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Parasitological survey on golden jackal (*Canis aureus l., 1758*) in Friuli Venezia Giulia region (Italy)

Beraldo P., Pesaro S., Saccà E., Dorigo L., Lapini L., Bregoli M. And Filacorda S

Purpose/Objective: The golden jackal (GJ) is an expanding mesocarnivore in Europe and its presence in north-eastern Italy has been documented since the 1980s, consolidating its presence over the time and, therefore, constantly monitored both from the ecological and health perspective. In fact, its biology and behaviour set the stage for infection by a wide range of pathogens, including parasites. Material/Methods: Therefore, over the past 10 years, 47 road killed GJs in Friuli Venezia Giulia (FVG) region have also been investigated for parasites. Carcasses were collected throughout FVG, frozen before examination, and submitted to biometric analysis, necropsy and parasite collection by total worm count. All recovered parasites were identified according to their morphology and selected parasites were preserved at -20°C for DNA analyses. IZSVe also investigated on *Trichinella* and *E. multilocularis* presence. Coprological analysis was performed with feces collected from the rectum. Results: 91.5% of the examined population was parasitised, although in general the average parasite load was quite low (29,5; range 1-499). 68%of the animals had polyparasitism with on average from 2 species/animal (range 1-6), only in 8.5% the infracommunity was composed of 5 or 6 helminthic species. A total of 1280 parasites were counted, identifying 18 helminthic species: 11 *nematodes (U. stenocephala, T. canis, T. leonina, A. putorii, C. plica, M. legerae, T. vulpis, P. affinis, A. vasorum, C. vulpis, E. aerophilus)* 2 digeneans (M. yokogawai and A. alata) and 5 *cestodes (T. hydatigena, T. pisiformis, T. serialis, D. caninum and M. litteratus)*. Faeces collected from carcasses (n=22) presented generally parasitic elements attributable to the identified endoparasites, while 59% of animals were positive for Sarcocystis sp.. Muscle tissues were always negative for the search of Trichinella as well as faecal/gut samples for *E. multilocularis*. Few hard ticks (*I. ricinus, D. marginatus and D. reticulatus*) and fleas (*C. canis*) were found in 40% of the animals. Until now, all the animals were negative for *Trichinella spp*. and *E. multilocularis*. Conclusion : This study represents the first investigation on GJ parasites in Italy. The parasitofauna of FVG GJ population is almost overlapping with that reported in other European countries. The good parasitic biocenosis (even if the prevalence and mean intensity of infrapopulations is generally low) of FVG GJ is related to juveniles' dispersion between Italy and Slovenia, territorial mobility, and a very unselective diet. Most of these parasites can be shared with other wild canids and domestic dog. Our data help demonstrate the importance of GJ as a wild reservoir of human and animal parasites and, therefore, it is essential the health monitoring of this wild canid.

Synchronizing cranial morphometric measurements for *Canis sp.:* exemplifying on the first golden jackal (*Canis aureus*) skull from Finland

Hatlauf, Jennifer and Viranta, Suvi

Scholars use diverse methods to study skull morphology: photogrammetry, 3D scans, landmark-based geometrics and the traditional calliper measurements. The advantages of the latter are several. The measurements are less affected by post-mortal changes, such as missing teeth. The method works well for single teeth, especially the canine. Measuring with callipers is also a very time efficient and inexpensive, yet an accurate method. However, there is a methodological limitation: in large scale studies involving more than one researcher, the inter-observer variability in measurements may result in the loss of data. Precision and accuracy are highly dependent on the observer, however, with a protocol on the exact measurements, errors and variability might be strongly reduced. Therefore, for this study we focused on the exact documentation and description of the measurements taken by callipers. Our goal is to develop a method to standardize canid cranial measurements. As our trial specimen we used the first golden jackal (*Canis aureus*) skull sampled in Finland. We took 19 measurements using a digital sliding calliper (Mitutoyo Digital Calliper) with the precision to 0.01 mm, and repeated measurements to gain consistence. The results are presented in a line of pictures which can be used to standardize the basic cranial measurement in studies involving multiple observers However, larger datasets and collaboration are needed for our method is subject to further studies.

First multispectral imaging analysis of jackal skeleton and pelage

Krickl, Robert and Hatlauf, Jennifer

Multispectral imaging is a versatile technique for investigating the nature and mapping the distribution of certain material phases by detecting differences in absorption, reflection and emission of electromagnetic radiation. For it is non-invasive, with no need of sample preparation, and highly variable sample size ranging from submillimetres to kilometres, it is yet often applied in forensic, materials and archaeometric sciences. However, there are certain methodological limitations that may have hitherto restricted the use in certain study areas, especially in cases of non-microscopic investigations of mammals. To the best of our knowledge, multispectral imaging of entire body parts in high resolution has never been applied on jackals. This feasibility study was conducted on three skulls of golden jackals (*Canis aureus*) from the collection of the Golden Jackal Project Austria (www.goldschakal.at) as example for variations in bone and teeth, and a pelt of a black-backed jackal (*Lupulella mesomelas*), as an example for fur analysis. Applied techniques included high resolution imaging of reflected and emitted light from the ultraviolet to near infrared spectral region with the aid of a custom-made light-source and detector array. Images reveal marked differences between and within the investigated samples. A notable portion of the recorded variations of signals is attributed to measures of preparation and conservation of the biogenic materials – but even within the small sample number, there are also indications of osteological differences and pathologies. The results are a proof of concept that multispectral imaging can be applied to common canid zoological specimens. However, precise interpretation of many recorded signals is yet difficult and therefore subject of further studies. This successful feasibility study and promising results enable general conclusions on topics where this method may be applied in the future to provide data for jackal research. Possibilities include insights into not recorded conservation and preparation treatments of (historical) collection objects, localisation and assessment of the number of remnants of organic tissue on osteological samples, information on colonization and degradation by fungi and other microorganisms, revelation of pathologies and biological differences connected to life history and possible forensics of hunting marks (even after their visible removal by preparation). To further enhance practicability, building up expertise and reference data for future investigations is intended.

Potential effect of intraspecific isolation: observations of a golden jackal (*Canis aureus*) and red foxes (*Vulpes vulpes*) living in sociopositive relation

Felix Böcker, Hannah Weber, Janosch Arnold, Sebastian Collet and Jennifer Hatlauf

Interspecific interaction and competition within the guild of canids are intensely documented and researched all over the world. Still the relation between foxes and golden jackals is mostly competitive with a top-down effect. Both species can form various forms of intraspecific social bonds. However, both species are not known to build social coalitions with interspecific partners. The aim of this study was to observe a resident, single male golden jackal in the municipality Bad Wurzach in the district of Ravensburg, Baden-Württemberg, with the use of camera traps and active searches for scats using a scat detection dog. Eight camera traps were active in summer 2021. The observed behaviour was categorized to allow a better impression of the situation and quantities. From June 2020 on, a single jackal was documented regularly by different camera traps and genetically identified by scat analysis (genotype code GG008m). In August 2020 the jackal was photographed and filmed by camera traps in company with young red foxes. The interspecific group showed familiar behaviour, which could be documented again in September 2020. The behaviour of the foxes and the jackal was familiar and social. In 2021, a comparable situation could be observed. The golden jackal was again photographed with foxes. The recordings show interaction between a fox female, her cubs, and the jackal and that the jackal is also carrying food. To our knowledge, the described observation is the first record of a sociopositive behaviour between golden jackals and red foxes. It is important to consider the fact that the golden jackal observed here is a single male individual isolated from other golden jackals. Social isolation could be a driver for interaction and social bonding with another species. Red foxes might be an attractive alternative for golden jackals in situations where there is a lack of conspecifics. We assume that the golden jackal in this case benefits from the foxes' company in a psychological way, fulfilling basic social needs. We cannot draw any general conclusions from this exclusive behaviour of individuals to similar situations. However, interspecific groups at least between single individuals of the two species should be considered a possible scenario at the edge of the golden jackal's distribution range. In a comparable situation, where single golden jackals meet other relatives of the genus Canis, hybridization should also be taken into account as a possible scenario. Further research on such interspecific groups at the edge of one species' distribution range is necessary in order to figure out whether the observed situation is an individual or a common occurrence.

Dietary flexibility promotes range expansion: the case of golden jackals in Eurasia

József Lanszki, Matt W. Hayward, Nathan Ranc and Andrzej Zalewski

Ongoing global changes can lead to the expansion of species' geographic range. Exploring the drivers of the successful ongoing expansion of the golden jackal (*Canis aureus*) across Europe is essential to understand the species' trophic ecology. We analysed which climatic and environmental factors affected the dietary composition of golden jackals and compared these drivers in the species' historic and recently colonized distribution ranges. Using 40 published data sets, we modelled jackal diet composition using 13 food categories based on the relative frequency of occurrence of food items and trophic niche breadth (BA) against climatic and environmental factors from throughout the jackals recently colonized (22 studies) and historic range (18 studies) using general additive models. The proportion of small mammals in golden jackal diet decreased with annual mean temperature, whereas the consumption of wild ungulates increased with environmental productivity. Increasing temperature and environmental productivity positively influenced niche breadth, while increasing precipitation negatively affected it. The recently colonized distribution range of golden jackals in Europe had a lower mean temperature but higher environmental productivity compared to the species' historic range in Eurasia. In the recently colonized range, jackals consumed small mammals and/or wild ungulates (mostly from scavenging) more frequently, and fewer plants and/or domestic animals (again, mostly from scavenging). The golden jackal is an opportunistic, omnivorous carnivore with high dietary flexibility and biogeographical variation. Climatic and environmental factors shape the species' diet composition, which, in a changing environment, greatly enhances the opportunities for golden jackals to colonise new areas successfully. Golden jackals will likely continue to expand their range in the foreseeable future. The species' trophic niche is expected to broaden with predictions of overall increasing temperatures and reduced precipitation.

Diet composition of the golden jackal (*Canis aureus*) in the Balatoni Nagy-berek (Hungary)

Bende Z. and Lanszki J.

Targeted studies can elucidate the impact of carnivores on big game populations and domestic herds. Today, the golden jackal (*Canis aureus*) is a rapidly expanding canid in Europe. We examined the seasonal and age group-dependent diet composition and feeding habits based on stomach contents of 57 jackal individuals (adult 44, juvenile 13) collected during legal hunting in Balatoni Nagy-berek. Based on the known opportunistic foraging of the jackal, we hypothesized that the wild ungulate viscera and carcass consumption would be primary in its diet due to the intensive big game management in the area. In the diet of adult and young jackals, the viscera and carcasses of big game species (cervids and wild boar) were primary, plants (mainly fruits and seeds) were secondary, and small mammals (mostly rodents) were tertiary. The varied diets often included arthropods, rarely other types of food (e.g. hares, birds, lizards). In the area, which mainly comprises open, wet and swampy habitat types, big game viscera from intensive hunting activities were utilized decisively. It also played a role in removing naturally dead or injured individuals from large numbers of wildlife. Despite significant beef cattle keeping and grazing in the area, we detected no livestock consumption. Overall, consumption followed the food sources in the highest quantity and easily available in a given season. Despite significant jackal populations, we did not observe a decline in big game species or other potential prey species.

What do golden jackals (*Canis aureus*) in Austria feed on?

Hatlauf J. and Lanszki J.

Golden Golden jackals (Canis aureus) were firstly recorded in 1987 in Austria, and the first reproduction was confirmed in 2007. In 2016 the first family groups could be confirmed with the help of bioacoustics and a citizen science project started to collect data from hunters and the general public. Questions about the possible impact on potential prey species arose, and therefore the collection of stomach samples started to explore diet composition and feeding habits. Between 2016 and 2020, we collected 14 golden jackal stomachs from seven different areas in four Provinces in Austria: Burgenland, Lower Austria, Upper Austria and Styria. The samples come from diverse habitats with different food availability. All stomachs were obtained from either road-killed or legally shot golden jackals. From these stomachs, we could analyse the wet weight (W%) and the relative frequency of occurrence (RFO) of each food item. In this study, we present the first analyses of stomach contents from golden jackals in Austria based on macroscopic and microscopic examinations of the hard parts (e.g. hairs) from foods consumed. The results showed, that the most frequently consumed foods were plants (e.g. cherries, plums, grasses). However, based on quantitative analysis (wet weight measures), the primary foods of jackals were wild ungulates (mosly cervids – both as cadavers and fresh – and partially wild boar), domestic animals (in one case a rabbit) had secondary and plants tertiary importance. The intake of birds, bird eggs and invertebrates were subordinate. In one sample, we could detect smaller carnivores, namely marten (Martes sp.), while remains of fish, amphibians and reptiles were not present in the samples. The results support the fact that golden jackals show diverse and opportunistic foraging. The demonstrated feeding habits, similar to those experienced in the central-southeastern region of Europe, will predictably help further expansion of this species in Austria, and whole Europe.

Weak signals implicate potential relation between MHC genes and parasites in golden jackal (*Canis aureus*) – preliminary results

Dean Konjević, Magda Sindičić, Franjo Martinković, Nikica Šprem, Ivica Bošković, Siniša Slijepčević, Miljenko Bujanić, Tihomir Florijančić, Boštjan Pokorny and Haidi Arbanasić

Golden jackal (*Canis aureus*) population is currently rapidly expanding across Eastern and Central Europe. Due to its adaptation and affinity for human-dominated landscapes golden jackal is interesting as a potential source of diseases for humans, livestock, and companion animals. The aim of this study was to investigate intestinal parasites of golden jackal and their potential relation to immunologically important major histocompatibility complex (MHC) genes. We examined genetic variability at MHC class II DRB, DQA and DQB loci in 28 individuals collected in Croatia. The analysis revealed three individuals that carried dog specific MHC haplotypes (DLA-DRB1*00201/DQA1*00901/DQB1*00101), implying golden jackal/dog hybrids. In further two animals, one locus failed to amplify. Finally, we detected five DLA-DRB1/DQA1/DQB1 three-locus haplotypes in 23 individuals. Haplotype DLA-DRB100901/DQA1*00402/DQB1*02305 was the most frequent one, while DLA-DRB1*13101/DQA*100402/DQB*06801 occurred only once. Following morphological and molecular analysis, 9 species/families of intestinal parasites were detected: *Taenia serialis* (26.7%), *Mesocestoides litteratus* (6.7%), *Echinococcus multilocularis* (1 animal), *Uncinaria stenocephala* (16.7%), *Toxocara canis* (10%), fam. *Strongylida* (6.7%), *Toxascaris leonina* (3.4%), *Alaria alata* (16.7%), and fam. *Opistorchiidae* (16.7%). In two cases we found statistically significant relation of DQA and DQB alleles and *Strongylida sp*. parasites, whereas in two other instances the result was marginal (dependence of *Echinococcus multilocularis* on DQB1 and DQA1). However, results are preliminary and in all four cases restricted to single infected animal, but still indicative and encourage further investigation on larger sample set, ideally with N>100, with specific focus on parasites and MHC haplotypes.

Population structure and genetic variability of jackals in Bosnia and Herzegovina

Dragana Šnjegota, Mihajla Djan, Jelena Nikitović, Marina Antić and Duško Ćirović

1 Purpose/Objective: The European golden jackal has experienced the expansion of its range since the end of the 20th century. In Bosnia and Herzegovina (hereafter BIH), the jackal has also expanded its range. In the past, the species was recorded in the south of BIH, while recently individuals from Croatia and Serbia have established the core population in the northern lowlands of BIH. The north of BIH was not inhabited by wolves in the past and is highly populated by humans. Given the preferences of jackals, both aspects probably facilitated their expansion in this part of the country. The core population has gradually spread into the other parts of the country, sneaking steadily into regions inhabited by wolves. Given the absence of population genetic studies on jackals in BIH and potential concerns regarding their range expansion, such as conflicts and hybridization with other Canidae, we aimed to produce the first results on the population structure and genetic variability of the species in the country. 2. Material/Methods We analysed 24 autosomal microsatellite loci from 48 jackals sampled mainly in the northern lowlands of BIH, considered the core area of the species` distribution. The samples were muscle tissues from individuals found dead for various reasons from 2018 to 2021. We explored the population genetic structure of jackals using STRUCTURE, DAPC, and sPCA. Basic parameters of genetic variability were calculated using the following R packages: adegenet and hierfstat to determine the number of alleles per locus (Na), observed (Ho) and expected (He) heterozygosities, and pegas to test for Hardy–Weinberg and Linkage Disequilibrium. 3. Results All analyses indicated the absence of population structure, despite K=2 suggested as the most likely number of genetic clusters by Structure and DAPC. The absence of population structure was expected given the results of previous population genetic studies of jackals in Europe, where only individuals from Dalmatia differed. Genetic diversity was higher compared to neighbouring and other European populations (Na=5.83, Ho=0.56, He=0.59). 4. Conclusion The results of this study are important as they form the basis for future population genetic studies on jackals and other Canidae in BIH. The absence of a population structure and the high genetic diversity of jackals in BIH indicate a continuous gene flow throughout the country and a possible further expansion of their range. The high genetic diversity could also indicate the hybridisation of jackals with dogs and wolves due to the gradual overlap of their territories. To investigate these hypotheses, further population genetic studies on jackals in BIH should include i) jackals from the wider region and ii) samples from dogs and wolves.

A population genetics-based study of the recolonization of the golden jackal (*Canis aureus*) in two core areas in southern Hungary and southern Romania

Péter FEHÉR, Krisztián FRANK Péter KEMENSZKY, Attila FARKAS, Ferenc JÁNOSKA, Péter BEDŐ, Endre BARTA, László VARGA, László SZEMETHY and Viktor STÉGER

The golden jackal (*Canis aureus*) is a medium-sized canid, distributed across southern Asia, the Middle East and South-eastern and Central Europe. In Europe in the last two decades populations have undergone significant changes. During the first two decades of the 21st century the size of the jackal populations increased in their distribution and abundance across Europe. Hungary and Romania apply similar game management practices, and the golden jackal appeared approximately at the same time in both countries. In this study our objectives were to determine the genetic structure and the origin of the expanding jackal populations. We analysed samples obtained from Romania and Hungary. Twenty-two canine autosomal di- and tetranucleotide microsatellites were optimized for multiplex PCR, and analysed using multivariate, Bayesian – to determine the number of genetic clusters and visualise any suspected hybrid individuals – and landscape genetic methods. In the Romanian samples all loci were polymorphic with 3–12 alleles. The overall observed (HO) and expected (HE) heterozygosities were 0.552 and 0.647, respectively. In the Hungarian samples 20 out 22 loci were polymorphic with 2–11 alleles. The overall observed (HO) heterozygosity (0.561) was higher, and the expected (HE) heterozygosity (0.564) was lower than the corresponding Romanian value. Based on our clustering results, Romanian and Hungarian samples separated into two different genetic clusters. No evidence of hybridization was found in the Hungarian and Romanian samples. These results show that smaller groups of golden jackals could settle in different regions following several episodes of colonization at different times and arriving from various locations.

Golden jackals in Poland – an emerging threat or a victim of ignorance?
Preliminary results

Hatlauf J., Bojarska K., Lanszki J., Bende Zs., Okarma H. and Śnieżko S.

The fast-expanding golden jackal (*Canis aureus*) made its way to Poland. The first individual was observed and photographed in 2015, and the first reproduction was reported the same year. With only 19 hard-proof records so far, very little is known about the species´ status, distribution, and ecology in Poland. To adequately plan the species management, research is crucial for understanding potential impact on biodiversity and economy. As the golden jackal is enlisted in Annex V of the EU Habitats Directive, its exploitation may be subject to management under the condition of maintaining its proper conservation status. Despite the international obligations, the golden jackal has become a game species in Poland. Since 2019, eight individuals have been officially shot in the country. In the beginning of 2021, first observations in southern Poland indicated the presence of a golden jackal family group. The local hunters have agreed to cease hunting jackals for one year to enable detailed and comprehensive research. We began our study involving a combination of methods: active and passive bioacoustics monitoring, scat-detection dogs, genetic analyses, camera traps, parasitic- and diet analyses. Here, we present the preliminary results of the ongoing research project. Bioacoustics stimulation on 10 preselected points in the first field season showed potentially 2 groups (likely closely related). In a second step, three trained human-dog teams (handlers with their scat detection dogs) searched the area in a total of 94 km transects, identifying 19 potential golden jackal scats. Next, the scats were analysed genetically to confirm the species and to assess the number of individuals. The promising incorporation of a combination of modern techniques that allow time-effective collection of high-quality data will be finally evaluated at the end of this study. The outcomes will help to fill knowledge-gaps on basic ecology of the golden jackal in the recently colonized areas of Poland.

How many territorial und reproductive golden jackals are there in Germany?

Felix Böcker, Hannah Weber and Sebastian Collet

The golden jackal (*Canis aureus*) is a species which is currently expanding from eastern towards western Europe. The presented study describes the first records of golden jackal cubs in south-western Germany and therefore confirms the first known reproduction of the species in Germany. After single records of golden jackals in an area between the black forest and the Swabian Alp (district Schwarzwald-Baar, Baden-Württemberg) in October 2021, camera traps provided pictures of a juvenile individual on 26th October. This picture was the first proof of reproduction which could later be confirmed by further genetic evidence and camera trap pictures. In total, three to four cubs and one parent could be genetically identified. In June 2022 pictures showed two adult golden jackals accompanied by cubs in the same area. As the migration of sub-adult individuals to adjacent areas might be the consequence of this development small scale monitoring was established for further investigation. As golden jackals do not only appear in south-western Germany but in all other regions of Germany and neighbouring countries, unnoticed territorial single jackals or even reproducing pairs are likely. A focused view on suspicious cases and good communication about this species can help to gather better insight to the development of golden jackals in Europe. Besides the known reproduction from Baden-Württemberg there is another very recent case of confirmed golden jackal cubs from Germany in September 2022. The hunting association from lower-saxony reported the proof of golden jackal cubs (Landesjägerschaft Niedersachsen 2022). References: Landesjägerschaft Niedersachsen (2022) Aktuelles – Goldschakal, 26.09.2022. https://www.ljn.de/ueber-uns/aktuelles/news-artikel/news/goldschakal (30.09.2022)

High density population of Eurasian jackal in Deliblatska Peščara (Serbia)

Rudi Kraševec and Nik Šabeder

Purpose/Objective: In our study, we surveyed the population of Eurasian jackal (*Canis aureus*) of the Special nature reserve Deliblatska Pešćara (South Banat region, Serbia). Our goal was to assess whether the population densities of the jackal differ within and outside reserve. Material/Methods: The study was conducted between 29. 4. and 1. 5. 2019, at night at least one hour after sunset. We have used acoustic survey method on 13 calling stations, using playback record of territorial jackal group calling, with 4 consecutive broadcasting series. Survey was conducted in the special nature reserve (10) and its vicinity (3). Based on the direction of jackal response, we determined whether a certain group was situated within or outside the reserve. We estimated the survey area within 1.5 km radius around calling station (79.8 km2 surveyed – 51.4 km2 within reserve boundaries and 28.4 km2 beyond reserve boundaries). Results: Altogether we recorded 21 jackal group (two or more ind.) and three individual responses on nine (69 %) of the calling stations. The jackals' groups responded to the broadcasting in 38 % after first series, 14 % after second series and in 48 % after the third series. After the fourth series we received no further responses. Average jackal group density per 10 km2 was 2.6, the density within reserve was 3.7 and 0.8 outside reserve. Conclusion: First results from our study of the jackal show a significant difference between jackal densities within the natural reserve and outside it. We assume that be so, due to strong difference of habitats. The reserve is mostly covered by grasslands and shrubs, the latter provide daily shelters, places for rearing the young, and better food sources (small rodent communities, wild ungulates, slaughter remains etc.), in contrast, surroundings of the reserve are mainly very intensive farmlands and human settlements. The intensive farmlands are suitable feeding habitat, but the lack of shelter makes it inadequate for breeding habitat. The downside of our study is rather small study area. Further detailed study on jackal group densities and habitat available, on the scale of the reserve and its vicinity, is needed.

Modelling the expansion of the golden jackal (*Canis aureus*) in Hungary

Hanna Bijl and Sándor Csányi

1. Objective: In Hungary, the golden jackal (*Canis aureus*) was one of the first to reappear in Europe at the beginning of the 1990s. Since then, the species has been of growing concern for game managers and hunters and reignited the human-carnivore conflict debate. This research takes a quantitative approach to model the expansion of the species in Hungary temporally and spatially. We model 1) how large the annual increase in the population size/hunting bag of the golden jackal was in Hungary during the last 25 years; 2) how large the annual increase in the range of the species was in the country during this period; 3) if there was a change in population density, if yes, then how much? Lastly, 4) if the spatial rate of increase during this period changed, and if yes, how? The aim is to present the population change of the golden jackal throughout the years and make predictions for the future on which to base management actions. 2. Material and methods: Official hunting bag data from the Hungarian National Game Management Database has been used since 1995 and were obtained from Game Management Units (GMU) in Hungary. As GMUs change over time and are therefore biased, the UTM grid system was used (10x10 km). The population of the golden jackal was modelled by carrying out a temporal and spatial analysis based on these hunting bag data. 3. Results: Since 1995, exponential growth in the hunting bag and a strong increase in the occupied area with a slight deceleration can be seen in the last two-three years. The annual increase in occupied areas (km2) shows a logistic curve where a difference can be observed between the first half of the period (1995–2006) and the second half (2007–2019). The golden jackal spread with an average velocity of 536.9 km2/year in the first period and 5581.3 km2/year in the second period. The spatial analysis shows that the annual spatial rate of increase is in the range of 15-25% of the occupied area. The annual increase in occupied UTM grid cells reveals that the expansion of the golden jackal has exceeded its maximum, and the annual increase is declining. Additionally, the numbers of occupied UTM grid cells and the occupied area sizes have grown at roughly the same rate. 4. Conclusion: In the near future, we will face a further decline in population growth which might be observed in neighbouring countries too. Moreover, it is crucial to continue monitoring the golden jackal population and their (negative) impacts on the ecosystem. To further mitigate the expansion, the species needs to be managed according to an action plan that includes active, density-dependent control measures.