOV 2012). IANKOV, GRADINAROV (2012) reported that a nest with young was found in the Central Balkan Mountains in 2006. However, this record of an active nest has been since discounted (IANKOV *et al.* 2013, DOMUSCHIEV *et al.* 2011), and the best evidence of breeding during the period 2006-2010 was of two instances where juvenile sakers were seen after the nesting season in areas where adult birds were earlier observed carrying prey (IANKOV, GRADINAROV 2012). However, it is not clear whether these juveniles were recently fledged young (FL/12; Table 1) or if the adults were carrying food for young (FY/14; Table 1). IANKOV (2010) noted that there were a further nine observations of birds carrying prey in the Danubian Plain and the Balkan Mountains during the period 2006-2010; these records were considered to constitute evidence of *Confirmed* breeding by assuming that the prey was being delivered to dependent young (FY/14; Table 1). These records together with 33 *Probable* (based on observations of display and presumption of permanently occupied breeding territories) and 49 *Possible* breeding records resulted in an estimate of at least 6-9 sakers breeding pairs in Bulgaria each year from 2006-2010 (IANKOV, GRADINAROV 2012).

Whether or not the last saker nesting attempt in Bulgaria occurred in 1998 or 2006 is an academic and relatively trivial point, but the issue as to whether or not the saker is extinct as a breeding bird has become contentious and is of relevance to identify the conservation measures required to re-establish the saker as a regular breeding species in Bulgaria (RAGYOV *et al.* 2010, IANKOV, GRADINAROV 2012). Whilst there is consensus that restoration of the saker breeding population requires an integrated approach operating at various scales from the landscape to the species level, there is a difference in opinions on how this restoration can be achieved (IANKOV, GRADINAROV 2012, RAGYOV *et al.* 2012).

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