

Biology of alpine accentor IX. Overview of the breeding distribution of the Alpine Accentor (*Prunella collaris*) in the West Carpathians, 1980 – 2023.

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Motto k tejto práci, venované J. Flouskovi:

Mail zo 16.8.2021, od Jirku Flouska, znalca nielen krkonošského vtáctva a bývalého námestníka riaditeľa KRNAPu, ktorý od 14. 11. 2022 nie je medzi nami:

Ahoj Mariáne,

zastavil jsem se na otočku v práci a našel tu Tvoji učebnici. Díky moc za ni. Takže teď už Ti zbývá "jen" monografie o pěvušce podhorní. Srdečně zdravím a přeji pěkné dny,

Jirka

Moja dnešná odpoveď: Jirka budem sa snažiť, zatiaľ len články. Prosím dozri z neba na mňa.

Motto for this study, dedicated to J. Flousek:

Mail from August 16, 2021, from Jirka Flousek, an expert not only on Giant Mountains birds and former deputy director of KRNAP, who has not been with us since November 14, 2022:

Hi Marian,

I was at work and found your textbook. Much appreciated. Now there is "only" one monograph left for you on the Alpine Accentor.

Regards and have a nice day,

Jirka

My answer today: Jirka, I will have a try, for the time being only articles. Please watch over me from heaven.

Abstract. This study summarises the occurrence of Alpine Accentor (*Prunella collaris*) in the Western Carpathians during breeding seasons between

1980 and 2023. At the beginning of breeding season, there are about 390 adult individuals in the Belianske and Central Tatras, about 80 individuals in the Western Tatras, 60 individuals in the Low Tatras and about 15 individuals in the other mountain ranges of the Western Carpathians. Altogether, this constitutes approximately 550 breeding adults in the Polish/Slovakian Western Carpathians, forming polygynandrous families. This estimate of 550 individuals in the Western Carpathians is closer to the maximum than to the minimum interval. Important positive factors limiting the occurrence of this species in the breeding season include: the low-growing alpine meadow vegetation, the persistent snow fields in the high mountain valleys, and the relatively small number of predators in this environment. Synanthropisation is the most notable negative factor affecting this population over the last 100-200 years, which, especially nowadays, affects a relatively high percentage of breeding individuals. The reduction of nesting in the lower satellite mountains of the High and Low Tatras, such as Malá Fatra, Veľká Fatra, Babia hora and others, in comparison with earlier times, indicates a declining trend in the occurrence of these birds in Slovakia and Poland.

Key words: *Prunella collaris*, breeding atlas 1980 – 2023, the West Carpathians

Introduction

In the Western Carpathians, *Prunella collaris* is a paleo-montane species in the northern part of its European range, and its abundance can vary greatly from year to year due to different climatic conditions. A decrease in abundance in extremely unfavourable years, inevitably compensated by an increase in favourable breeding years, was described as early as the 19th century (Kocyan in Kocian 1998).

Local territory size of Alpine Accentor families can vary and may also depend on geomorphology of a particular mountain range - for example, estimated sizes in the Alps were 8 ha (Heer 1996), in the Pyrenees 18 ha (Davies *et al.* 1995) and in the Japanese mountains 22 ha (Nakamura 1995). Group home range size is influenced by several factors, including intensity of aggressive interactions with neighbouring groups, and habitat structure. The size of the family itself plays a minor role (Davies *et al.* 1995, Nakamura 1995, Heer 1996).

Females also establish individual, exclusive territories within the area used by the group. However, this is limited to nesting. The size of a female's individual territory is usually much smaller than that of a male. It is usually restricted to the vicinity of the nest - typically 0.5-5 ha (cf. Pikula 1958). In areas where Alpine Accentors are less abundant, the size of females' territories, that is, the distance between nests of the same family, may be much larger (Davies *et al.* 1995). (Davies *et al.* 1995, Nakamura 1995, 1998a, b, Heer 1996, 2013). Under good foraging conditions, adults tend to feed near the nest. However, under poor conditions, they may expand their search (Dyrz 1976, Davies *et al.* 1995). This means that even in summer, when ornithologists studying avifauna observe only singing males or females, they can observe uncorrelated, higher numbers of Alpine Accentors in the mountains than their actual status.

The High Tatras including Belanské Tatras

One of the first records of the accentor in the West Carpathians comes from 1850 (Wodzicki 1851, 1853). Domaniewski (1915) in Klíma (1959) mentions that the species winter in the dwarf pine zone. In October 1920, birds were recorded by Janda (1921) in the Mengusovská valley. In the 1930s, Baum (1937) observed them in the Tatras during the June breeding season at Hincove Pleso, Velká Studená dolina, Ohniska, Pät Spišských Plies, Zbojnické Pleso, and Dlhé Pleso. The first nest found and documented was likely in 1952, when an egg was collected by Z. Kluz on June 18th, 1952 (Sitko 1991). Balát *et al.* (1955) consider the species to be common in the Tatra Mountains. In 1952 they documented localities such as Muráň, Nový, Litvorove pleso, or the valley above Zelené pleso. One of the most systematic ornithological studies in the 1950s was carried out in the Tatras by Klíma (1959). According to this author, Alpine Accentors nest in all suitable habitats between 1800 and 2400m, and in the Western and Belanské Tatras, they also nest at lower altitudes. Klíma (1959) queries how many birds migrate further in autumn and how many stay in the Tatras and their vicinity. He documents that, in the 1950s, birds in the Central Tatras were already descending to lower altitudes at the beginning of October. In 1956 and 1958, the Belianske Tatras were a place where, among several species, *Prunella collaris* was found to be the most abundant in the alpine vegetation zone. Alpine Accentors nested in the Dolina siedmich prameňov (Valley of seven springs) as well as west of the Skalné vráta (1520 m - Klíma 1959, Pikula 1962). In the 1950s, Ferianc and Feriancová (1956a, b) observed individuals on the Žltá stena (Yellow Wall) and synanthropic specimen at the Zbojnická and Téry chalets. Pikula (1956, 1958) reported them in the second half of July 1955 on Havran, Bujačí vrch, Skalné vráta, and Holubyho dol. He described numerous birds on both the southern and northern slopes of the ridge. In 1959, four birds were observed on Bujačí vrch on the 29th of June, as well as on the top of Jatky on the 6th of August 1959, a female fed her fledged young (Kozák 1960). At Bujačí vrch they were also re-

corded by Mošanský (1978) on July 21st, 1960, but he also remembers them from Červené vrchy in the 1950s. The records from the southern slope of Kriváň are also remarkable: on August 24th, 1970 Hubálek (1974) observed 10 birds, two of which were juveniles, and on July 7th, 1972 Hudec (1974) writes of eight birds, recording the feeding of the fledglings. Alpine Accentors are now the subject of many monographs on the Tatra Mountains and are the subject of extensive ecological research at the Institute of High Mountain Biology at the University of Žilina under the direction of the author of this study.

The West Tatras

The forester Anton Kocyan did meritorious work toward knowledge of West Tatras birds in the 1880s (Kocian 2010). Alpine Accentors were recorded by Kocyan in the Western Tatras as early as the 1850 - 1880s (Kocian 1998). Kocyan (1884) found young birds that had just left the nest in Osobitá on July 26th and pre-hatched eggs on July 22nd, 1884. All this suggests that even in the past, when winters were much colder, birds still only nested once, and the breeding season being during the warmest months of the year. While the species used to feed around foresters' huts and sheep pastures (Kocyan 1884), today it is increasingly synanthropised with garbage left by tourists near high peaks and huts. The mountains have changed enormously in the last two hundred years due to human influence. (Janiga 2022). In the 1920s the Alpine Accentor was reported in the Western Tatras - Roháče by A. Kocian (in Karaska *et al.* 2014). At that time, the species was also mentioned by Melichar (1929). In the 1950s, Gaisler *et al.* (1954) documented sufficient abundance and feeding of chicks at Volovec, claiming that after July 10th the Alpine Accentor no longer sings, but feeds its young. On October 3rd, 1960, Štollmann (1995) reported that an adult female had been shot from Roháče. In 1964, nesting was confirmed between Biela skala and Sivý vrch (Bohačík 1995), from Ostrý Roháč, Hudec reported three individuals on July 5th, 1972, and in the early 1980s birds were reported from Roháče (Kocian *et al.* 1985). Later, Harvančík (1987) confirmed nesting on Sivý vrch. The year 1993 was a good year for early nesting of some families, when, for example, I saw a feeding female and a male with two fledglings on the summit of Baníkov as early as the 24th of May. At the beginning of this century, Michalec described breeding along the whole of the ridge from Sivý vrch to Ostrý Roháč, with confirmation of nests at Sivý vrch (July 12th, 2006) and Baníkov (July 4th, 2005) - in Karaska *et al.* (2014). The species was also reported in the Western Tatras by Topercer (2015), and is an important subject of research at the Institute of High Mountain Biology, University of Žilina

The Low Tatras

In 1953, the Alpine Accentor was quite common on the whole of the Low Tatras ridge, and its occurrence was confirmed on Poľana, Dereše, Bôr, Chopok, Ďumbier, and Kráľova hoľa, as well as

in Orlová (Hanzák 1954, 1956). On the ridge of Králova hoľa, it was observed to be more numerous than it is today, and it can be assumed that there was intensive grazing at that time, which was undoubtedly one of the reasons for the shorter grass. The author describes the species as abundant on the Chopok summit, and it has been proven to nest on Králova hoľa. At Králova hoľa, birds were also observed on May 25th, 1972 (Mošanský 1978, 1979). Ferianc (1979) mentions in his monograph that the birds breed in the Low Tatras, but (Feriancová - Masárová 1968, 1978) doesn't mention them in her studies from Chabenec, where important families of these birds fly today. As of July 1989, the accentors were observed from Ďumbier ridge to Chopok, as well as from Skalka, but they have not been observed on Králova hoľa (Kropil 1990). Repeated monitoring confirms to the author of this study that local families of accentors from the Králova hoľa massif are in a definite decline. Breeding shifts from annual to sporadic in some years, and the species is disappearing from the area.

Malá Fatra

One of first records of this species in nesting season is recorded in an unpublished report by A. Kocian in 1929 (Karaska *et al.* 2014). Nesting of the Alpine Accentor in Malá Fatra is likely continuous, or at least has been observed since the first third of the 20th century, when Černý (1946) heard Alpine Accentors singing on the ridges of Malá Fatra on July 2nd, 1931. At Rozsutec, a density of about 10 Alpine Accentors per 100 ha in the alpine vegetation zone was published by Randík (1981). The survey was carried out in the spring-summer period. Even at that time (1960-1970), it is unlikely that more than two families of birds were present in the Malá Fatra National Park. Štollmann (1962, 1970, 1995) reports an adult female shot near Rozsutec on September 6th, 1961. A relevant breeding record could include one from the end of June 1964 (Černý *et al.* 1971/72), when more accentors were noticed on the eastern slopes of Hromové. Birds were also observed on the ridges in the last decade of May 1969 (Sládek 1970). Boháčik (1974) found a nest below Chleb where the birds have long been known to be synanthropic in their movements around mountain chalets. Accentors were also observed around Biele Skaly to Stratenec on June 12th, 1981 (Janík 1985), as well as in Rozsutec by Darola (1972). From Malá Fatra, the birds were also reported by Ferianc (1979). Nowadays, the birds can be seen migrating on the ridge of Veľký Fatranský Kriváň or Chleb every spring, but permanent breeding occurs only on Rozsutec. In the 1970's and 1990's continuous breeding by this species at Rozsutec was also confirmed by Topercer (1998). The number of adults on Rozsutec has likely decreased over time. For example, in 2007, there was a family of two males and one female, whereas in 2017, only one pair raising two juveniles was observed. Juveniles used to dig out rubbish left behind by tourists on the top of Rozsutec (see photo in Janiga 2022). The small breeding group in Malá Fatra is the closest

to the previously stable and northernmost European local breeding population of Alpine Accentors in the Krkonoše mountains (Czech Republic). Between 2012 and 2014, the number of breeding individuals in this location was estimated at 20-30, but it is expected to decrease by 20% in the current period, and by as much as 40% in the worst case scenario (Flousek *et al.* 2015). To date, this species nests permanently in the Krkonoše (Giant) Mountains, but its breeding population has probably been reduced to two families, one nesting at Sněžka and the other at Sněžné Jámy. The total population can be estimated at 10 individuals at the beginning of nesting (Jasso 2019).

Veľká Fatra

The breeding range of *Prunella collaris* in the Slovak mountains may have been wider during pastoral times. The extinct breeding reported on Salatin in the Low Tatras (Krištín in litt.) is probably connected with this. In Veľká Fatra, this species was recorded on Krížna, on July 4th, 1930, by Černý (1946). This means that the Alpine Accentor has been known to this mountain range since at least the first third of the 20th century. Ferianc (1979) and Kupcová and Boháčik (1980) also mention Veľká Fatra as a place where the birds occur. During the 1986-1988 breeding season, Saniga (1989) observed them on the top of Suchý vrch. According to published densities, this was probably a single family. Later, he confirmed them to originate from Suchý vrch. He also described their spring occurrence from Borišov (Saniga 1993, 1996). More recently, four freshly fledged chicks with two parents were recorded on Suchý vrch by Dobrota (in litt.), on June 13th, 2000. This atlas also includes his data. Saniga (in litt.) reports the following from the site: „The year 2000 - Spring came early and there was no snow on the mountains until the end of April. Already on the 10th of April I had wallcreepers (*Tichodroma muraria*) at three nesting sites! This is one of the earliest arrivals I've seen in over 40 years, and they mated as early as 20 April, which is another record!“. Currently, the site is increasingly becoming a place where the Alpine Accentor does not consistently breed every year. This is likely to depend on other factors such as the change in the height of the grass in late summer, the return of winter, and in particular, the snow cover in the second half of April or May and the associated activity of predators.

Choč

Choč, as a kind of transition zone between Malá Fatra and the Western Tatras, is also mentioned as a nesting site (e.g., Kupcová 1981). This is likely because past and present ornithologists make their standard surveys of nesting birds in May. They automatically consider the singing male Alpine Accentor as a nesting site. Evidence of a nest or fledglings is unlikely. Occurrences on clear days in midwinter are common on the Choč, and wintering and migrating Alpine Accentors will be the subject of another study. In April, there are more than a few specimens, and in May there is usually

only one. For example, on April 24th, 2007, when there was still a lot of snow present at the summit, four individuals were observed. They were undoubtedly still in winter formation. Birds were on the summit, but often flew long distances from the summit and returned. On May 5th, 1990, only one male was attracted with the tape recorder, and with a full day's observation I would undoubtedly have detected a second individual (female), but this was not the case. Therefore, it is not possible to document as evidence of breeding the spring and late spring occurrences on Choč reported by other authors. On the other hand, the site seems to be a very important and stable place for the accentors as a stop-over. The site was known to be used for migration and overwintering from the 1950's (Randik 1958) until today. In the 1960s the species was reported by Darola (1970) or Štollman (1978, 1995). Štollman reported an adult male shot from Choč on May 17th, 1960, from the 1970s the species was reported by Kupcová (1981) or Štastný *et al.* (1987). Choč is a hill high enough for nesting, and it is not impossible that accentors may have tried to nest there in the past. However, it has a relatively small ridge for foraging and is now dangerously overgrown with tall grass and dwarf pine, making it less suitable for nesting.

Babia hora - Piłsko

In 1965 Alpine Accentors were observed on the Polish side of Babia hora in July, on a rocky outcrop. The data indicate a rather high probability of nesting (Bohačík 1995). They were also reported from Piłsko on Mechy Ridge in the second half of June 1964 (Bohačík 1995). It is very likely that in several cases in May or June, the accentors are summering (cf. Topercer 1997) non-breeding birds (see Hudec 1983). Accentors have long inhabited the ridge of Babia hora, undoubtedly a place where they find abundant food. On the summit, even if they have nested in some years, their nesting has been irregular, and occurs mainly on the Polish side (Štollman and Kocian 1965). Bocheński (1970, 2003) repeatedly writes that a small number breed on rocky rubble fields on the northern Polish side of the Babia hora, but nests or young have never been documented. From May (11th, 1985), June (5th, 1985), or July (9th, 1984) Karaska (1986, 1989, 1992) always observed only one bird, the same is true for the last few years (July 17th, 2011, P. Hotala), and it is the same now in 2022 and 2023 (Kuligowska in litt.). Though the author of this study stayed there during the breeding season and would undoubtedly have seen more individuals. Although breeding cannot be ruled out in some years, it is very likely that the site is more likely to be used by individuals that survive the summer, initially males.

Material and Methods

This geographical record of the occurrence of *Prunella collaris* in the Western Carpathians spans a breeding period between 1985 and 2023. Some data from other authors are used with their per-

mission, particularly in locations where the species only breeds periodically, and its occurrence is marginal. Data from October and November data is usually associated with sites no longer utilized for breeding, especially when birds form large multiple aggregations. Autumn sites are often constant from year to year. In the Low Tatras, groups from the High Tatras may also stop on the ridges during their southward migration. Similarly, data from March and April are marked separately. During this period, some birds have already moved back up to higher altitudes; especially males, who tend to sing more often in mild weather. Some birds, especially in the case of a long winter, may still be at the wintering grounds in April. A significant return migration of females takes place in April. The actual period of suitability, which can be defined as the breeding season, can be observed in the Western Carpathians from May (potentially the first breeding attempt, with a low success rate in this region) to September (including brooding of the young by the females and moulting). Alpine Accentors are fiercely loyal to their breeding sites, and their polygynadrous lifestyle also allows them to pass on information about breeding sites from generation to generation. It should also be noted that the main conditions for the presence of the birds include availability of food on leeward sides of mountain ridges, where wind-blown insects from the rising valley winds are concentrated, as well as the abundance of snowfields in valleys, where birds collect invertebrates brought in by the wind or trapped in the snow until the beginning of September.

Each specific site was determined through visual observation of birds in the field, or using binoculars, with the possibility of determining the distance and inclination of the observation. During breeding season, birds were sometimes attracted by a tape recording of a female or male singing, with an instantaneous recording of where the bird had flown from. This allowed for coordinates to be accurately plotted on maps. The points indicate the approximate locations where birds have been confirmed at least twice (often several times) but sometimes more than ten times, over the years of observation. The points always indicate the first sighting in a particular microhabitat of a local group. The final demarcation of the sites on the maps in this study is based on the authors' own experience of the geomorphic type of environment in which the birds are found, their preferred sites, and on the long-established knowledge that birds choose nesting sites within a short range of each other from year to year, sometimes even at the same site for several years. Birds also use their own "flight paths" between rocks, as well as favourite elevated rocks, to observe their surroundings, to sing, or to preen. Points on the map assume a larger radius for the birds to fly.

Most data presented in this study comes from the author's own systematic observations. As a result, the maps are conceptually consistent in terms of the perspective and interpretation of the individuals observed. To a minimal extent (less than 5%), the database is supplemented by observations made by students at the Institute of High

Mountain Biology. In the case of the Babia hora and Pišsko, the database is supplemented by older publications, although the author also utilizes his independent sightings from the spring period.

Other relevant summer and autumn observations during the breeding and moulting season, whether from random photographs taken by hikers and climbers on websites, data from Slovak, Czech, or Polish databases, or information from friends, have not yet been included in this study. This is because the occurrence and presumed distribution of animals in their random observations is consistent with the author's database. In general, however, these are places where tourists tend to concentrate on the summits, at mountain huts, or at passes. Winter and spring distributions, especially in smaller ranges, are incomplete and will be subject to further study. This will include clarification of how birds move spatially from wintering areas to breeding areas, as well as how they spend winter. The detailed geomorphological and mountaineering description of the High Tatras is based on the map Vysoké Tatry (1:25 000, DJD and Jenki Studio 2000). For a final design to visualise and explore the geospatial content in 3D of the Alpine Accentor occurrence data, a free application of ArcGIS Earth (Esri) was used.

Basic markers on maps (Figs.1.-39.):

● May to August occurrence, the dot indicates confirmation of birds at the site at least twice during the reporting period within a radius of approximately 100m from the first record. In the earlier period, the occurrence was recorded directly on the forest maps (1:10 000), and later, as mentioned above, GPS locators and binoculars with distance measurements were used. If there are several yellow dots in close proximity to each other, this means that the birds have been observed at the same location on several occasions or are present there on a permanent basis. If the birds flew to lower elevations during snowfall and snow storms in the summer, both in search of food for nestlings during the breeding season, or even juveniles follow adults in search of food in valley huts, a yellow dot was also added. However, it may not

have been confirmed a second time. Since birds can nest in the same crevice, nest locations are not listed in this study.

● September to November. If there are markers on the peaks and ridges that are not accessible to hikers, they are relevant for the definition of the presence of animals and mean at least two autumn records. The birds remain at the sites during the moulting period, and the males do not like to leave the breeding sites and can be found there especially in the early morning and in the evening. In September, females are still feeding their young. Fledglings, which are independent of food, roam around with the whole family. Some of the September, October and November records are no longer relevant for determining breeding sites. Birds, either individually or often in large flocks, may fly long distances to find suitable feeding sites. Some individuals can be found near tourist huts until late autumn. This data will mainly be of use for the next migration study of this species.

● December - February. This database is not complete at the moment. It will be completed with additional data from bird databases from the wider area, including from Poland, Slovakia, Czech Republic and Hungary. The database shows only an indicative occurrence of some birds seen in winter; they like to return to the peaks in good weather.

● March - April. A sensitive time when in some years birds are still caught in their winter habitat. If there is not much snow in the winter, the birds generally appear on the breeding ground in April, especially after the females have arrived. Males start to ascend in March in a normal winter, but if the weather is bad they fly down to lower altitudes. Moreover, if heavy snow falls in April, the birds may gather in large numbers where they can find food (see ski slope on Skalnaté pleso). This data is not usually used to define breeding sites and will be used in a future study on the migration and wintering of Alpine Accentors from the Western Carpathians.

THE TATRA MOUNTAINS



The High Tatras, Gerlach, Velická próba, July 13th, 2006. Photo M. Janiga

Fig. 1. Belianske Tatry – south. The peaks of the Belianske Tatras are a location preferred by Alpine Accentors. According to breeding activity (nests, fledglings) it is possible to consider around six females in the mentioned area (Hľúpy - Bujací vrch) and about 20-25 adults in total at the time of breeding. The southern limestone ridges of Bujací vrch are also a permanent wintering area.

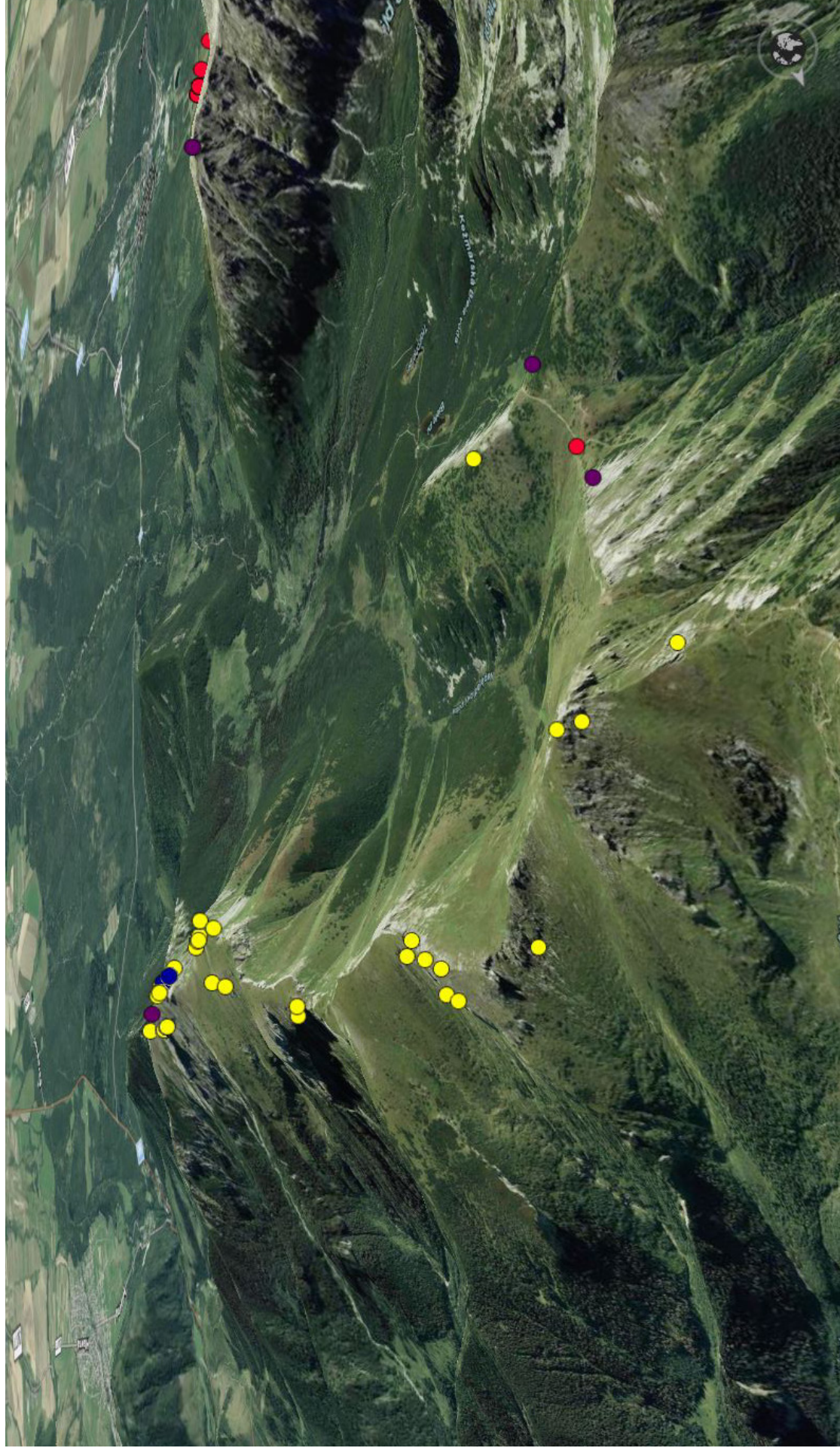


Fig. 2. Belianske Tatry – north. In the area between Muráň and Ždiarska vidla, Muráň is particularly popular with the birds; around five females and a total of around 15 adults can be estimated to be present in the area at breeding time.

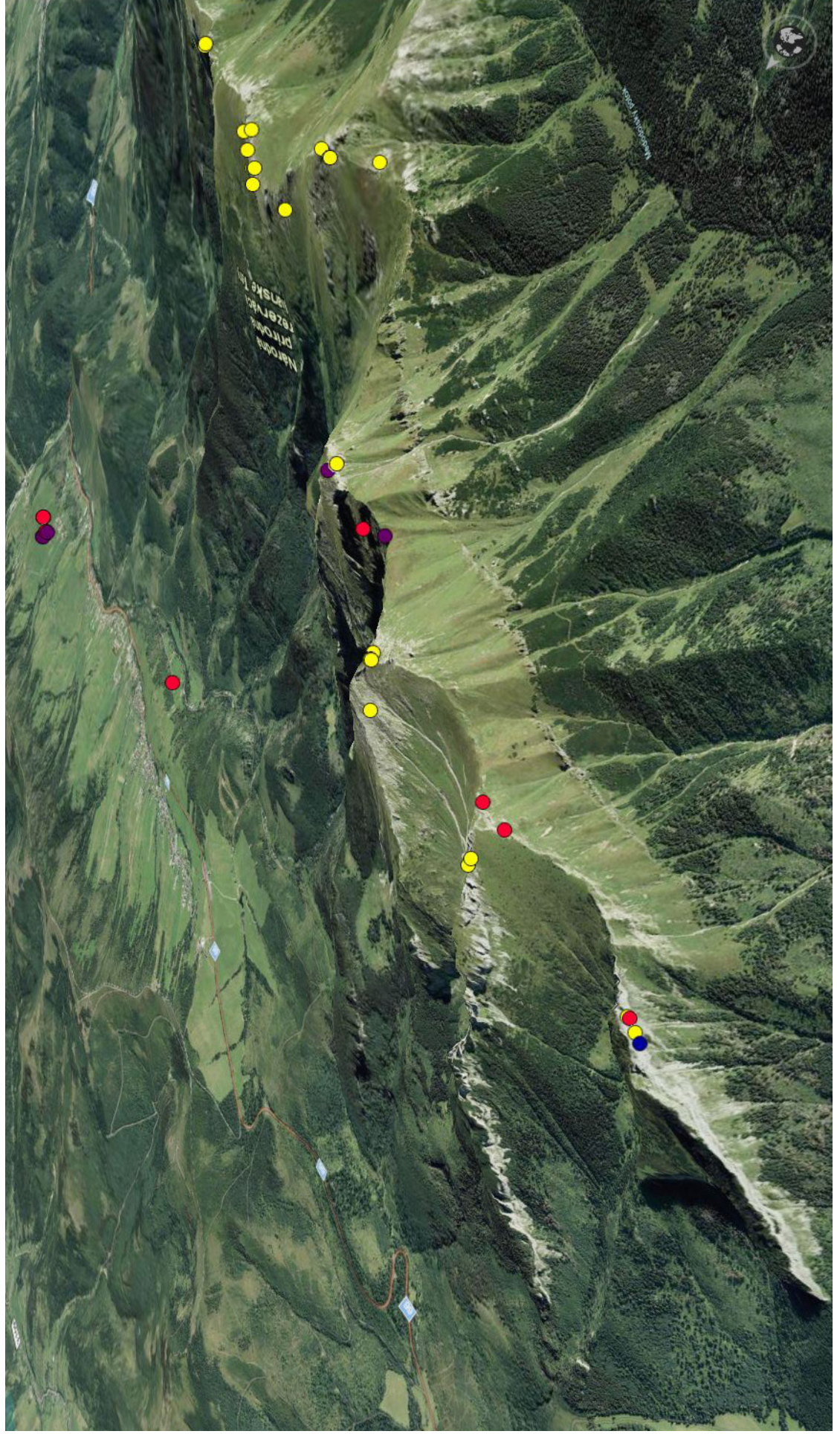


Fig. 3. Dolina Bielych plies – Červená dolina – Malá Zmrzlá dolina – Veľká Zmrzlá dolina – Malá Zmrzlá dolina – Veľká Zmrzlá dolina. Popular nesting sites are located around the peaks of Jastrabia veža and Západné Jahňacie Kópky. Approximately 15 adult birds can be estimated in the whole during the breeding period.



Fig. 4. Zadné Medodoly – Kolová dolina. The northern slopes of Jahňáci Peak are inhabited by birds from the south during the breeding and moulting seasons. The peak itself is a place of synanthropy, with some individuals actively searching for rubbish left by tourists. There are two more groups nesting in Medodoly and above Kolové pleso, with a total of 8 to 10 adult birds estimated to be breeding here.

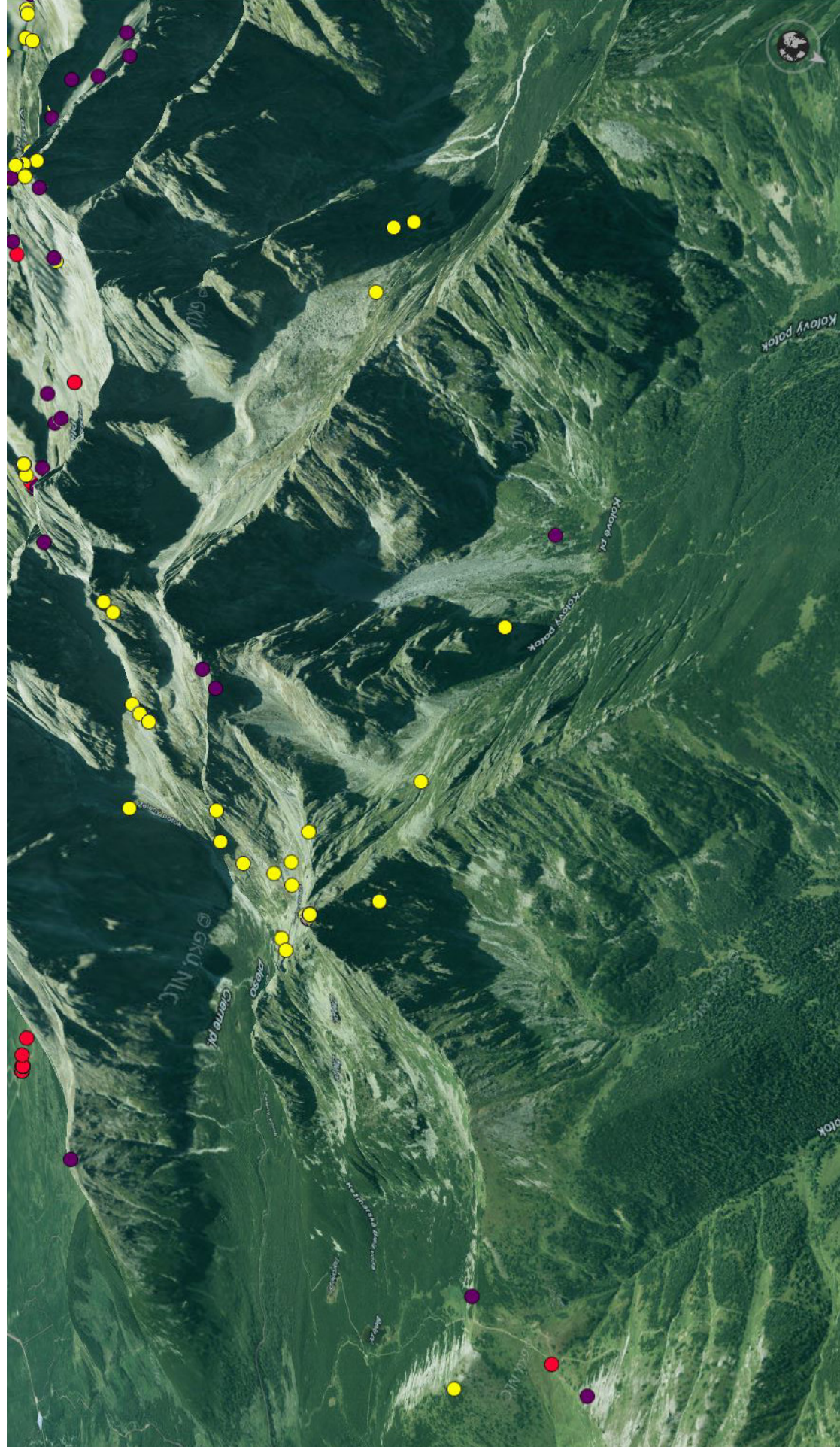


Fig. 5. Čierna Javorová dolina – Suchá dolina – Javorová dolina – Javorová dolina. In Čierna Javorová dolina a favourable site is in the rocky walls above Čierny vodopád, in Suchá dolina birds breed at the end of the valley near the peak of Ladový štít. These birds are often synanthropised with litter left by hikers, next are families in the rockies of Široká veža and on the north face of Javorový štít. A separate family seems to inhabit Zelená Javorová dolina, above the lake (purple dot below right). In total, up to 30 adults can be estimated to be present in this complex at the start of the breeding season.

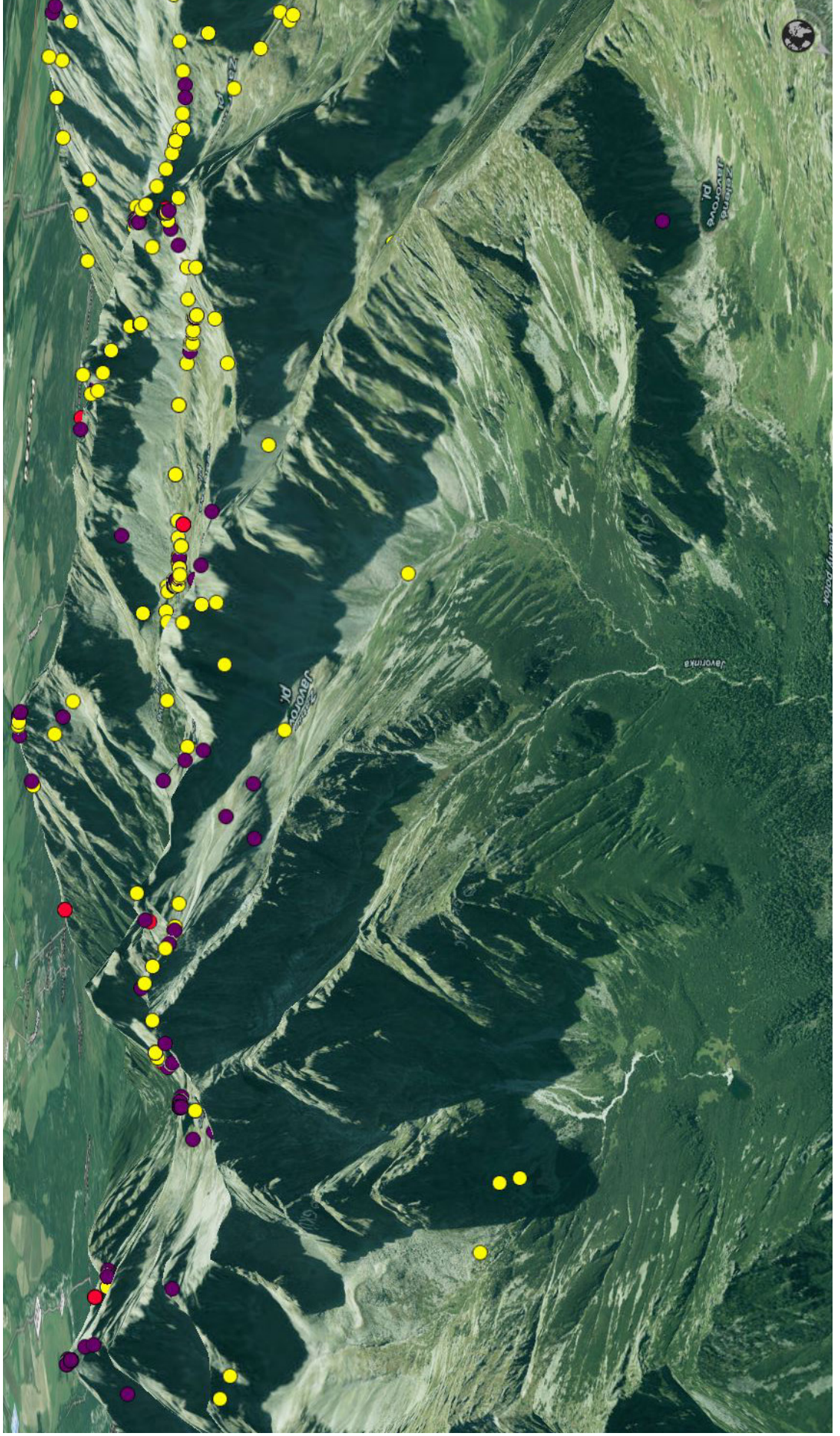


Fig. 6. The Start and Skalnaté pleso cableway stations and the deforested ski slope are used in March and April for more sustained arrival of males (March) and females (April). In March, the birds usually gather in groups of two to four individuals on exposed grassy islands in search of food. In the event of unexpected snowfall and new snow cover, especially in April, the birds gather in larger flocks and forage on exposed areas of the slope. For example, during the period between April 23rd and 30th, 1990, 20-30 birds were observed daily on this slope.

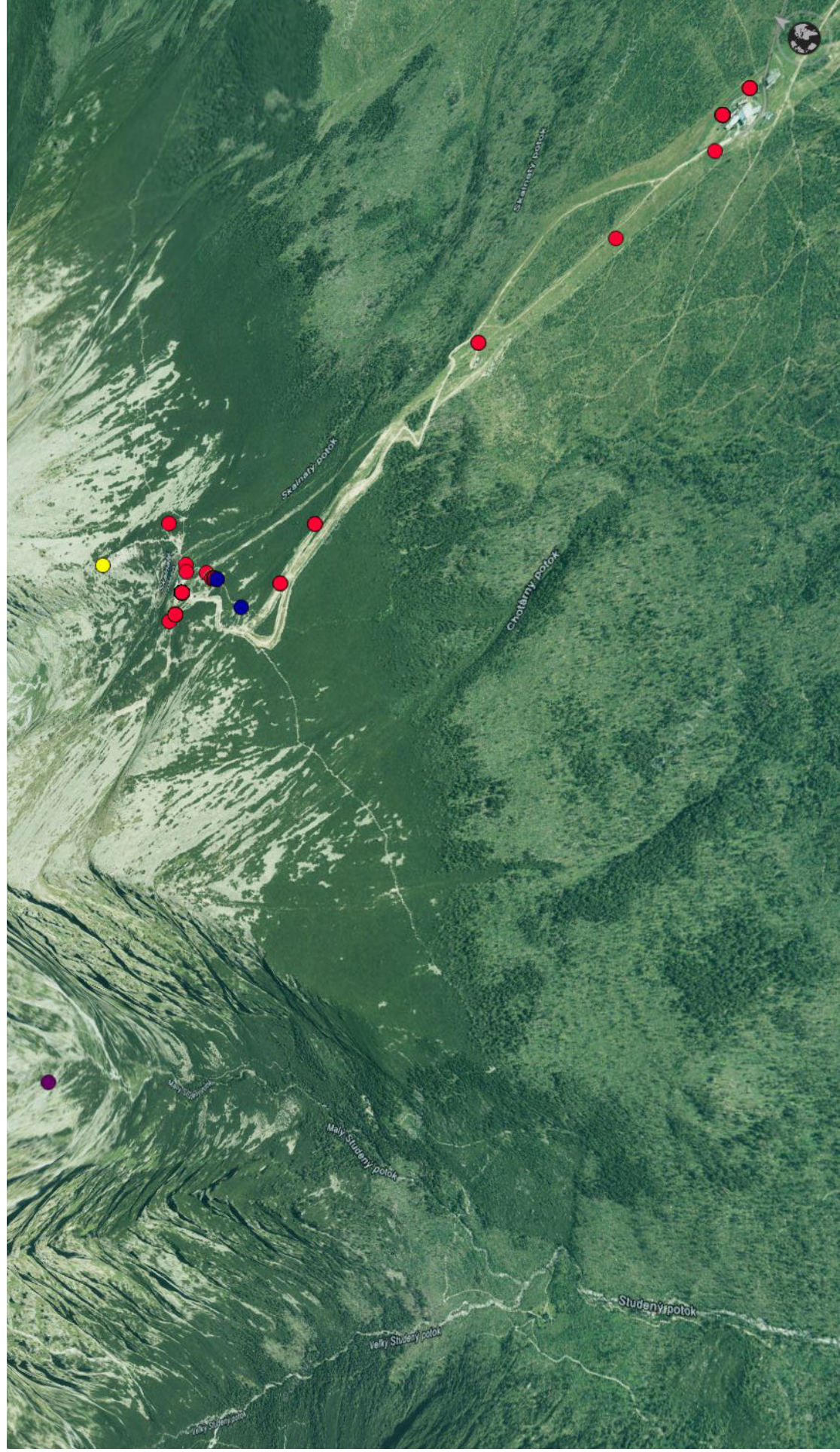


Fig. 7. Malá Studená dolina – Preferred locations for birds to stay permanently during breeding and moulting season are Lomnické sedlo - Lomnický štít - Pyšný štít, Baranie sedlo - Baranie rohy, and Ladový štít. Individuals here are often seen picking up rubbish after climbers, as well as at Sedielko, where the birds breed and scavenge for food after hikers. Popular nesting places are Žltá siena and the surroundings of Päť Spišských plies. The number of birds in the valley can be estimated at around 20, based on their nesting sites. The area around Téry's hut lends itself to synanthropy, in the summer, autumn, and sometimes during winter.

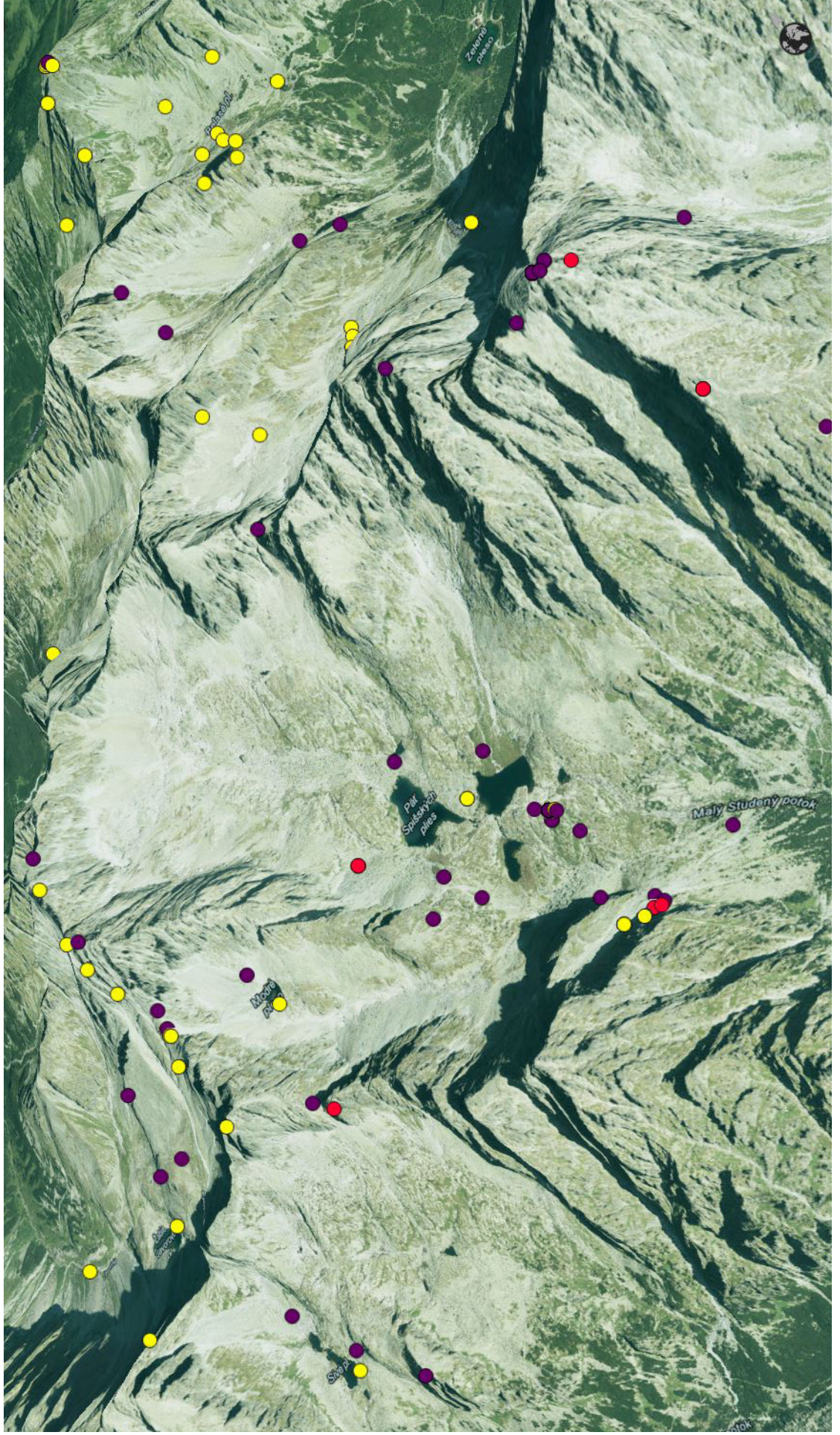


Fig. 8. Veľká Studená dolina - This popular valley hosts the most Alpine Accentor life. During the nesting season they can be observed in the Slavkovský štít - Slavkovský nos - Slavkovský štít, Svišťový hrebienok - Svišťový štít, around Starolesnianske pleso, Javorový štít, around Sivé pleso and Strelecká veža, Široká veža, Príčné sedlo. During autumn, a large concentration of birds may be observed near the waste dump of the Zbojnická chata, where they scavenge for food. It is estimated that the population of adult birds at this site during the breeding period is around 30.

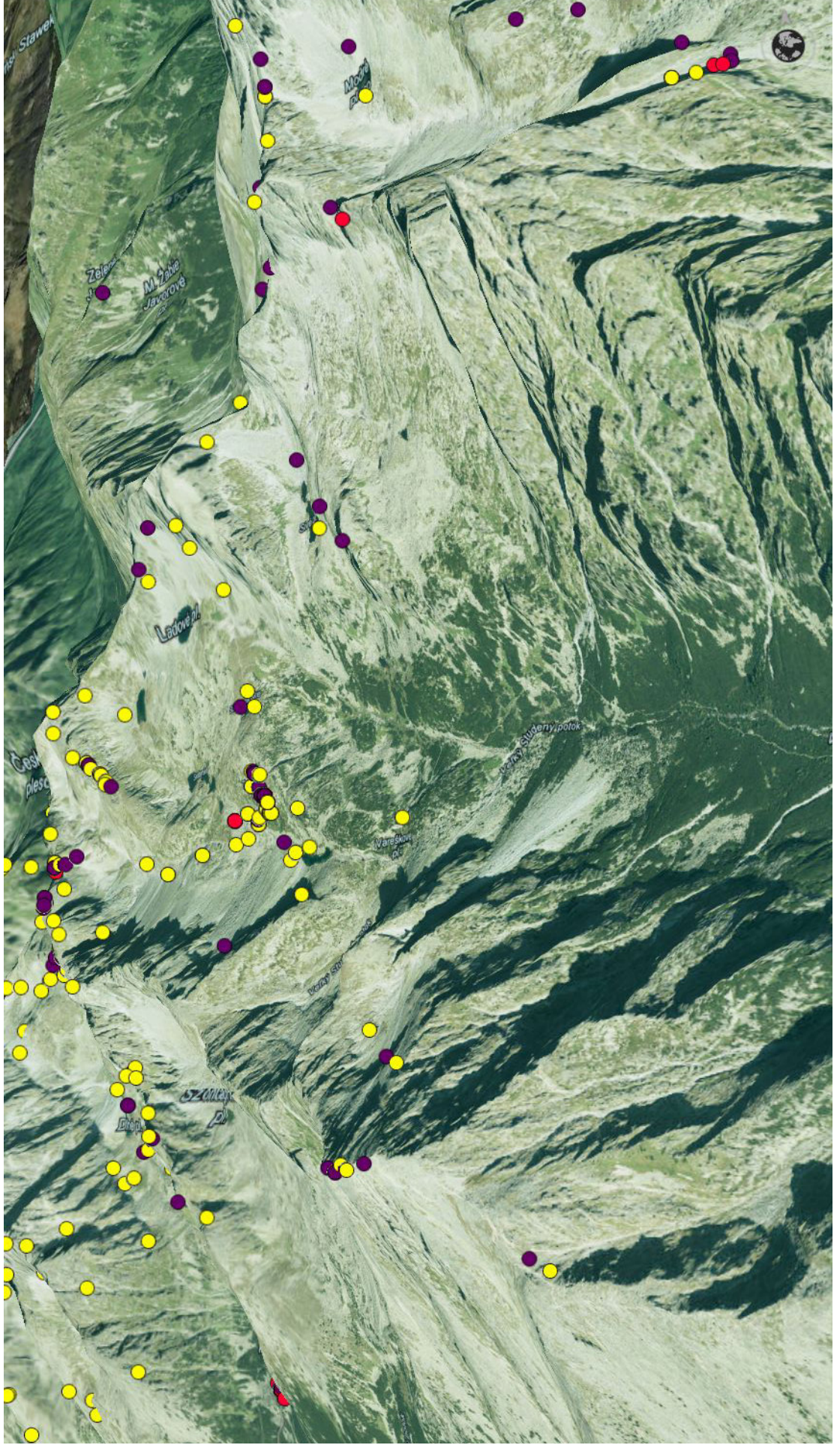


Fig. 9. Velická dolina - Favourite microhabitats include the complex around Kvetnicová věža, the complex from Čertova věža to Gerlachovský štít, the area from Lucivianská lávka through Zamrznuťá kopa, and Poľský hrebeň up to Východná Vysoká is frequently occupied. The increase in the number of observations (Poľský hrebeň – Východná Vysoká) is related to the popularity of hiking trails and the associated synanthropism of birds, particularly during summer and autumn. In the eastern part of the valley, the area around Bradavica and Veľká Granátová věža is particularly interesting for birds, where there are also undrained water springs at a high altitude. Some birds flew to Slavkovská dolina, and Szontaghovo pleso. In summer and autumn, some hemi-synanthropic individuals forage near the Slezský dom mountain hotel. The valley is estimated to contain around 20 breeding adults.

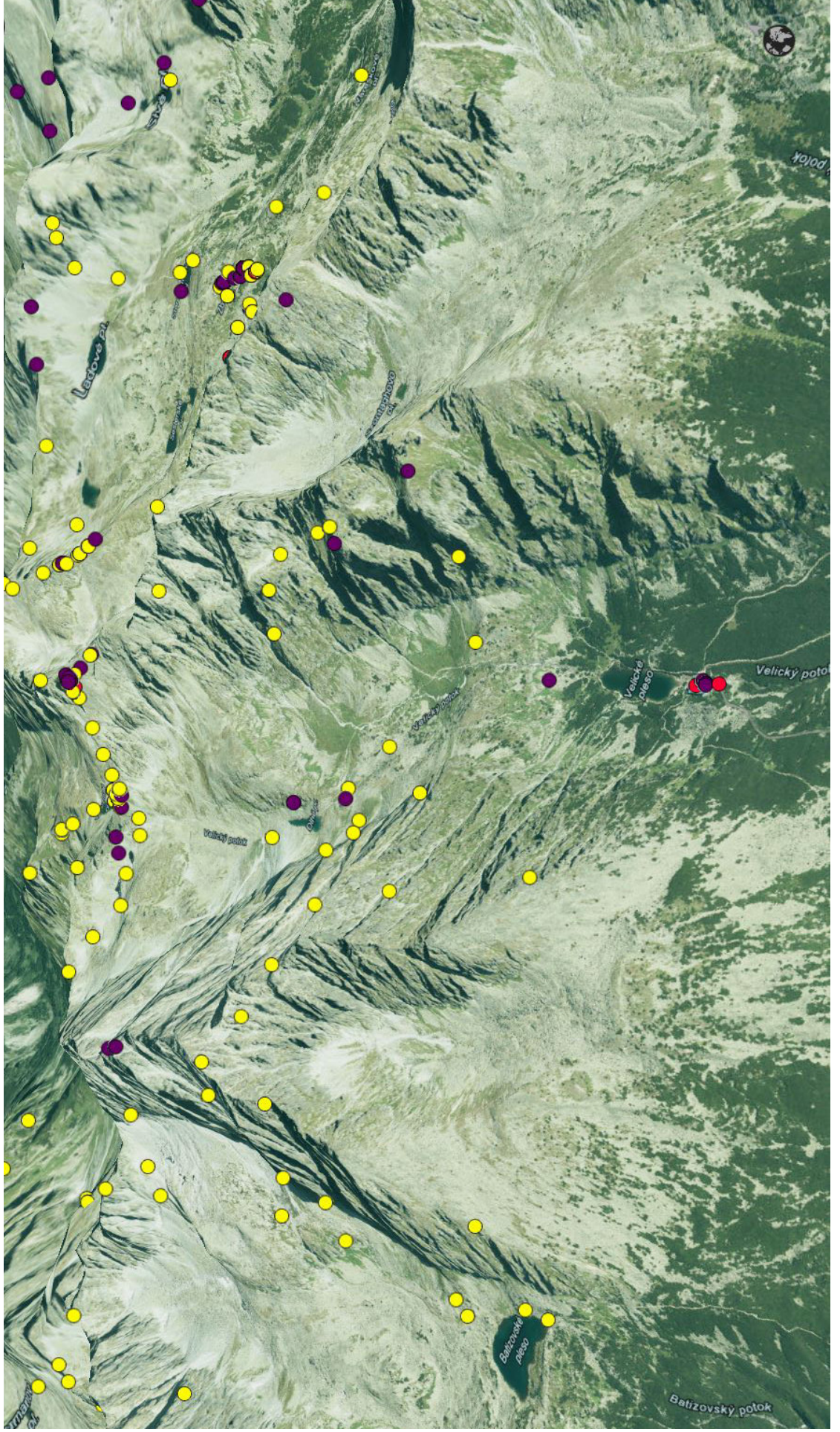


Fig. 10. Rovienková and Svišťová dolina - observed localities: Dolné Rovienky, Horné Rovienky and Svišť'ovský štít, where individuals occur on the southern side of the peak in Veľká studená dolina, in Svišť'ovská dolina there is one family between Hrubé pleso and Hrubá veža. It is estimated that about 10 adults are present during the breeding period.

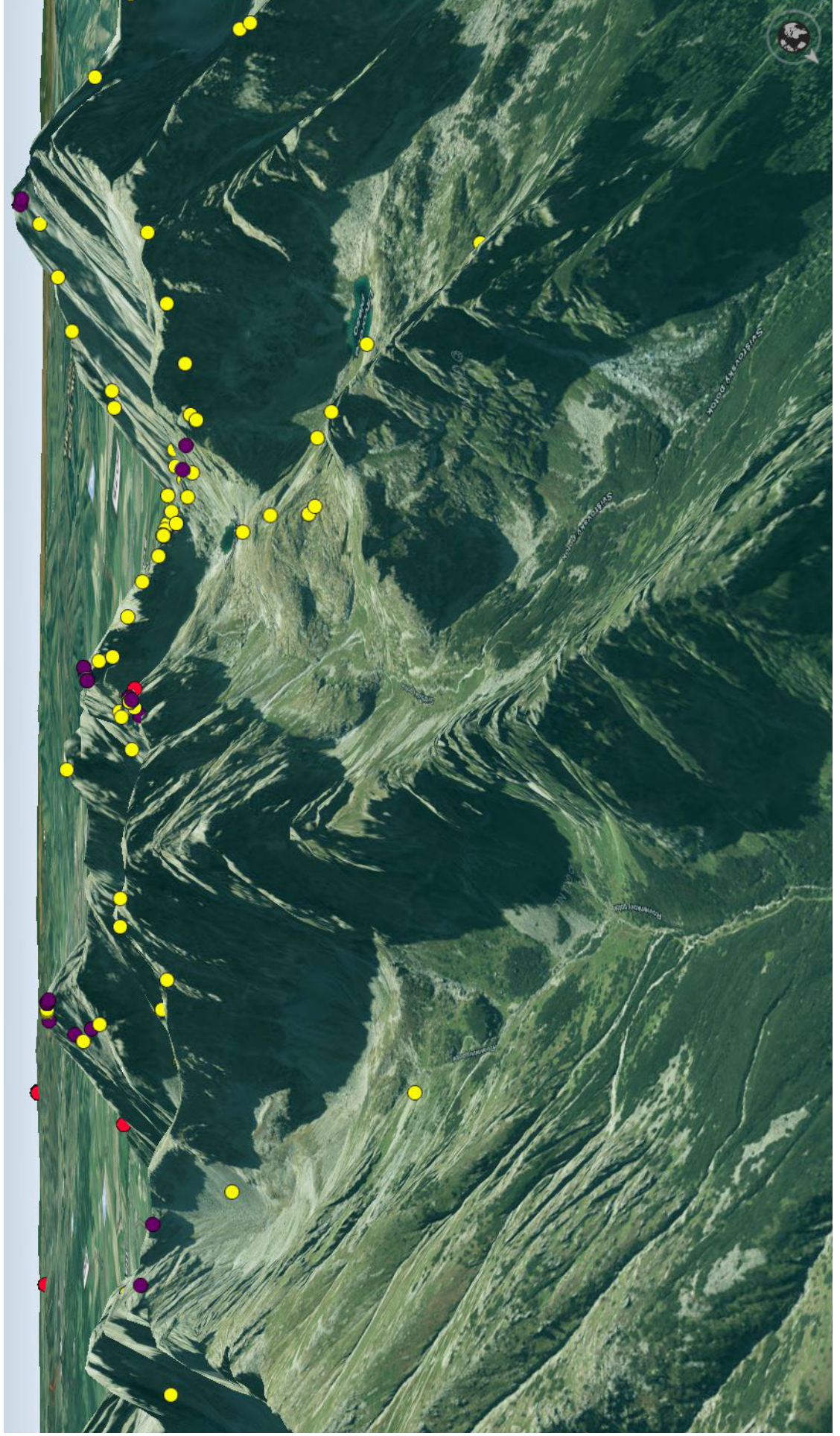


Fig. 11. Litvorová, Kačacia, Ťažká dolina - The birds in the Litvorová dolina can be found near Litvorové and Zamrznuté pleso, in the Kačacia dolina near Gerlachovské spády, and in the Ťažká dolina near Pusté veže. The total estimate is up to 15 individuals.

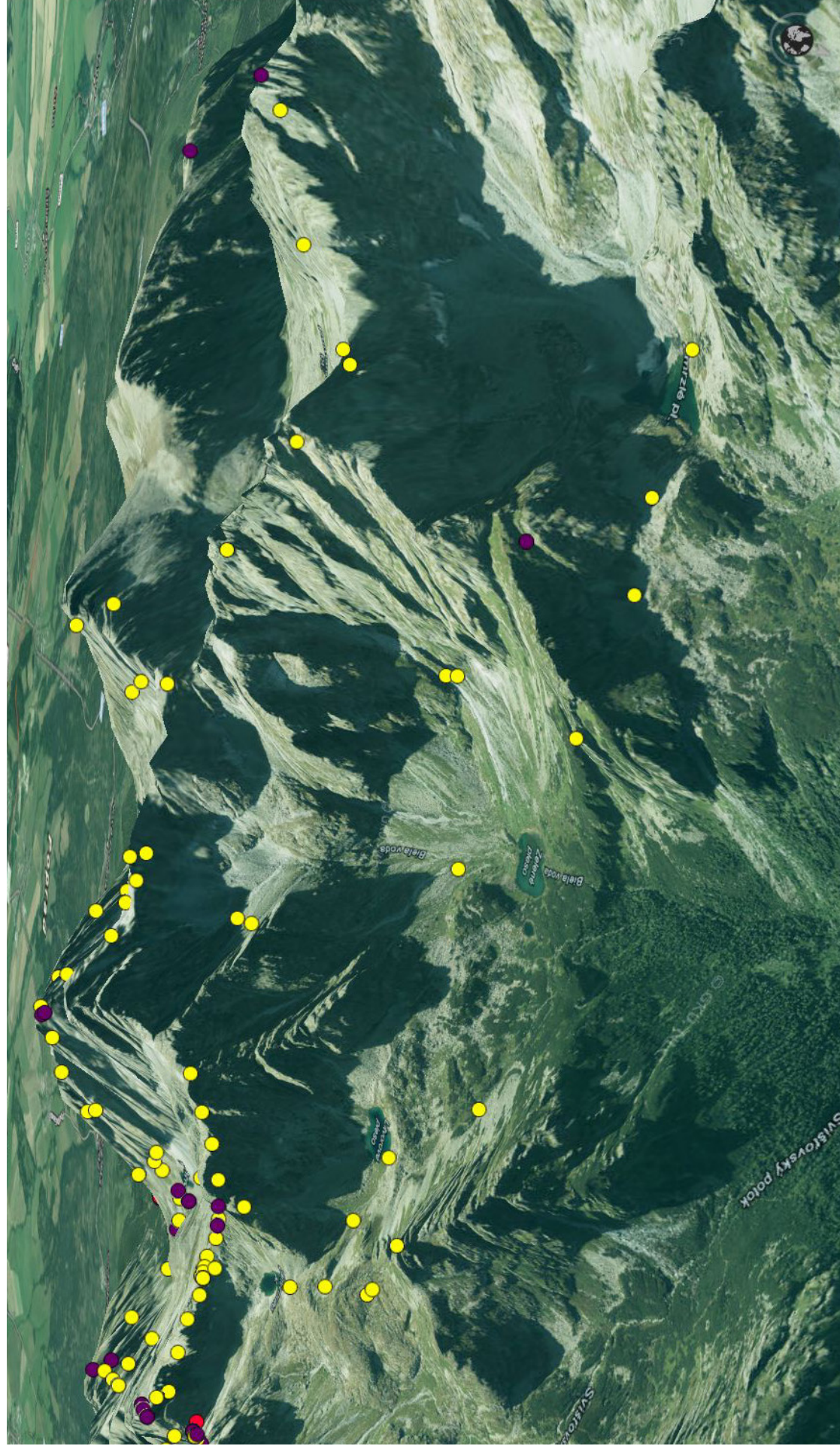


Fig. 12. Batizovská and Štolská dolina - This recurring site is in the vicinity of Dromedárov vrch and Batizovské pleso. The group ranges over the entire extent of the Dromedárov chrbát. Another extremely popular place, especially during the summer breeding season, is the western slope of the Batizovské štíty, around Východná Batizovská Roveň and Kostiolik. Birds fly up to the eastern slopes of the Končistá peaks. In the Štolská dolina, birds can be seen around Paštrákove zuby, but this family is related to individuals from Batizovská dolina. Total abundance in this location is about 10 adult birds at the beginning of the breeding season.

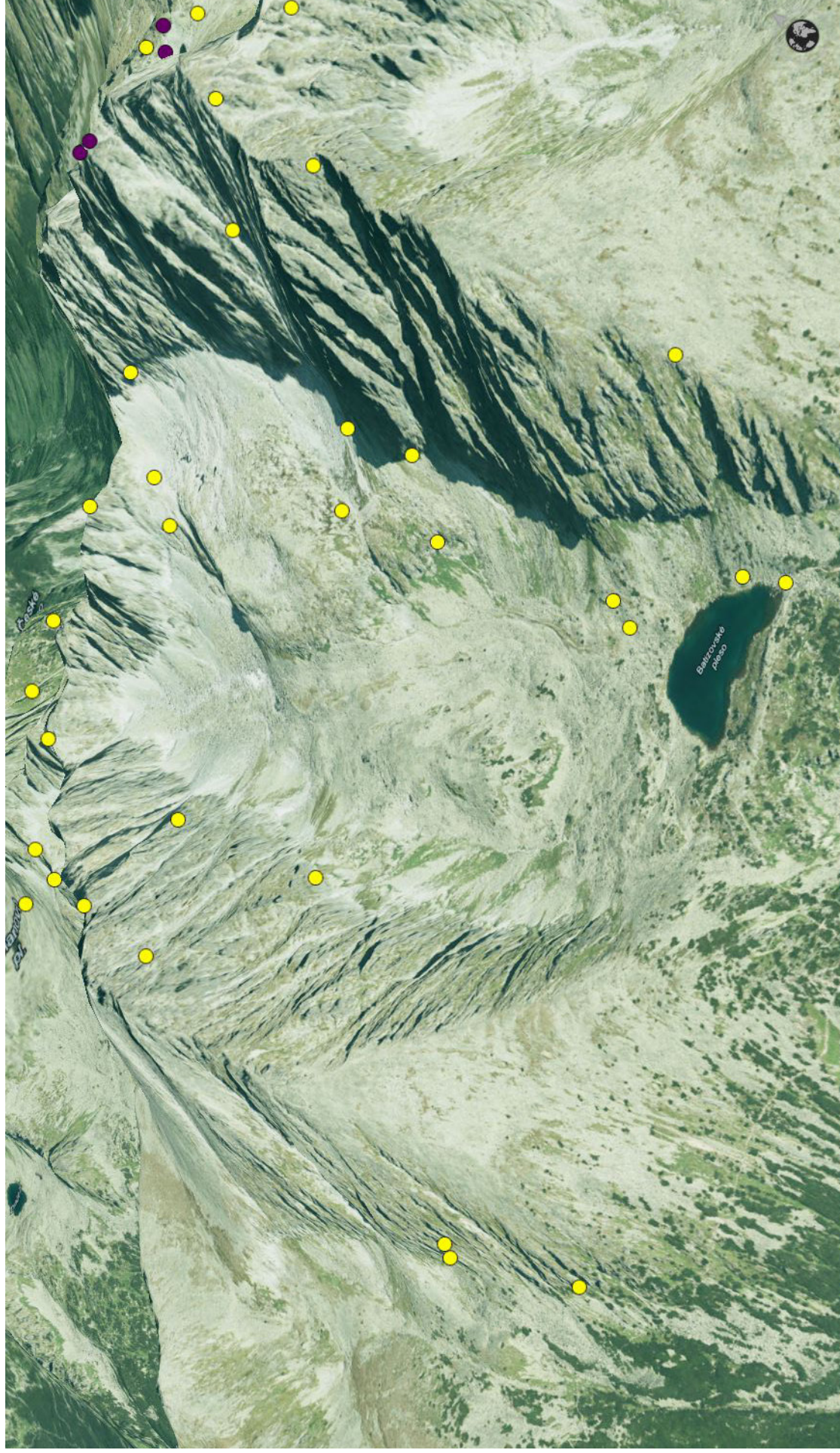


Fig. 13. Zlomisková – Dračia - Rumanova dolina - In Dračia dolinka, the family of birds lingers near Kópka ridge and near Dračie pleso. In Rumanova dolina they remain at length on the walls of the Ganek peaks, as well as the wall of Snežné kopy. The total number of birds at the beginning of the breeding season is estimated at 10-15 individuals. However, as with other localities, many birds fly to neighbouring valleys..

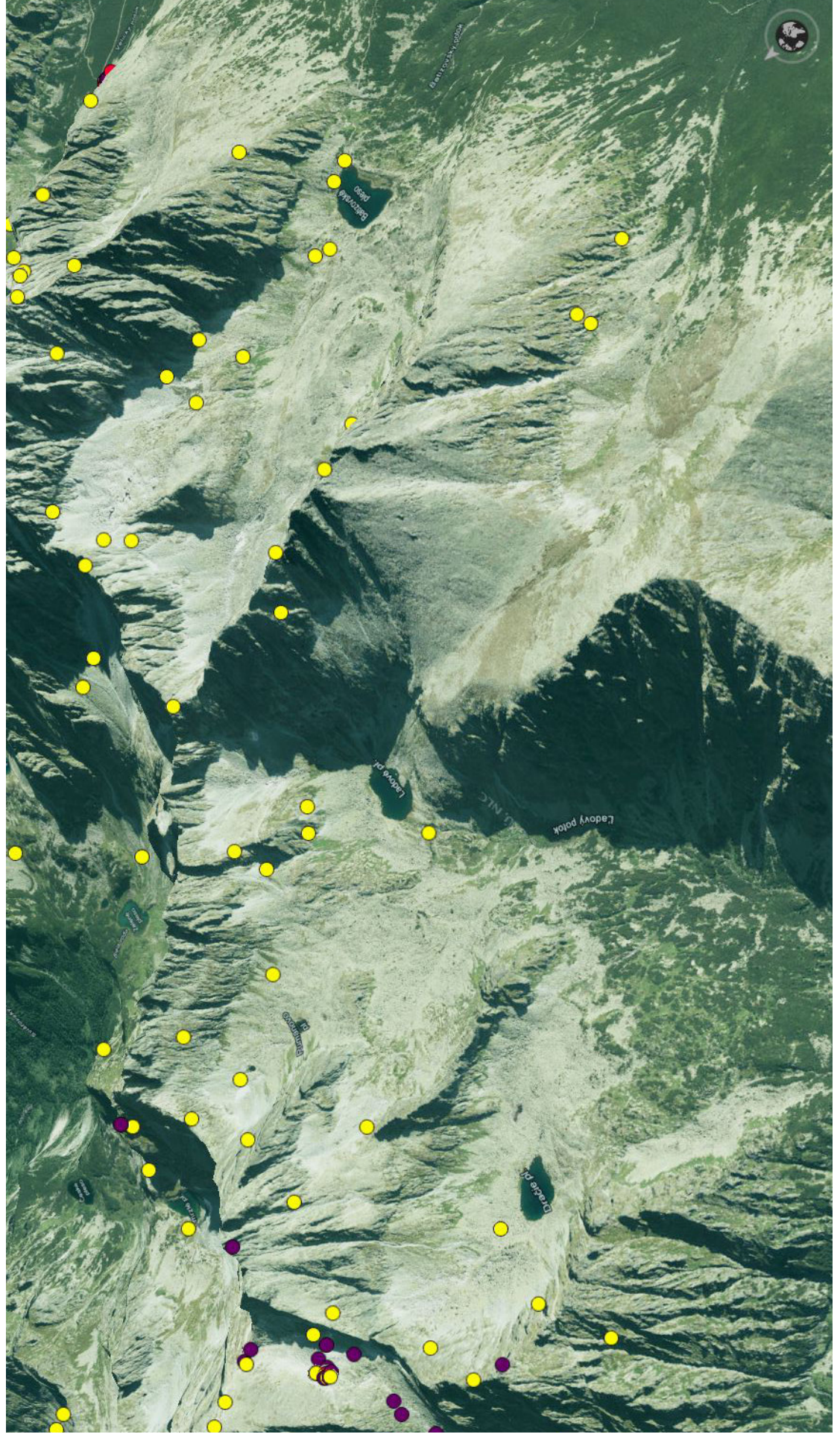


Fig. 14. Dolina pod sedlom Váha – Žabie plesá - Preferred locations, based on availability of food for scavenging include, Rysy, sedlo Váha, Vysoká, and Chata pod Rysmi, where intensive synanthropisation takes place during summer and autumn. Birds also search for food close to latrines. Nesting and hatching of chicks have been confirmed in the vicinity of Žabie plesá with overflights on the slopes of Kópký. The estimated number of birds at the beginning of the breeding season is about 15.

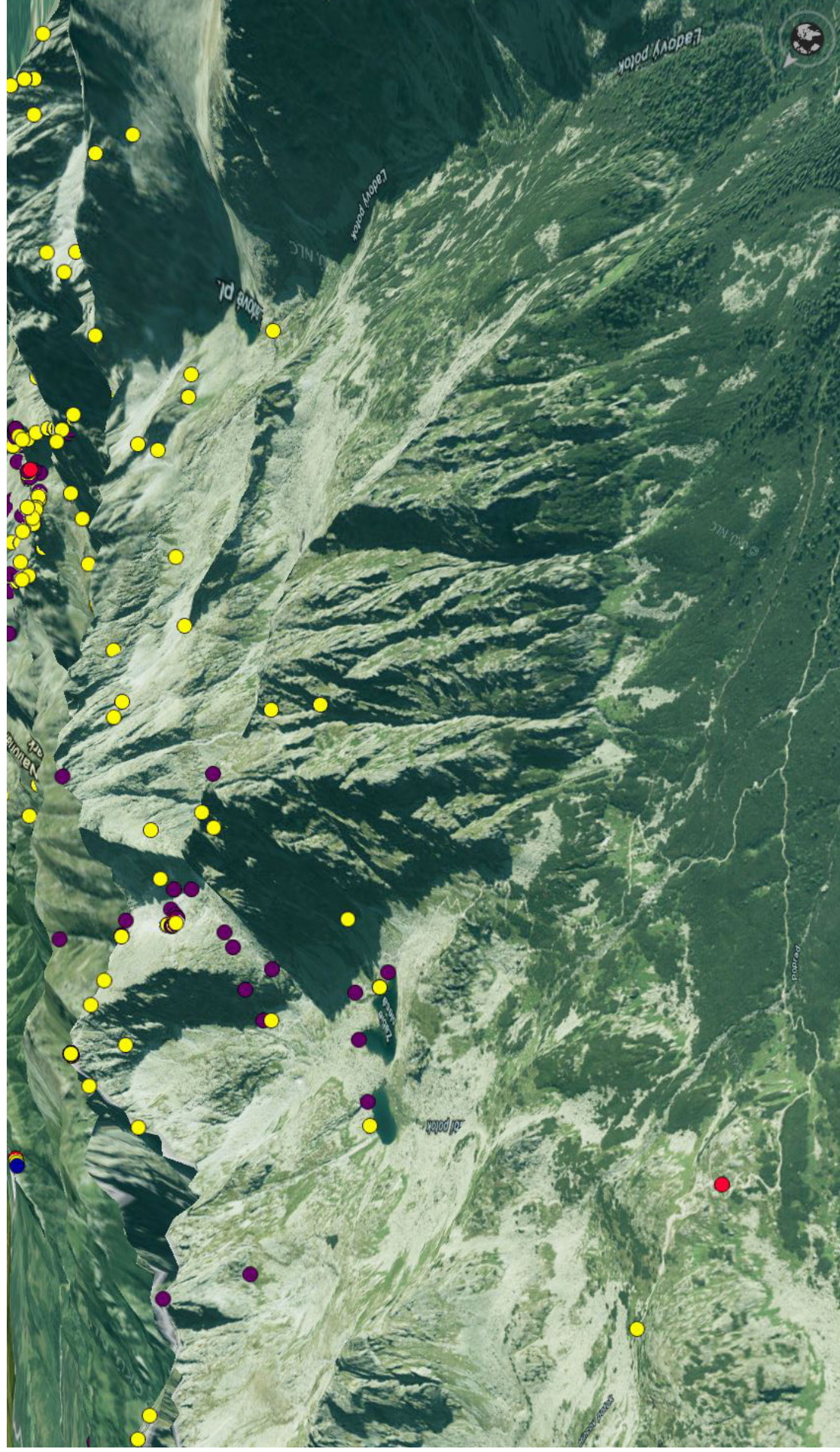


Fig. 15. The number of birds in Mengusovská dolina is usually not high, and is estimated to be no more than 10 birds. They remain in Kóprovské sedlo and Kóprovský štít (where they often look for rubbish). Nesting sites are likely directly between Hincova veža and Predný Mengusovský štít. The first adults can be seen on lakes (Hincove plesá) in this area as early as March and April.

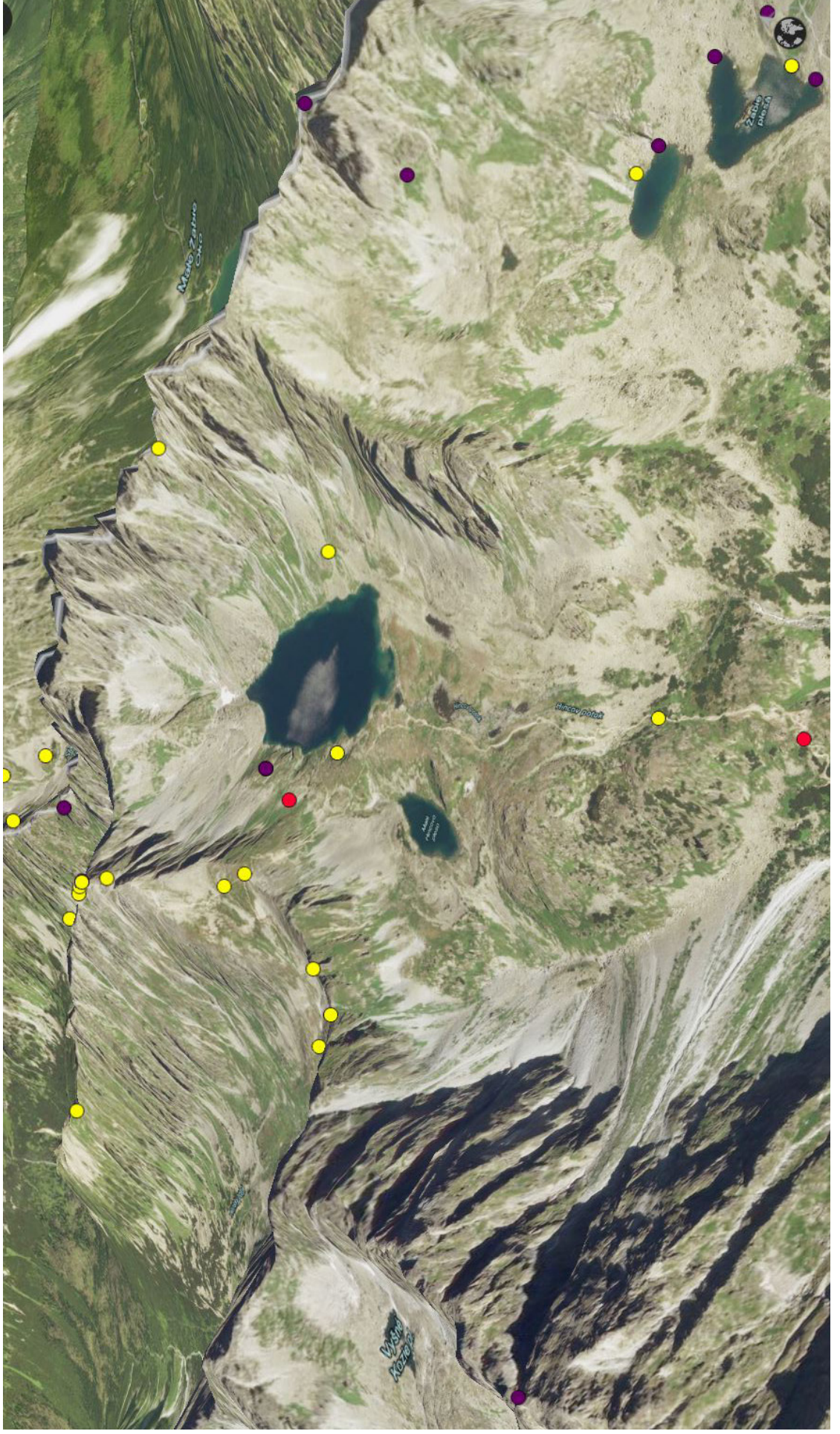


Fig. 16. In Žabia Dolina Bielovodská birds are found around Mlynár, on the other side of the valley they fly through in autumn toward Malý Žabi štít to Žabia kopa. In the Rybšlego potoka valley, as well as in Nadspady, birds are found around Bula near Rysy peak, where there are breeding sites. Birds can also be found in the area of Volia Veža and Hrubý vrch (synanthropisation, rubbish after hikers). Up to 15 birds are estimated in the area at the start of the breeding season.

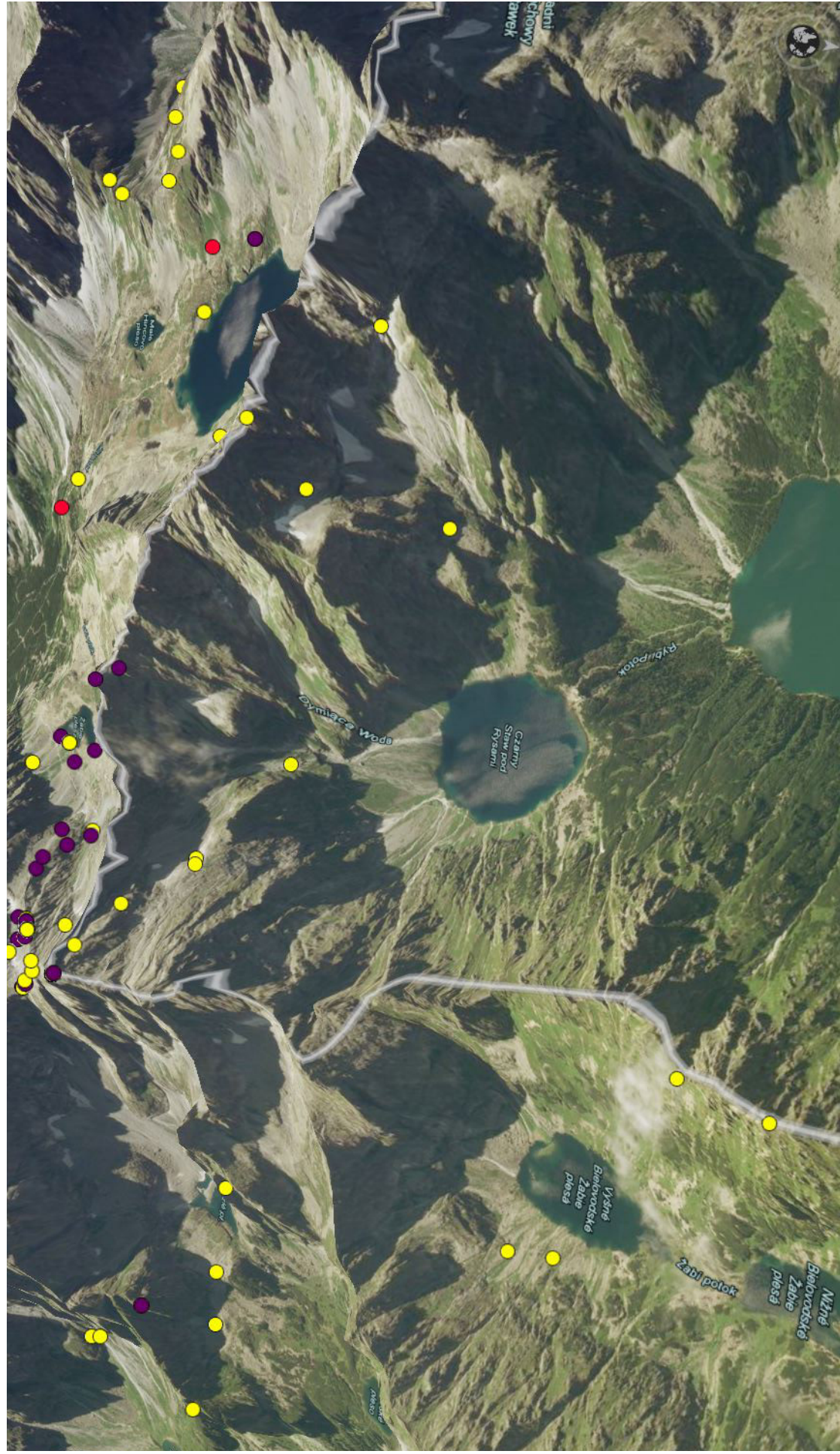


Fig. 17. Dolina Pieciu Stawów Polskich – Kozia dolinka – Favourite places in this location are: Hrubý vrch – northern slopes, Buczynowa dolinka, Zawrat, Granaty, Krzyzna, Koscielce. At the beginning of the breeding season, about 20-25 birds can be seen throughout this area. In Zawrat and Koscielce birds scavenge for rubbish left by hikers.

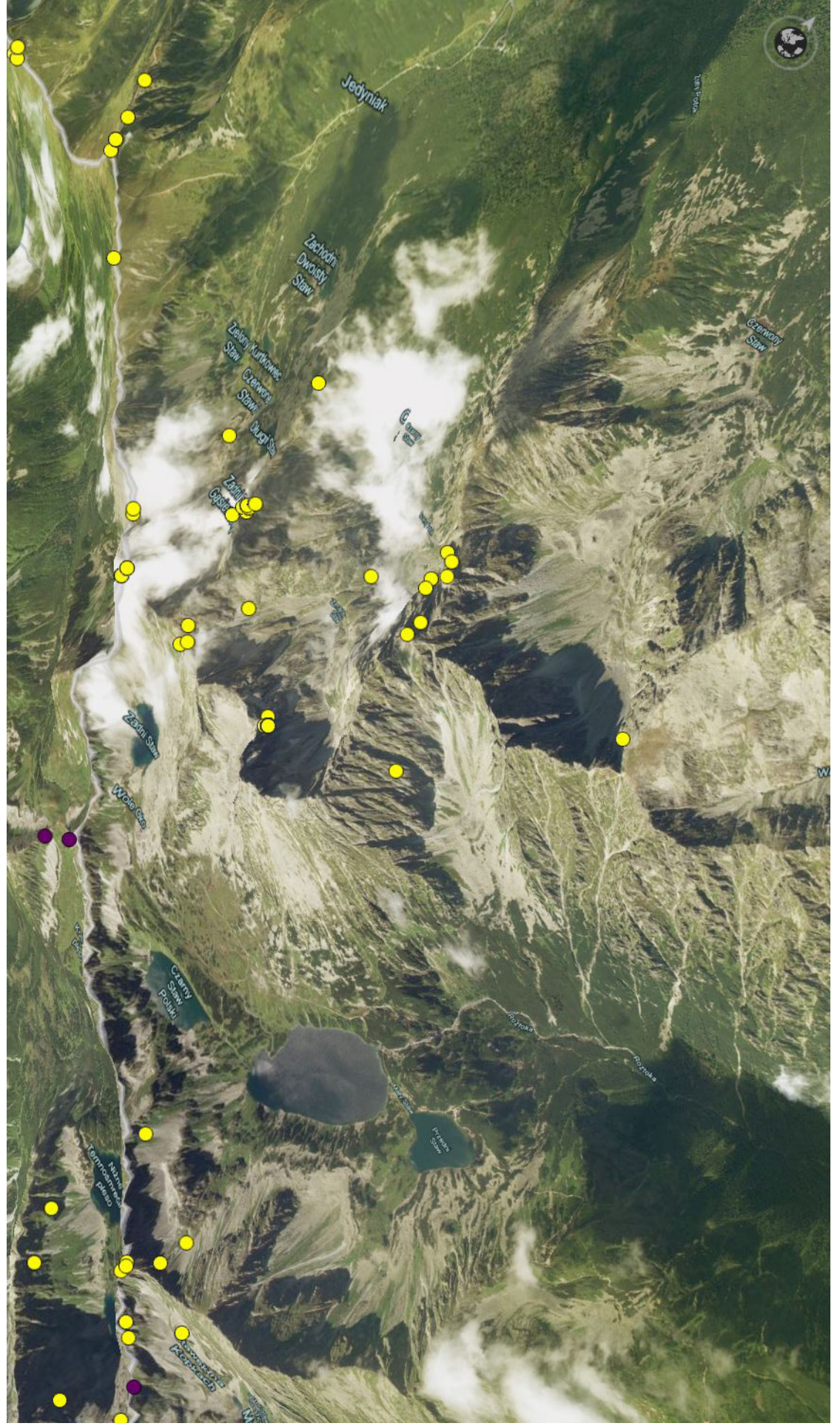


Fig. 18. Mlynická and Furkotská dolina - The most frequent location of occurrence: Bystřé sedlo (synanthropisation in summer), Furkotský štít, the line between Okružle and Cape pleso, the surroundings of Solisko, the line between Nízné and Vyšné Wahlbergovo pleso toward Soliskové hrby. Between both valleys, the maximum number of birds is 15 during the breeding season. The largest number of synanthropic birds can be seen between March and April on Predné Solisko. The birds search for litter from skiers near the chalet, as well as near the top station of the cable car.

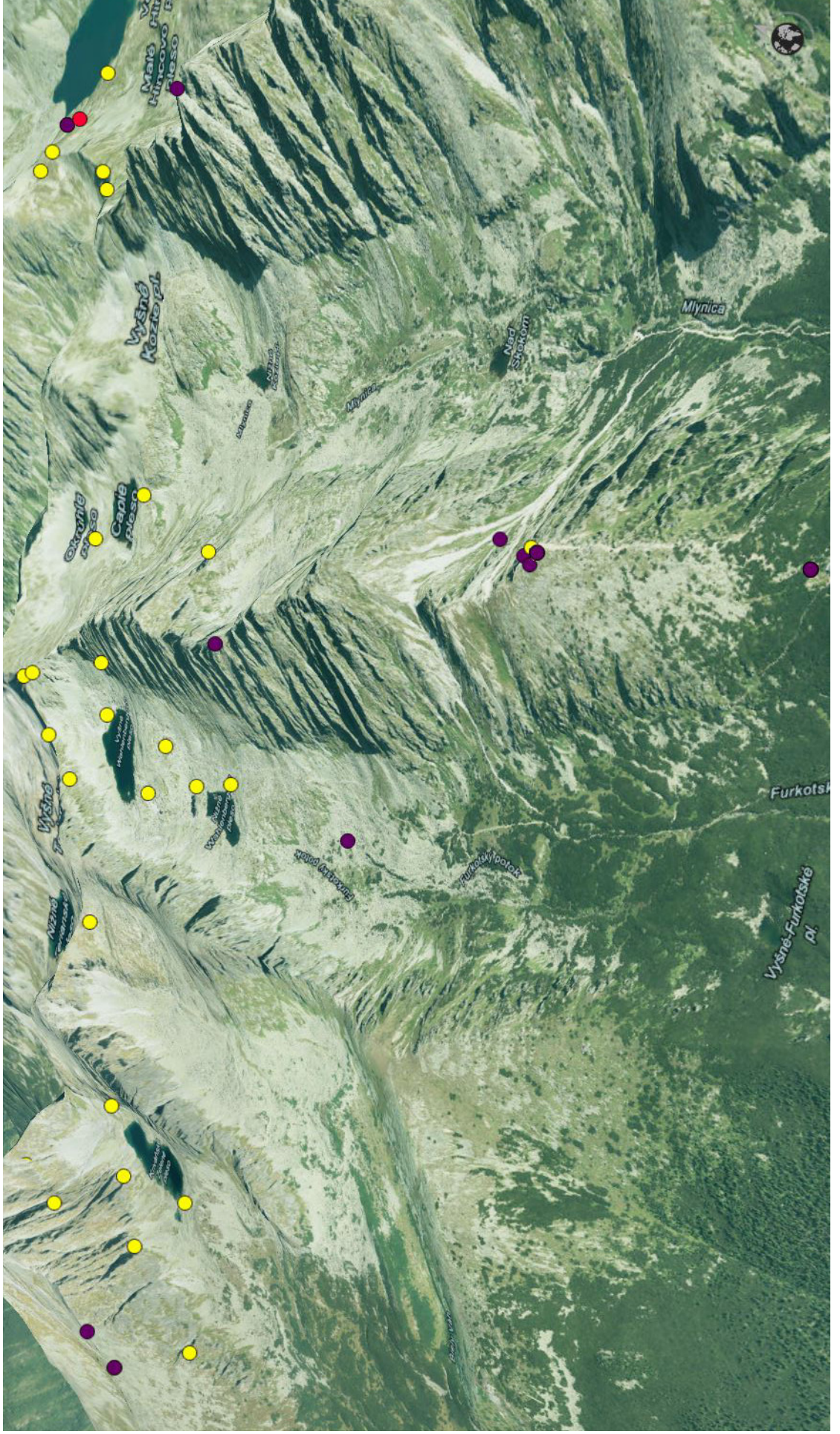


Fig. 19. Zadný Handel and Nefcerka (Kriváň) – are the most frequented places at the beginning of the breeding season. This includes Nefcerka, near Nefcerský brook, in the northern part of Veže nad Kotlinami, in the arm of Kriváň, in the north-western walls of Kriváň in the direction to Kotlina, on rocky benches below Nižné Tertianske Pleso and on the line between Furkotské sedlo and Furkotské veže. Zadný Handel: The Alpine Accentor family lives on the eastern slope of Kriváň, where fledglings often appear around Kriváňske Zelené Pleso. In both Nefcerka and Zadný Handel, 15 adult birds are estimated to be present during breeding season. Kriváň is a place of intensive synanthropisation from July to the end of October. Particularly in September, accentors from the wider area gather here.

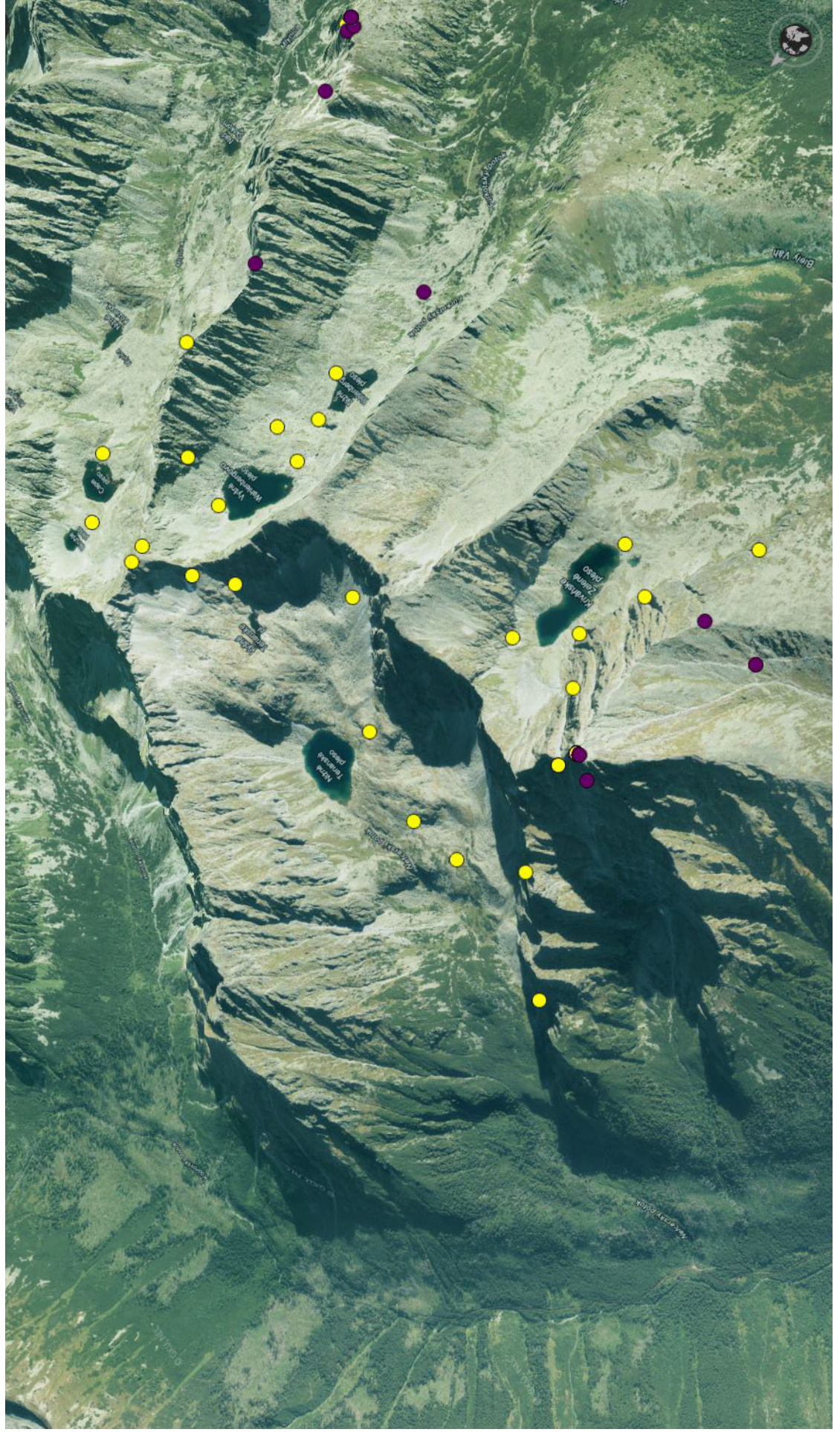


Fig. 20. Hlinská, Temnosmrečianská and Pargova dolina – In the Hlinská dolina, the birds are mostly found at the end of the valley in the Kóprovský chrbát, in the Pargova dolina in the Prostredný chrbát, above the Vysné Temnosmrečinové pleso, and in the Chalubinského vráta. Additionally, there is a family from Hrubý vrch that crosses over to the Polish side. The total number is estimated at about 10 birds immediately before breeding.

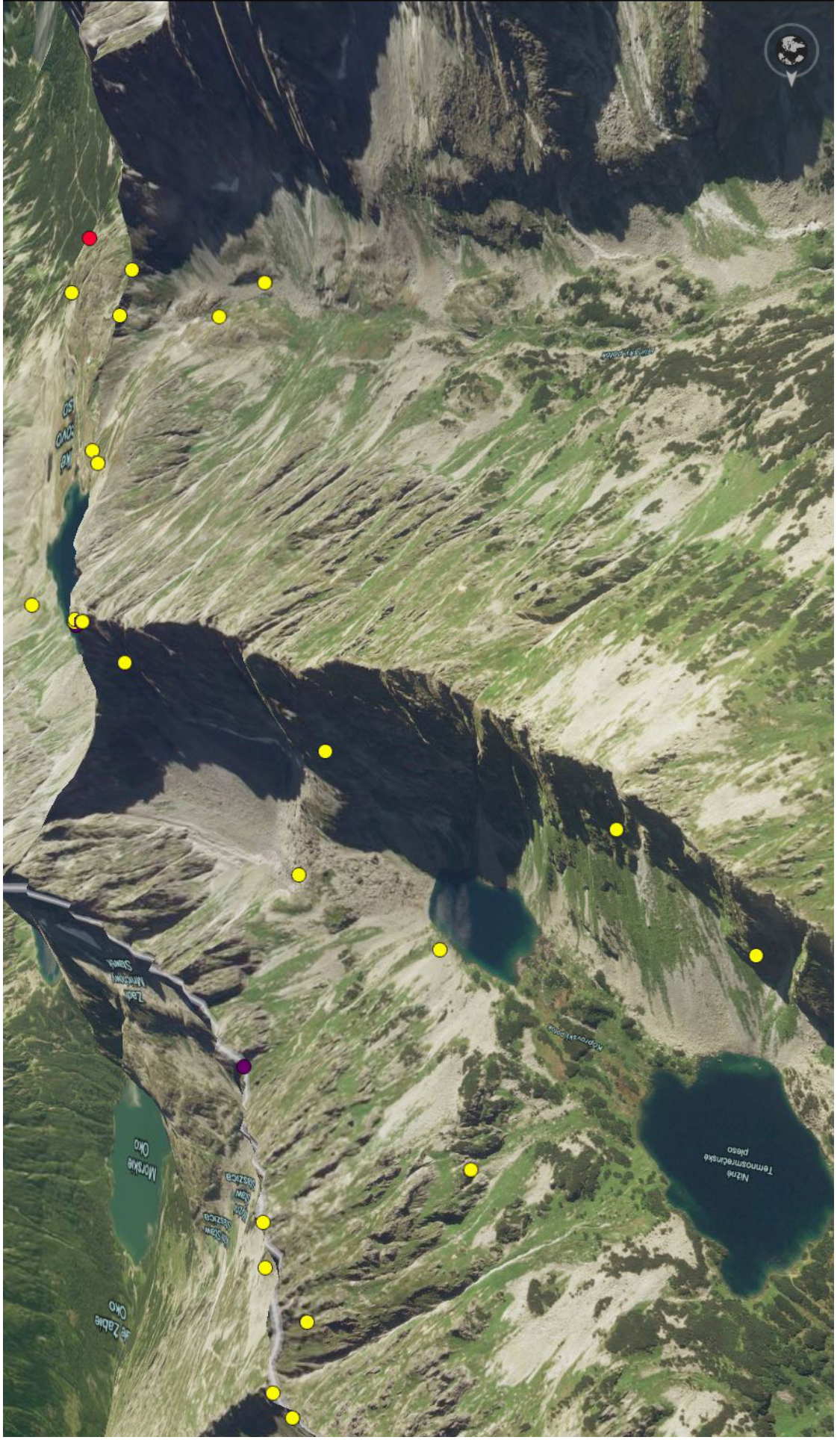


Fig. 21. Liptovské kopy - Dolina Gasieniczowa - Kasprowa - Goryczkowa dolina- In the Liptovské Kopy, the most frequent location of occurrence are: the northern slopes of Liptovská Krížna, Veľká Kopa Kóprová, and Kobyliá dolinka on Kotolnica. In the Gasieniczowa dolina, the birds are usually found at Zadní and Długi staw lakes and on the northern face of Svinica and Svinické sedlo. Along the western ridge the accentors can be seen on Beskyd, Kasprow Vrch (in this location extreme synanthropisation occurs, where birds forage from tourists offloading the cable car) and on Goričkova Kopa. In this area, between Liptovská Krížna and Goričkova kopa I estimate the occurrence of about 20 individuals.

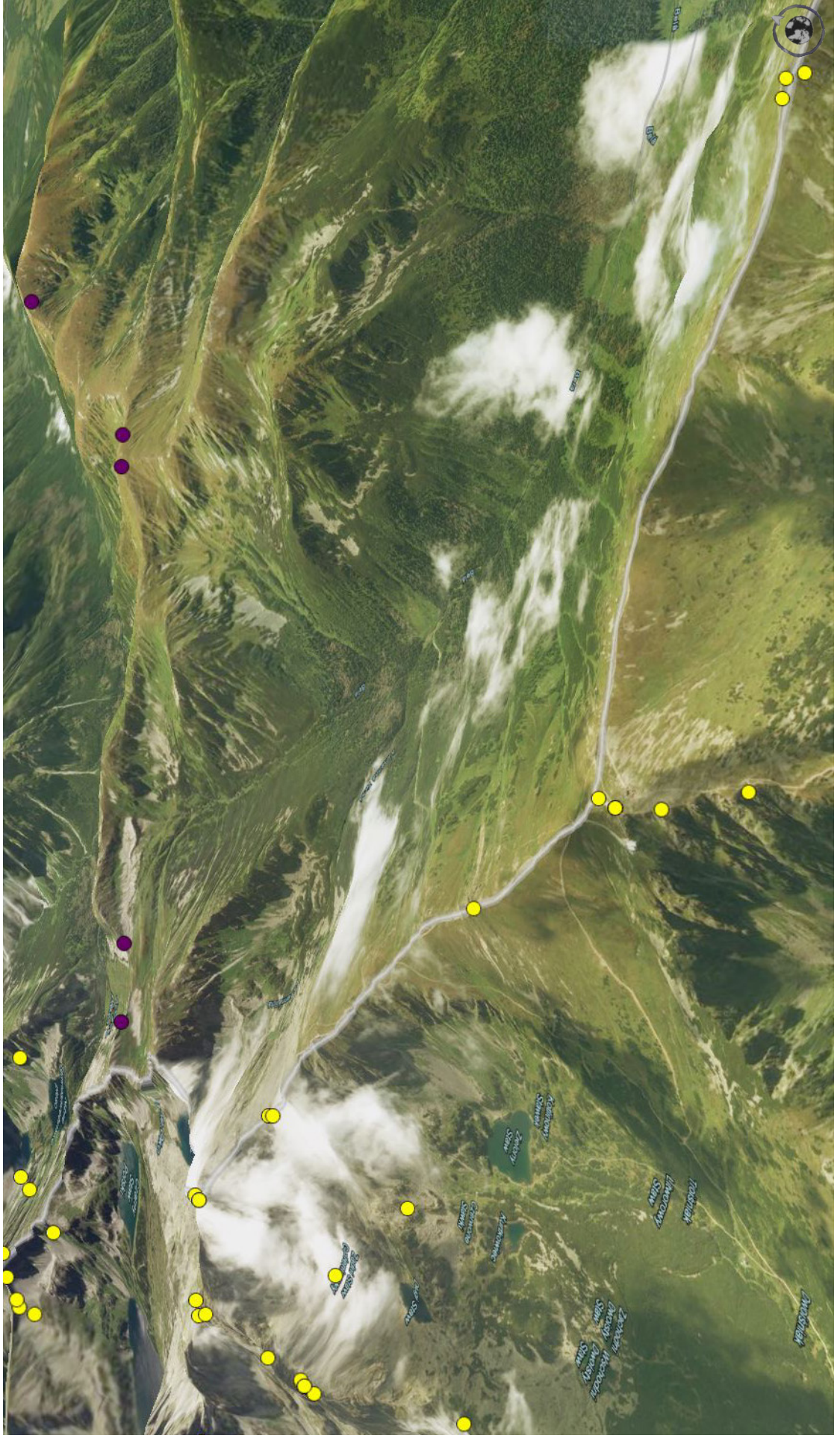


Fig. 22. Mountain ridge Suchá kopa - Malolučníak - Kresanica - Temniak - Temniak - Polská Tomanova - Tomanova kopa - Smrečiny - Kamenistá. This limestone relief is favoured by Alpine Accentors when there are enough rock faces and long-lasting snow fields (Smrečiny), and in several places there is evidence of nesting or fledglings. They are found in the Malolučníak, Temniak, Polská Tomanová, Smrečiny and Kamenistá mountain kettles. The western ridge from Kamenistá to Pysné sedlo is a recurrent feeding site. In autumn, during October, aggregations of 20 or more individuals can be seen. In total, 4-5 families can be identified in the area at the start of the breeding season. The total number of birds is estimated at 20.

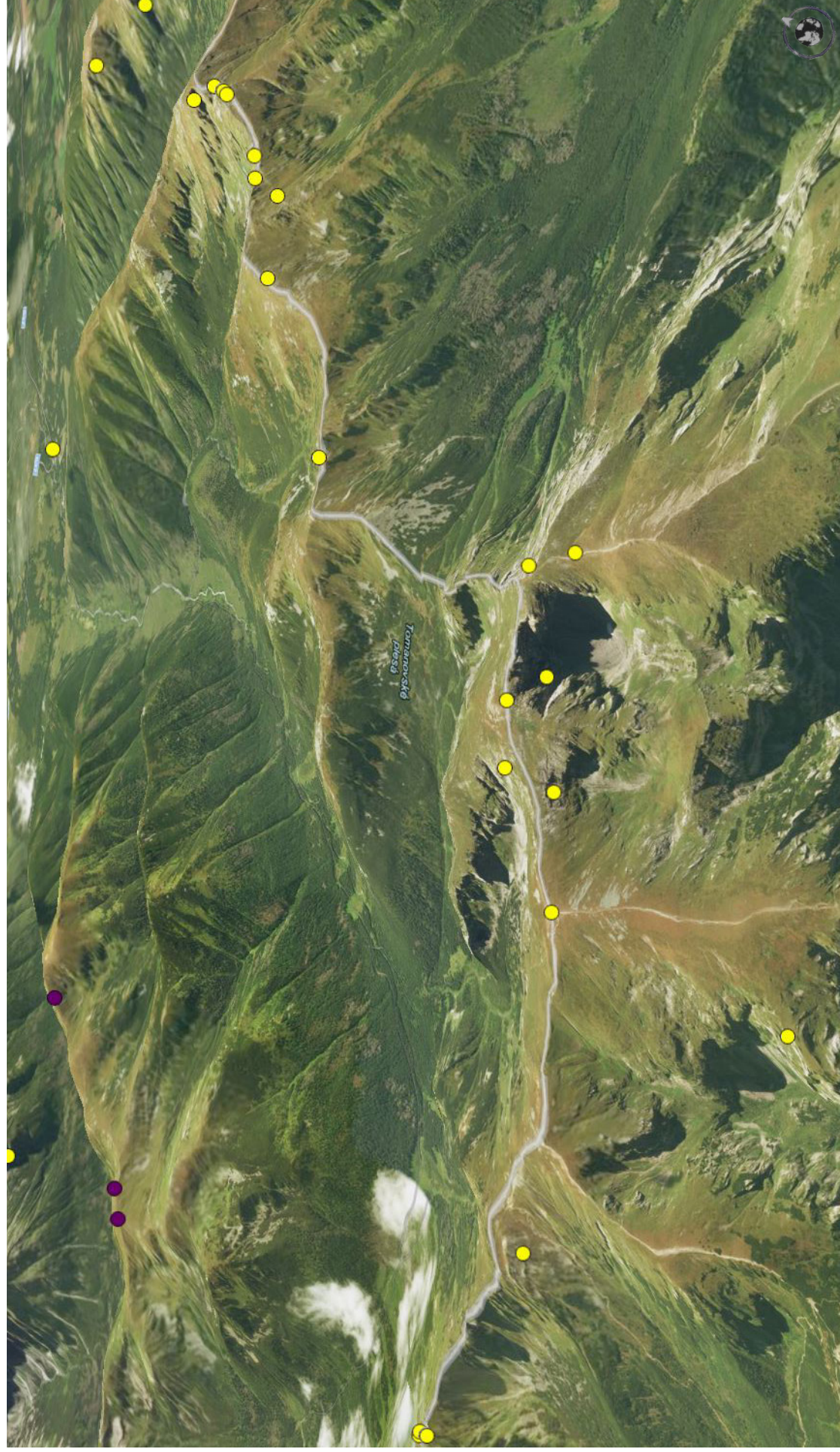


Fig. 23. Bystřá doolina. The eastern slopes of Kotlová and the eastern ridge of Grůň are known nesting places for birds. There is visible phenomena of foraging for litter from tourists on Bystřá. Up to 10 adults are estimated to be present at this location during mating season.

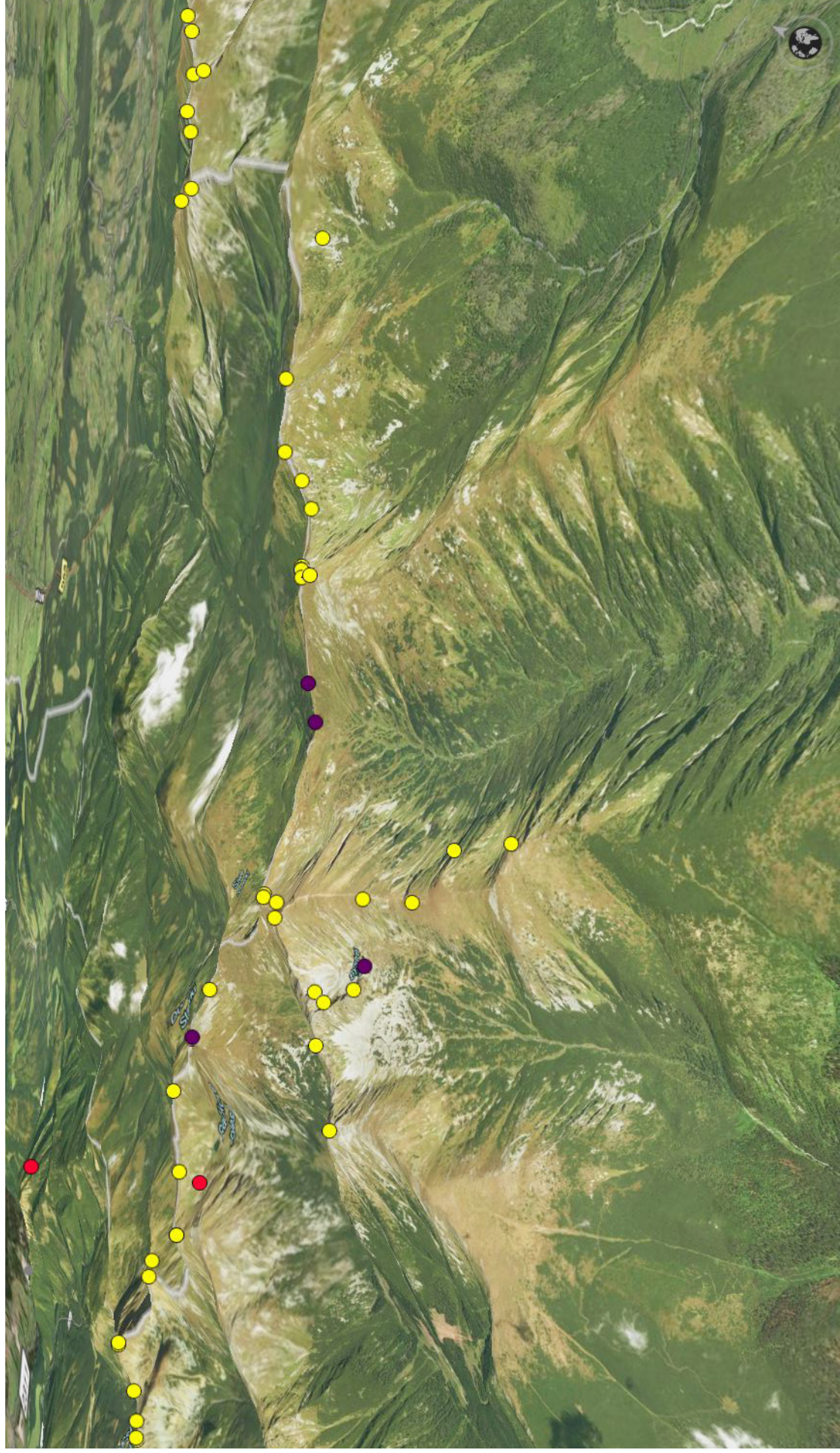


Fig. 24. Gáborova – Račková – Jamnická dolina. Alpine Accentors prefer the Slovakian side of the mountains to the Polish side, which is more meadow-like. Nesting and mating places are observed around Blyšť, Klin, Končístá, Jakubina and Ostredok. In the Jamnická dolina these sites occur near the area of Deravá and Volovec. A small, stable group is observed in Ostrý Roháč. At the time of breeding, a maximum of 15 adults can be estimated in this area.

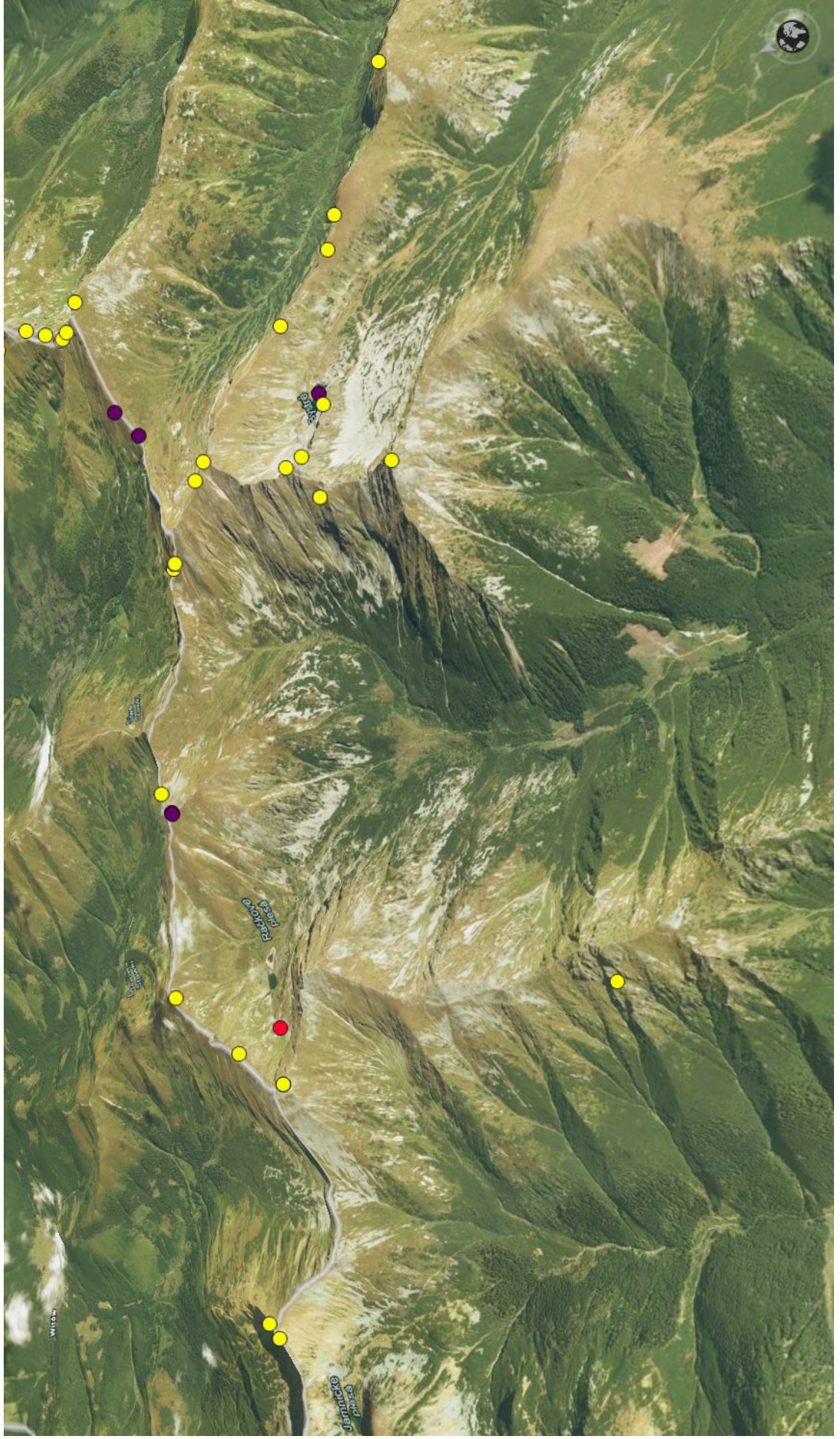


Fig. 25. Žiarska dolina. The family from Baranec flies to Smrek. The other accentors have been raising their young near Plačlivô, Smutné sedlo, Hrubá kopa, Banikov and Prislop for a long time. In winter, a few individuals can be found in the Žiarska chalet. During the breeding season, about 15 adults can be estimated in the area.

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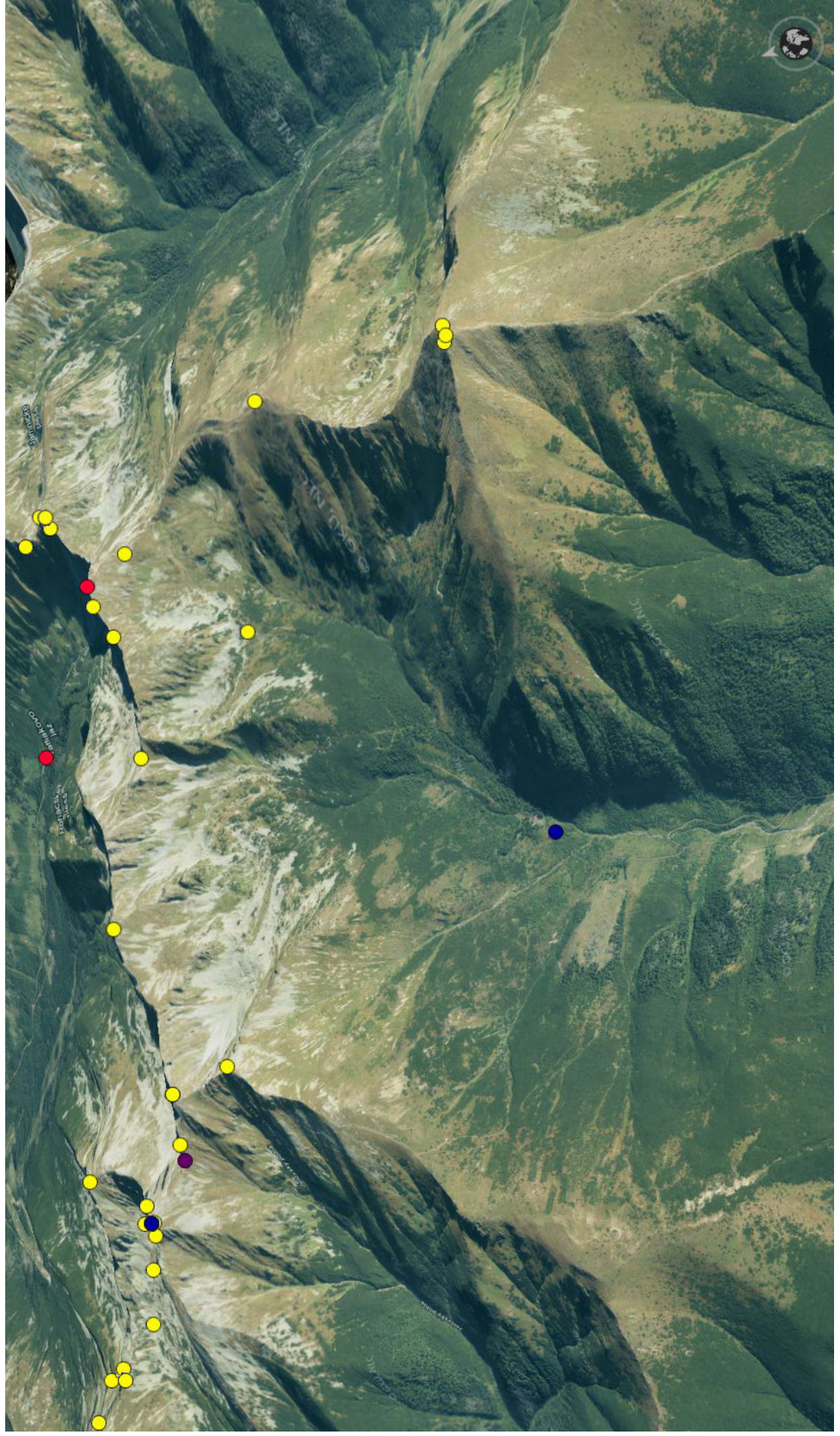


Fig. 26. Patichvost – Hlboká dolina – Podvátovec – Bobrovecká dolina. A large family is permanently present at the end of the Hlboká dolina, with some birds also present at Pachola, Spálená, Skrmiarky and Salatin, where they also stay on the northern walls of these mountains in the direction of the Roháčska dolina. The number of adults in this area can be estimated at about 20 at the beginning of the breeding season.



Fig. 27. Brestová – Sivý vrch, Bobrovecká dolina. A significant family is present on Grapy every year and accentors are also found on the northern slopes of Brestová. A small family also usually nests on the Sivý vrch. At the beginning of the breeding season there are about 10 adults in total.

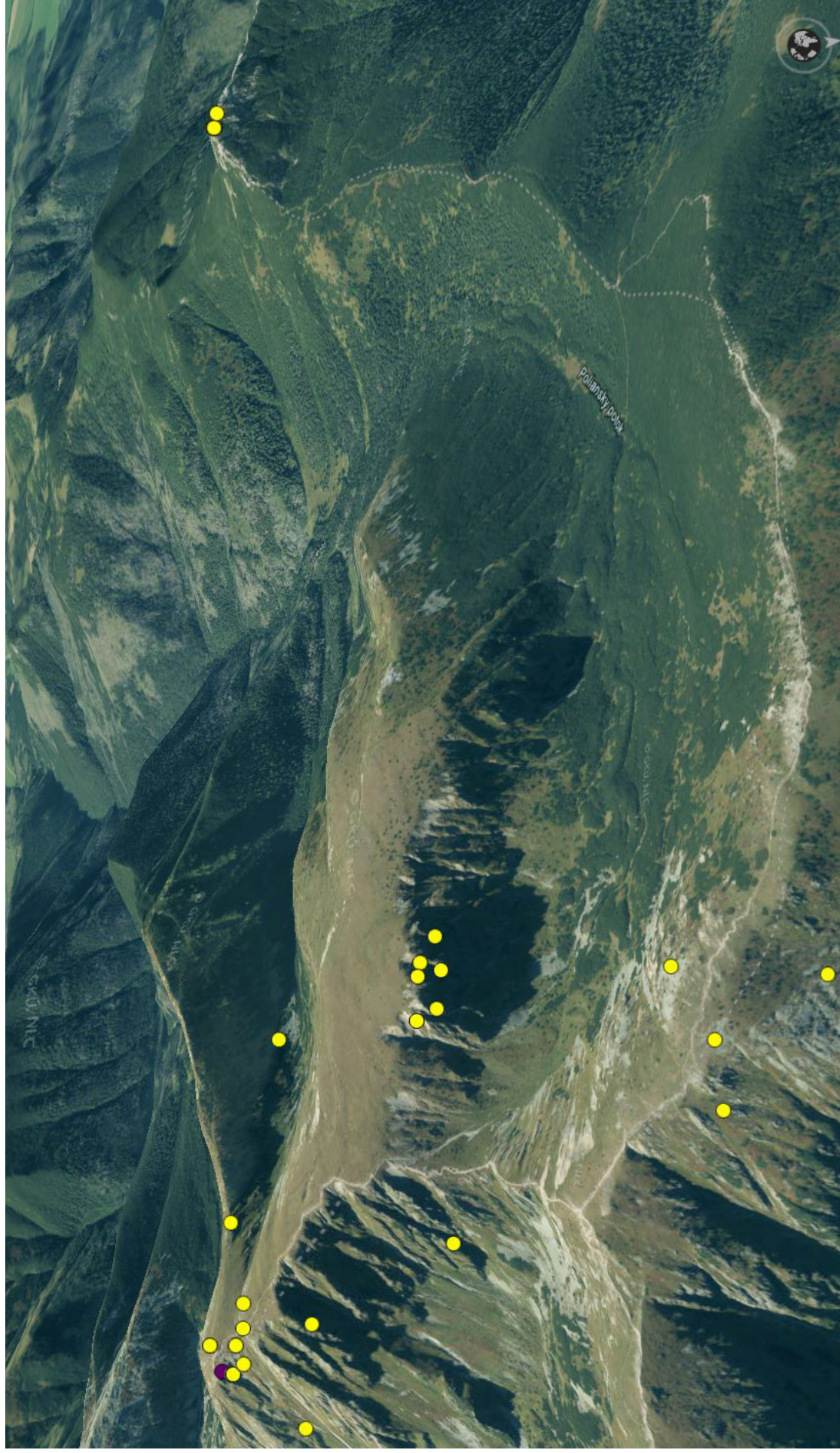
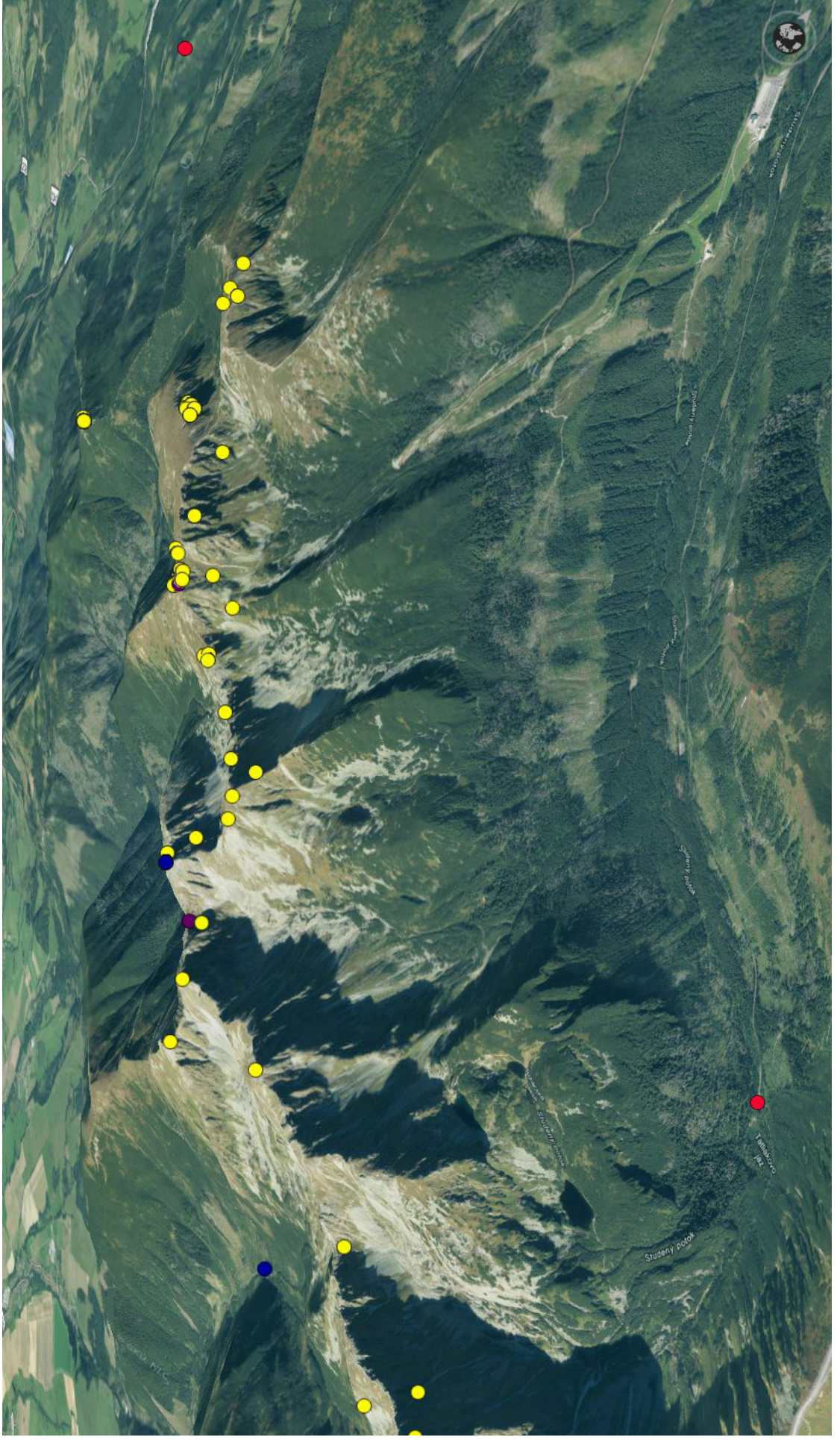


Fig. 28. These are the birds mentioned in the previous figures (Figs. 25-27). They fly to both sides of the Western Tatras. In the Spálená and Salatín basins one or two additional families can be expected. Meaning that about 10 adults are present before the start of the breeding season. In sunny weather, wintering individuals can be seen on the peaks even in the middle of winter.



THE LOW TATRAS



The Low Tatras, Chopok, July 8th, 2005. Photo: M. Janiga

Fig. 29. Kráľova and Stredná hola. The nesting site is likely to disappear over time. Around 2010 the whole family was here on the rocks, including the occupied kettle on Stredná hola. Five years later, no birds have been observed in this location, even when males were expected to respond to recorded birdsong. Based on continuous monitoring to date, it is likely that Stredná hola is no longer occupied. However, accentors may be present in the spring when the birds gradually return to other sites..

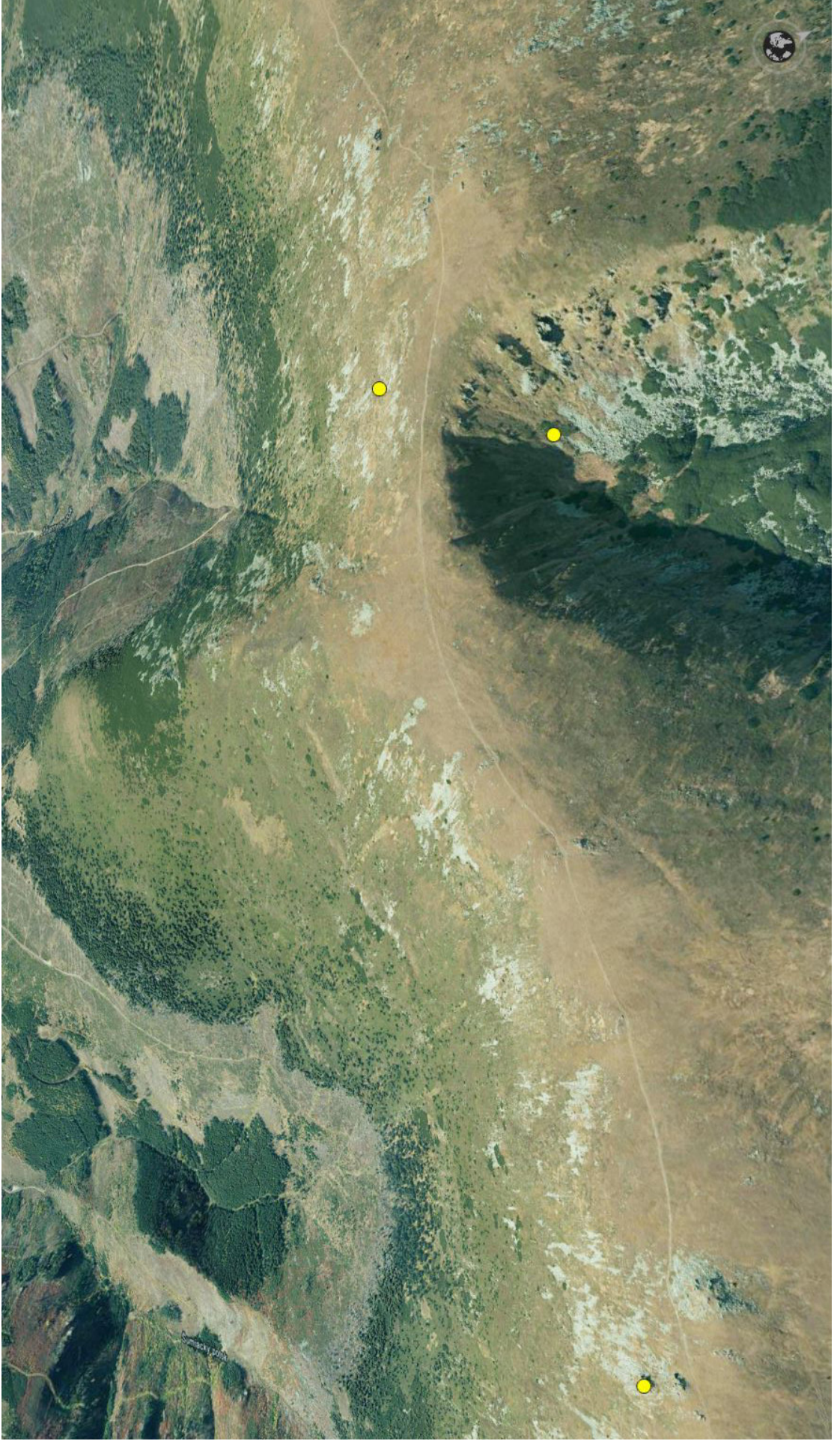


Fig. 30. Orlová. Until 2010-2011 the entirety of the breeding family was located here. In 2015, only one pair was present, and today, no nesting birds have been recently observed. This family was also in contact with the birds on Stredná hoľa, and some males would fly to Andrejcová's kettle for singing. In the case of breeding, a maximum of two to three breeding adults can be expected at the site.

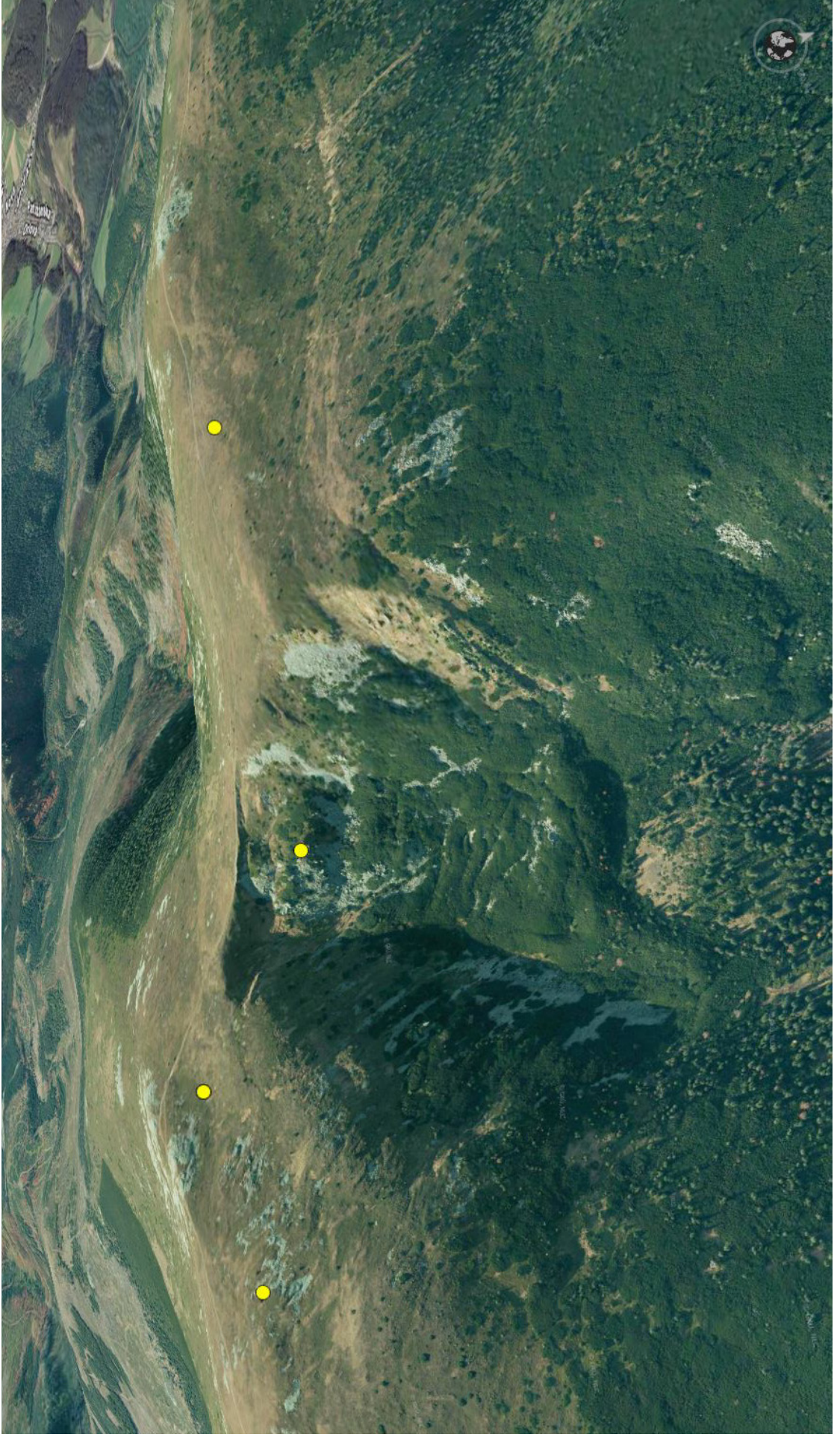


Fig. 31. Ludárova dolina and dolina Salašky – Štiavnica. With 3-4 females at breeding time, this accentor family is quite large. They also nest in the walls of Štiavnica summit. At the beginning of the breeding season, there can be up to 15 adults. Additional females often nest near the ridge, with fewer present in the lower parts of the ridge.

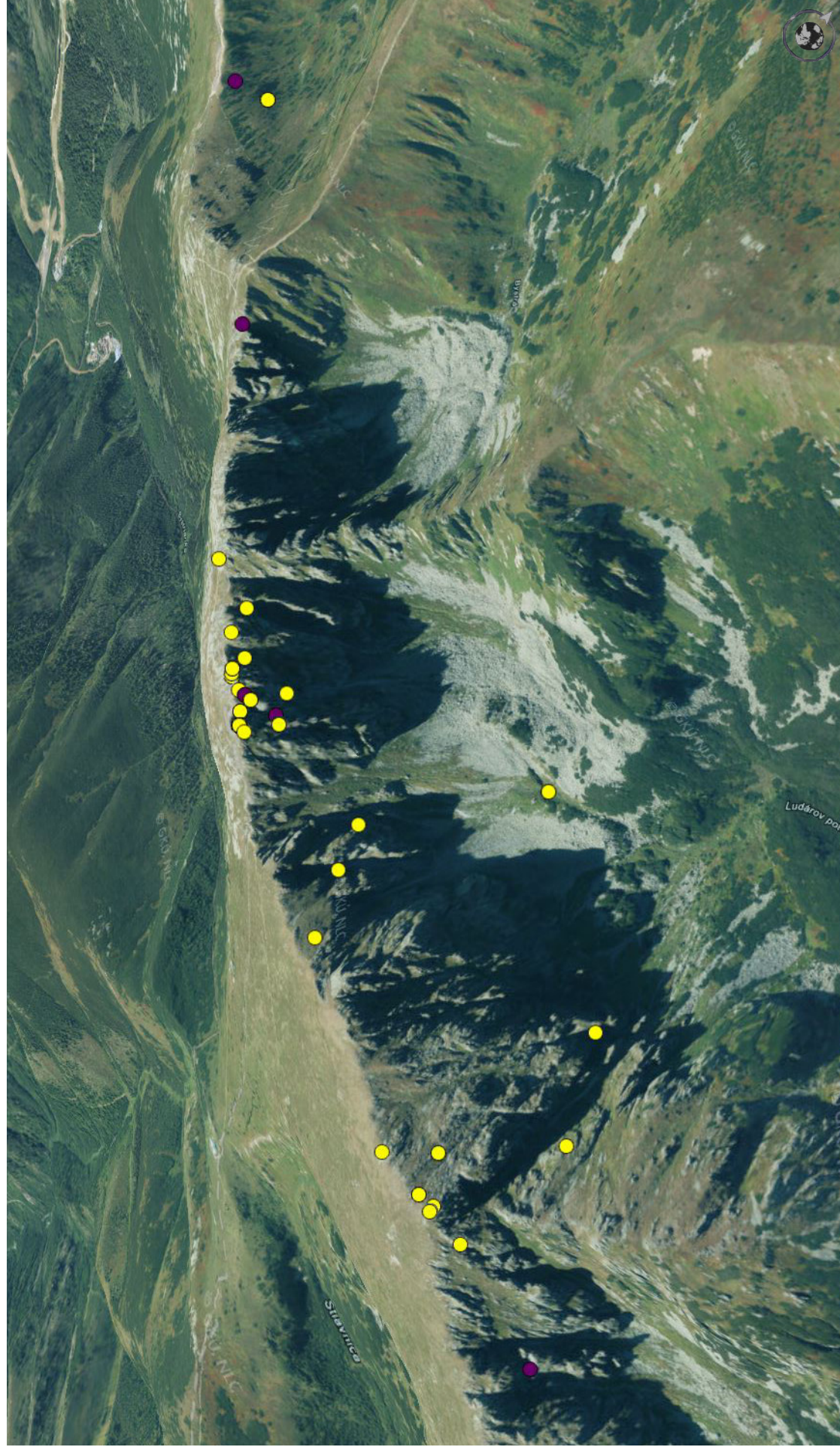


Fig. 32. Luková dolina. There is also a rather large family that can be observed at this location, which, like the family on Ďumbier, is partly synanthropic, and also seeks food from tourists at the top of Chopok, near the upper cable car station and at Kamenná chata. This family usually nests below the peak of Chopok, in the walls of Kónské and Kónský grúň. In severe weather or sometimes, during spring, individuals may also forage in the vicinity of the intermediate cable car stations. At the beginning of the breeding season there are about 10-15 adults.

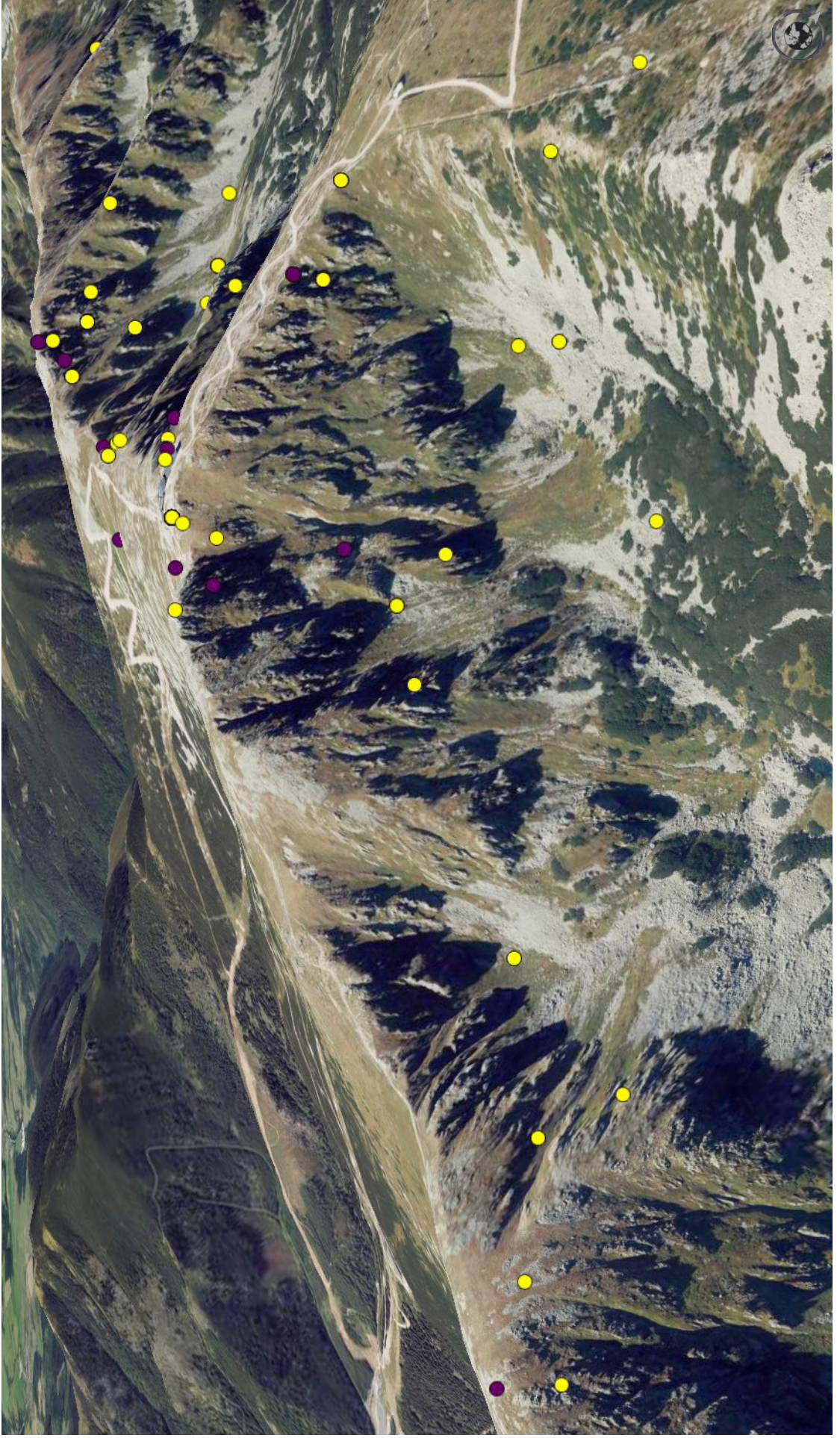


Fig. 33. Doliny Otupianka and Zadná voda. The centre of the family on the line Chopok - Dereše - Polana is the peak Dereše. The north-western part of Dereše is used more as a singing area than as a real nesting site. Usually there are three or four nests here, and the number of nesting adults is estimated at about 10.

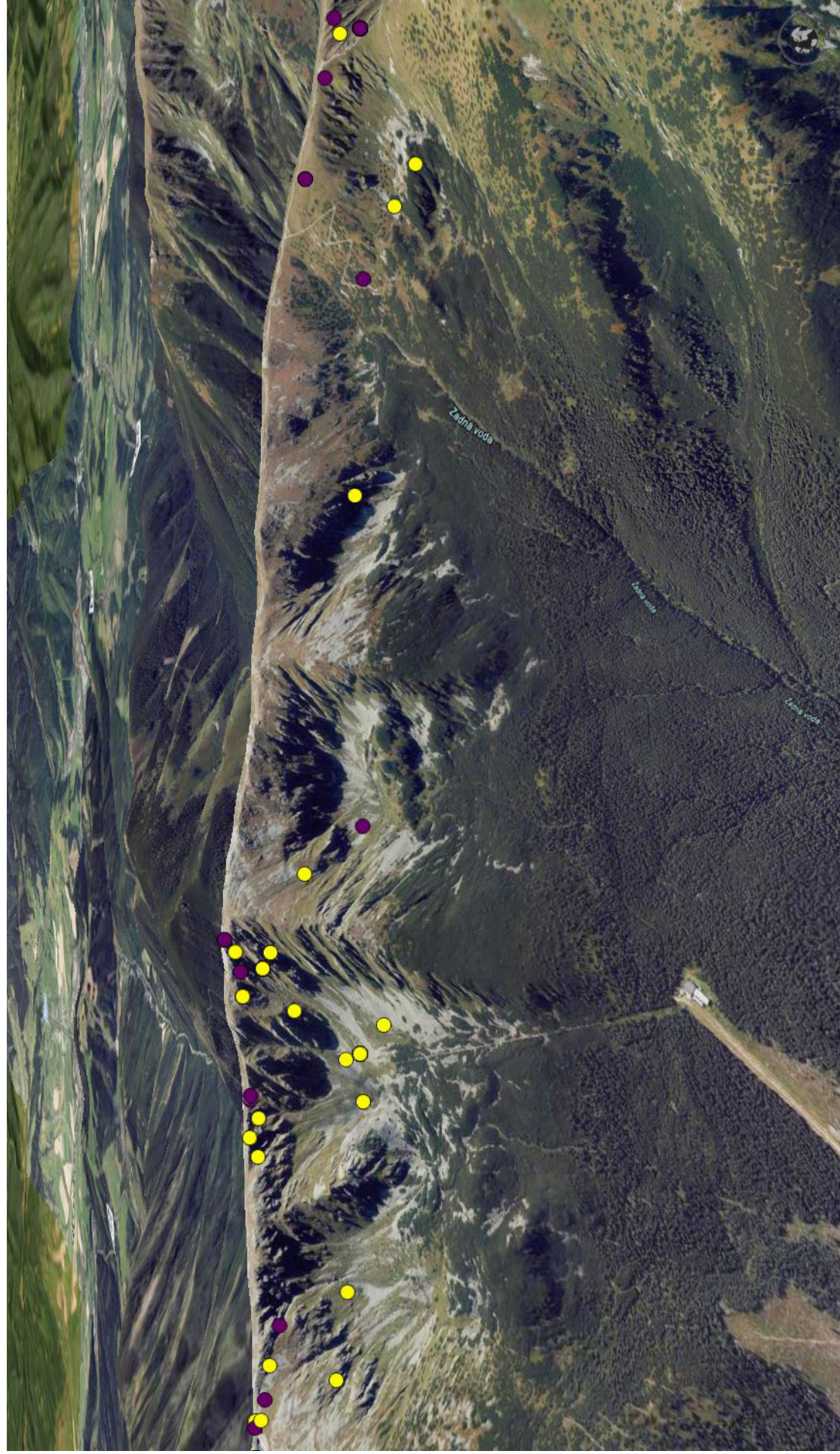
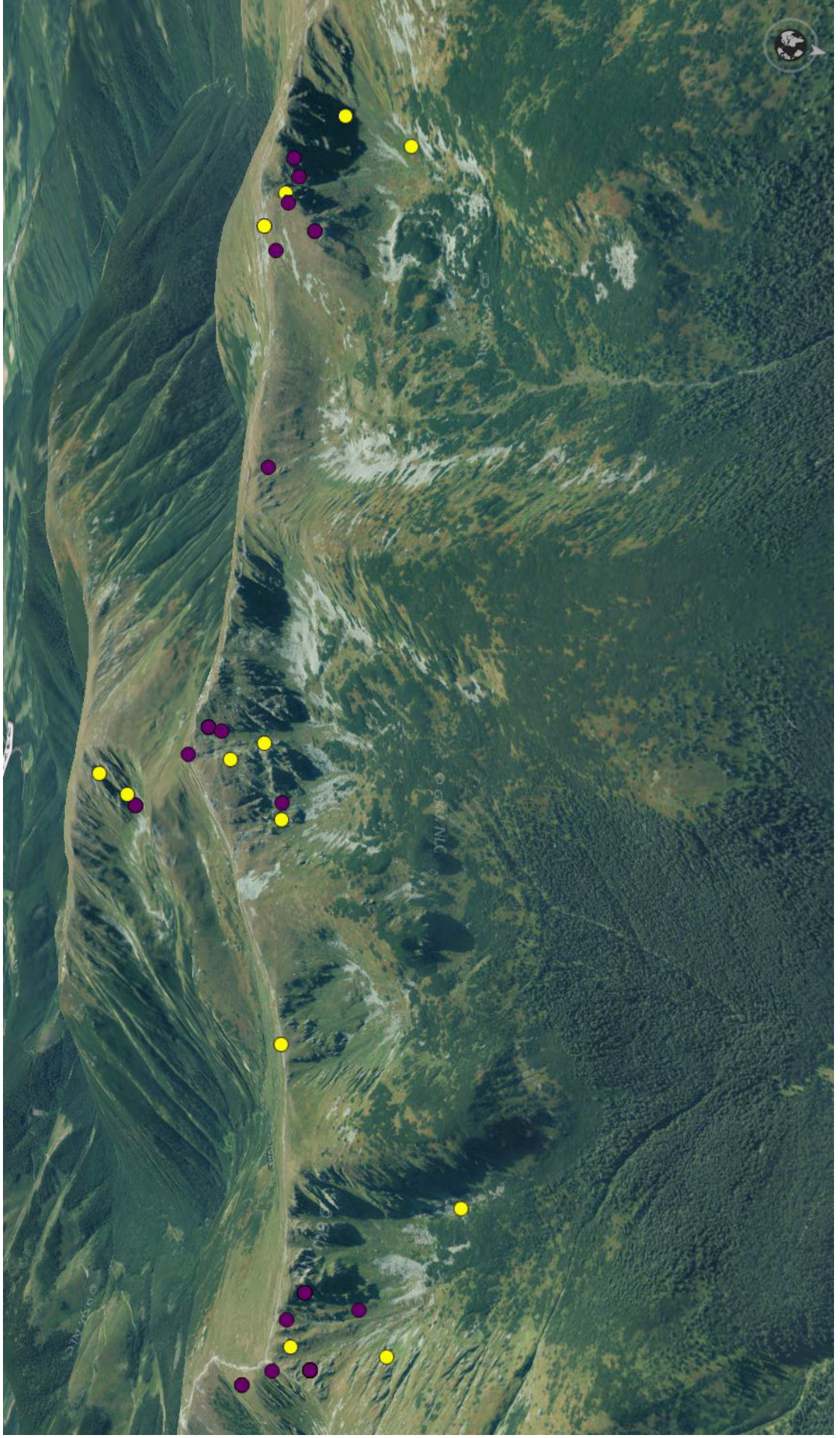


Fig. 34. Dolina Paludzianka - Zadná dolina - dolina Chabenec - Vajskovská dolina. On the trajectory of the peaks Bôr - Polana - Kotlíská - Chabenec - Skalka, there are around three independent families, each with potentially two females; one nesting at a lower altitude and the other nesting near the ridge. Birds from Kotlíská fly to Vajskovská dolina below Skalka, where they also nest. In total, up to 20 breeding adults can be estimated in this range. The area around Kotlíská is also a favourite place for flocks of up to 30 or more accentors in October. At this time of the year the accentors face predation from Goshawks (*Accipiter gentilis*) and Eurasian Hobbies (*Falco subbuteo*), that come to the area to hunt migratory songbirds.

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OTHER MOUNTAINS



Malá Fatra, Rozsutec summit, August 24, 2017. Photo: M. Janiga

Fig. 35. Velký Choč is the significant hill in the Choč Mountains where it is possible that birds may occasionally breed. However, the birds use this hill every year on their spring migration route, and also appear on the hill in winter when the weather is sunny. In the case of potential breeding, only one family comprised of one female and two males may nest here.

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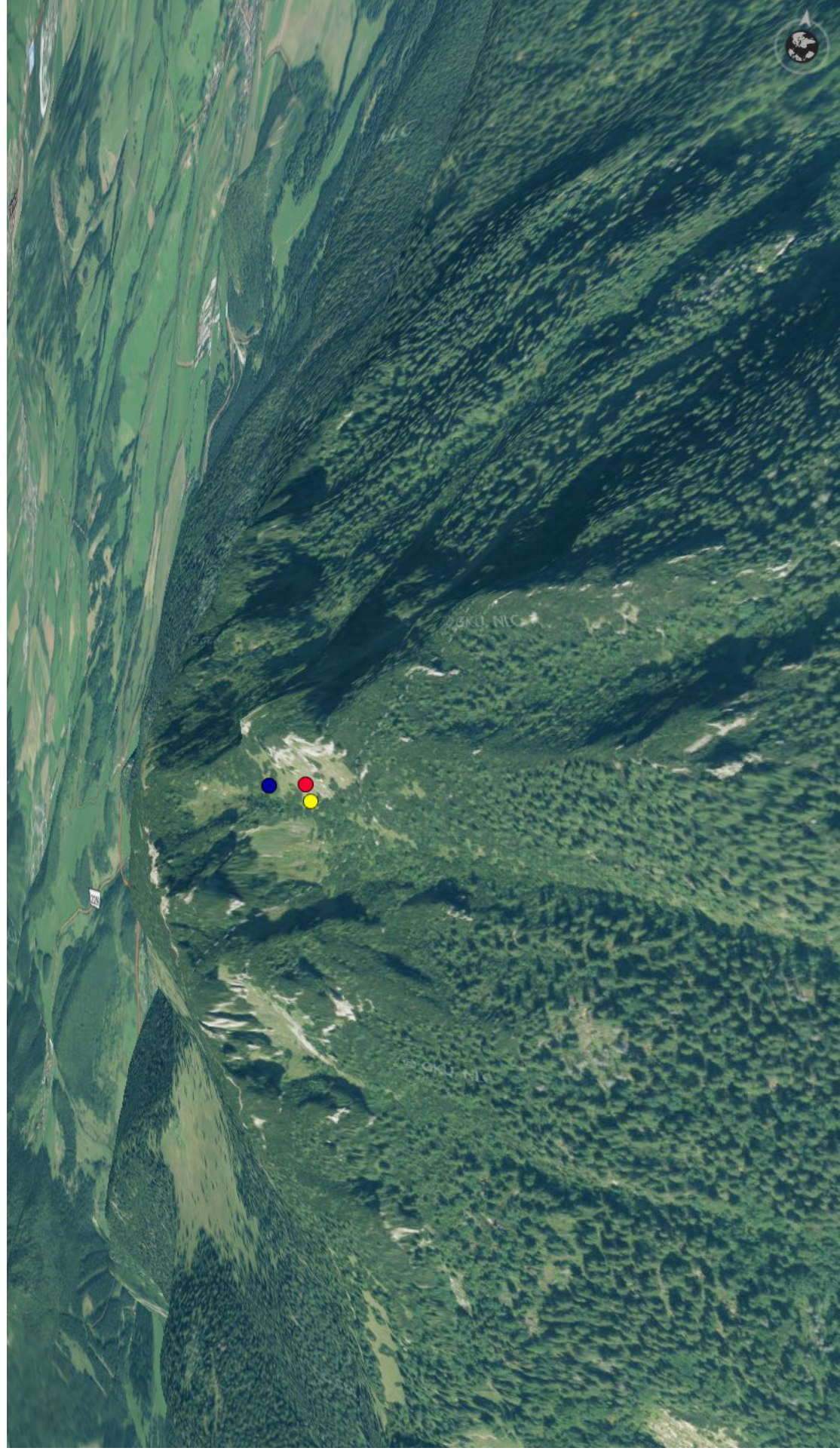


Fig. 36. Malá Fatra. Birds nest in Velký Rozsutec every year. Only one pair or family of three to four adult birds has been observed over the past few years, but they seem to successfully raise chicks in the conditions present in Velký Rozsutec. The birds scavenge for rubbish left by hikers and are largely accustomed to a synanthropic way of life.



Fig. 37. Malá Fatra, Chleb and Velký Fatranský Kriváň. Chleb used to be a well-known nesting site, and it was thought that these birds also nested on Velký Fatranský Kriváň. More recently, nesting on these mountains has likely ceased. It has not been possible to record the presence of birds over the last several years, even during nesting season. As a result, only spring migration sites are marked. The birds stop here every year to feed on insects found on the snow islands located on the ridges.

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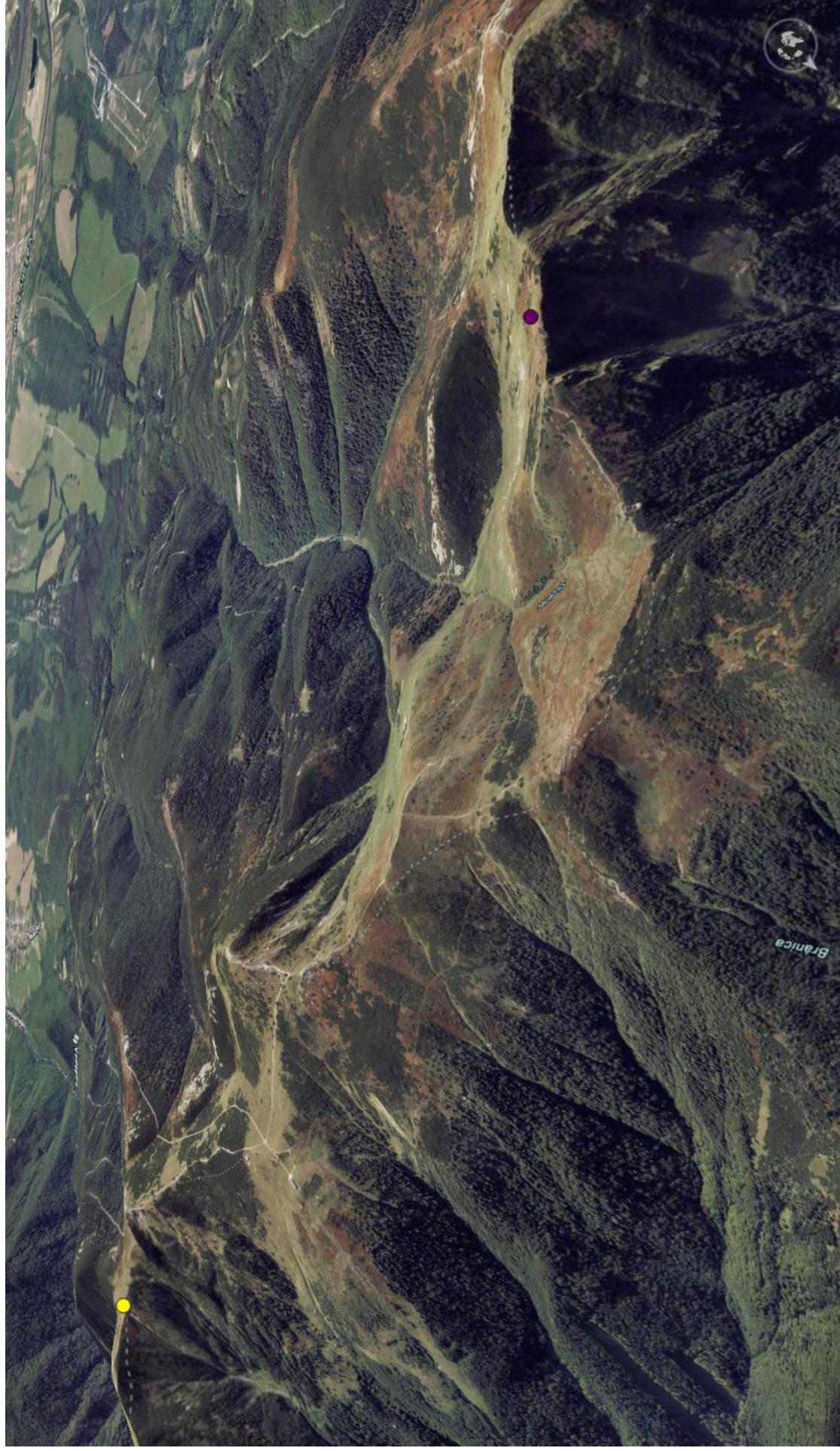


Fig. 38. Velká Fatra. Suchý vrch has been a nesting site for a long time, but the birds do not nest there every year. More recently, birds raise their chicks at this location. Two or three adult birds can be counted at the beginning of the nesting season.

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M. Janiga

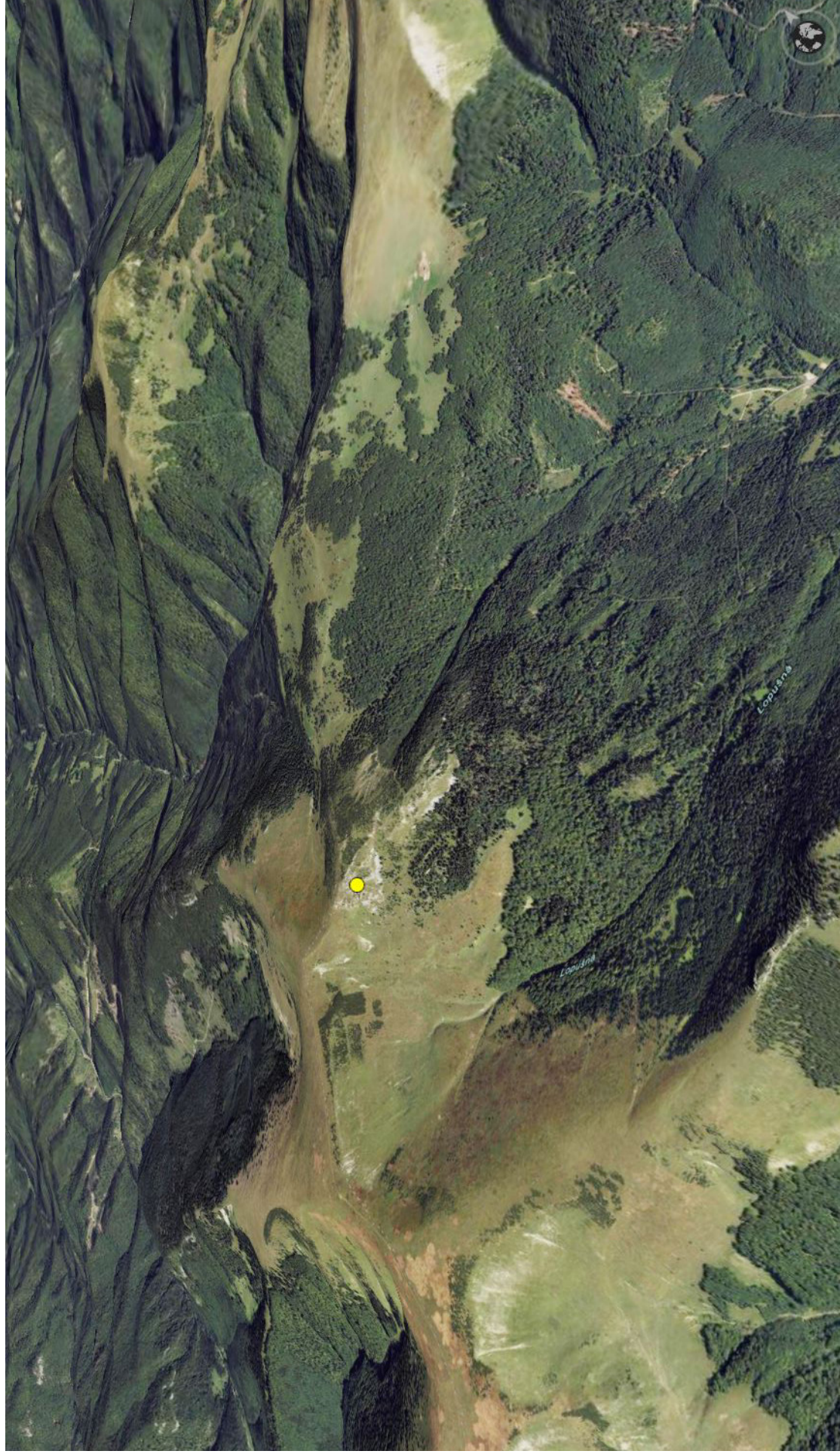


Fig. 39. Babia hora. Local Slovak-Polish ornithologists still report that at least one family could nest at this location. However, no fledglings have been seen. This site is part of the annual migration route for birds in both the spring and autumn.



Discussion

Abundance and density

In the Belianske Tatras and the Central Tatras, including the peak of Kamenistá, there are about 390 Alpine Accentors; in the West Tatras about 80 at the beginning of the breeding season; in the Low Tatras about 60; and in other Western Carpathian mountains about 15. In total there are about 550 breeding adults in the Polish and Slovakian Western Carpathians, forming polygynandrous families of which the author estimates that there are about 330 males (Fig. 40.). The estimated 550 individuals in the Western Carpathians is closer to the maximum than to the minimum interval. This estimate is very close to that given in the monograph by Hudec (1983). There, the authors put the number of individuals in Slovakia at about 90 pairs, or 180 individuals. If we consider the breeding birds in Poland, there are about 250 individuals, which is already close to the minimum that can be considered at present. Excluding Polish birds, the abundance of *Prunella collaris* is of the same order as that reported by Murin *et al.* (1994), who estimated a minimum of 300 to a maximum of 400 breeding adults in Slovakia, well within the confidence intervals of both the results of this study and the estimates published in Hudec *et al.*'s (1983) monograph.

Estimates of the number of Alpine Accentors also varied widely (cf. Karaska *et al.* 2014). They depended on contemporary ornithological knowledge and the ability and experience of the authors to observe individual birds. Mihál (1973) estimated the number of breeding pairs within the boundaries of the Tatra National Park (excluding the Western Tatras) at about 10-20, or a maximum of about 40 individuals. Štastný *et al.* (1987) estimated the number of birds in the whole of the former Czechoslovakia at a maximum of about 400, or about 380 individuals in Slovakia. Mošanský (1974) states that in the "Belanské Tatras an abundance of 63" has been found in the alpine zone. Glowaciński and Profus (1992) attempted to determine the number and vertical distribution of bird species in the Polish part of the Tatra National Park based on three daily observations made in May, two in June, and one in July 1981, then repeated these observations in 1982. In publishing the altitudinal distribution of *Prunella collaris*, they came to the somewhat exotic conclusion that birds on the Slovakian side live at higher altitudes than those on the Polish side. These are often the same ridges, but on the Slovakian side they may be hillier, while on the Polish side they are rockier. Predictable, the birds are often the same individuals. Authors estimated the number of breeding pairs of *Prunella collaris* in the Polish Tatras at 150-300, or at least 300 individuals in 1981-1982. This number is too high (cf. Bobrek 2016), because of the coincidence of the observations and the lack of knowledge of the biology of the species (as the same individuals are flying and feeding during the day on either side of the Tatras, and then flying over the summits). Tomialojć (1990) reported about 400 to 700 individuals in the Polish Tatras alone, and a few

pairs in Babia Góra (cf. Bocheński 1970). Between 1992 and 1995, Cichocki (1995, 1996) lists as many as 359 Alpine Accentor sites in the Polish Tatra National Park, which is undoubtedly related to both the overflight and the movement of individuals between sites, as well as to seasonal changes. Extremely high numbers of Alpine Accentors (e.g., 122 pairs in Dolina Pieciu Stawów Polskich) described by Cichocki (2004, 2015) do not correspond to the habitat and territorial possibilities of this species. In a way, they mislead both the professional and the conservationist public, as the number of individuals of this species in the Western Carpathians is low. The author also publishes some other misleading information about the way of life of this species, (e.g., that the birds live in pairs, etc.). The numbers from the Polish Carpathians are huge and unrealistic, with Bobrek (2016) currently reporting around 920 birds in an interval of between 400 and 1,600 birds in the Polish Tatra Mountains alone. The sheer size of the interval shows how imprecise these numbers are and how they do not allow us to follow the changes in the abundance of the local populations in the Tatra Mountains, as evidenced by the loss of breeding of Alpine Accentors in the peripheral mountains of the Tatra Mountains. From this data, the author cannot conclude anything other than that "the trend of *Prunella collaris* populations in Poland is unknown". On the contrary, Dyrzcz and Mielczarek (2007) point out that the status of *Prunella collaris* populations in the Carpathian Mountains is probably deteriorating. Slightly more realistic and higher numbers were given by Mihál (2006) from 1997, when he estimated the total number of Alpine Accentors in the Tatra Mountains (Belanské, Vysoké and Západné) at 80 to 100 individuals. He did not specify whether this data included the Polish Tatra Mountains or not. At the beginning of the 21st century, Michalec in Karaska *et al.* (2014) estimated the number of breeding individuals in the Roháče at 18-30 individuals.

A reasonable estimate of abundance in a particular mountain range may be indicated by the size of autumn and spring aggregations. For example, on May 16th, 1978, up to 80 and 110 birds were observed in the Belianske Tatry, respectively (Šimek and Petr in Štastný *et al.* 1987). Although, it should be noted, mainly in autumn, that these may only be migrating birds that have just stopped momentarily on the ridges. For example, accentors from the High Tatras may feed on the ridges of the Low Tatras in October before they fly south. The expression and comparison of density or abundance per unit area is also very problematic in the literature. Because birds live in high mountains, density is often calculated per unit area (e.g., 10 ha). However, such conversions are inaccurate due to altitude and slope gradients, and figures are imprecise. For example, Hudec (1980) recalculated the abundance in the High Tatras to 2.9 individuals per one km², and Randík (1981) calculated abundance in the Malá Fatra to only 1 individual per 0.1 km². In addition, the authors' method of producing occurrence maps is very crude. It is based on impressions of the terrain configuration and is therefore not very informative (Wasilewski

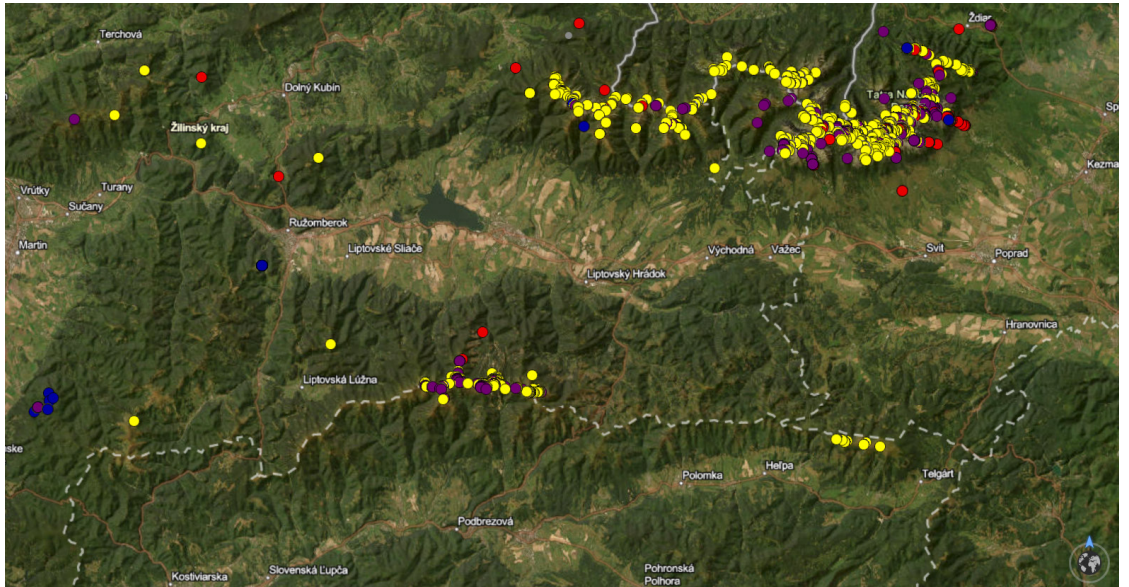


Fig. 40. The West Carpathian „islands“ of the breeding distribution of the Alpine Accentor.

1996, Karaska 2002). Similar measurements of bird density were made on the Polish side - about 3-4 individuals per 10 ha (Głowaciński and Profus 1992). Dyrzcz and Janiga (1987) reported 2-3 individuals per 10 ha for the alpine environment of the Tatras. After a complete contemporaneous analysis of breeding families, we now know that at the beginning of the breeding season there are far fewer birds, but during summer or autumn surveys some authors can double the number when fledged young appear. This was the case in our 1987 approximate survey.

Spatio-temporal variability in breeding

One of the most important factors determining the presence of the Alpine Accentor in the area during the breeding season is the presence of

low-growing alpine meadow communities (cf. Michalec in Karaska *et al.* 2014). These provide the accentor with food on the ridges in the form of wounded and native insects, and, in the autumn, seeds from native grasses (Fig. 41.). In addition, in low-growing meadow communities it is much safer to look out for predators such as hawks or pygmy hawks. Due to climate change and the shift of tall grasses and blueberries to higher altitudes, the habitats of not only accentors, but also, for example, Ring Ouzels (Resano-Mayor *et al.* 2019) or marmots (Prodaj and Kompišová Ballová 2021) are disappearing. It is therefore understandable that the documented hypsometric range heights in the Western Carpathians vary between authors (Hanzák 1954, Klíma 1959, Pikula 1962, Boháčik 1974, Mošanský 1978, 1979, Kupcová and Boháčik 1980, Randík 1981).



Fig. 41. Nefcerka, the High Tatras, June 30th, 2022. The presence of low-growing alpine meadow communities is one of the most important factors determining the presence of the Alpine Accentor in the high mountains. Photo: M. Janiga.

What is most important for occupying the peripheral mountain ranges, however, is that Alpine Accentors can breed or fail to breed for periods of several years, depending on the suitability of the climate each year. In the past, this was well described by Pikula (1962) from Skalné vráta in the Belianske Tatry, which is a peripheral, relatively forested part of this mountain ridge. The author writes that in 1956 he found a pair of *Tichodroma muraria*, two pairs of *Phoenicurus ochruros*, and a pair of *Prunella collaris* on the rocks to the west and east of Skalné vráta. During 1958, he found none of these species here. He also wrote that *Prunella collaris* was less common overall in 1958 than in 1956. This interrupted breeding is likely found throughout the Western Carpathians, in locations like Choč, Šíp, Osobitá, Salatín in the Low Tatras, Babia Hora, etc. (cf. Kocyan 1884). Cold years are a very limiting factor for this paleo-montane species in the Western Carpathians. This was probably the case in the winter of 1882/1883 when, according to Kocyan (1884), almost no young were seen below the Roháče Mountains in August 1883 compared to the previous three years. For example, the author also noticed that three individuals flew to the forester's house in Oravice on May 16th, 1882, after a heavy snowfall in the mountains, and described that in October the birds already descend to the level of the dwarf pine forests; at present a large part of the Tatra population stays on the mountain ridges in October, usually in larger flocks.

Synanthropy

Man has had an impact on the alpine vegetation of the Tatras since the end of the 16th century. At that time, local mining tunnels were built on the southern and south-western slopes of the Kriváň summit. The highest, used for tin production, was

50 metres below the peak. As early as at the turn of the 16th and 17th centuries, the first tourists appeared on the highest peaks of the Tatras. In the 18th and 19th centuries, tourism became more and more intensive, as high mountain chalets were built and the process of synanthropisation of the alpine fauna began (Ferianc and Feriancová 1956a,b, Ferens 1962, Radwańska – Paryska and Paryski 1973, Mihál 1973, Cichocki 2004, 2015, Janiga 2022). The colonisation of the Tatra high mountains by miners, shepherds, mountaineers, and tourists is described in detail by Bohuš (2003). Few publications describe the history of humans in the high mountains in such detail, with minimal references to fauna, touching only on chamois, marmots, and wallcreepers. At the end of the 20th century, the number of daily visitors to these peaks during the peak of tourism season fluctuated between 300 and 1,500 people per day, compared to the turn of the 19th and 20th centuries, when this number was only about 50 people per year (Kocian 1989). At the end of the 20th century, the average daily number of hikers on the high alpine paths in the peak months was around 23,000 (Kocian *et al.* 1989), while the average annual number of hikers at the beginning of the 20th century was around 15,000. At the end of the twentieth century, the scientific community estimated the number of daily visitors in the high mountain areas at 7-8 thousand. This number varies according to the ecosystem and geographical type. The result was, and still is, the destruction of the native ecosystems of the Tatra National Park, including depletion of the native vegetation, limiting space for fauna to exist, introduction of invasive species, synanthropisation (Fig.42.), dumping of waste near the huts, eutrophication of the mountain lakes, waste on the mountain tops, noise, and disturbance of the fauna, etc. (Kocian 1989, Karaska 2002, Bobrek 2016).



Fig. 42. Rozsutec, Malá Fatra, August 24, 2017. A juvenile taught by its mother to eat bread garbage left by mountain hikers. Photo: M. Janiga



Fig. 43. Wintering, village Ždiar, January 3rd, 2019. Photo: M. Janiga

Individual differences in migration distances

Individual differences in migratory range undoubtedly follow natural patterns. The behaviour of birds staying several kilometres away from their breeding grounds during the winter has been described in detail with the help of photo traps (Janiga 2021). It has been shown that when weather in the highlands turns bad, the birds fly to known food sources in the foothills. But when the weather gets better, they disappear from the foothills (Fig.43.) and are found on the Tatra summits throughout the winter. Thus, they alternate their movements during the winter (Janiga 2021). Individuals that fly longer distances are usually reported as females with some of their young. However, some individuals can fly long distances (around 500 km and more – Krišovský 2009), so it would be very simplistic to claim that this species only migrates short distances from its breeding sites (Kovalík *et al.* 2010). We can only assume that these longer distances play a serious role in natal dispersal. However, it is true that adult females return to the same breeding site, and sometimes even to the same burrow, which the author has observed on several occasions.

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