

Applied ecology and management aspects related to the golden jackal specific ecological system in Romania

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Summary

Conservation measures and wildlife management plan starts with population estimation. The dynamics of the golden jackal (*Canisaureus*, Linnaeus, 1758) in Romania is unclear. There are isolated records of the species presence, but there is no comprehensive monitoring performed to collect reliable information.

We performed a brief analysis of jackal reported quota (total jackal individuals estimation and harvest data) during the period 2011-2013. We compared this data with Red Fox estimations and harvest for the same years and only in counties where jackal have been reported. Additionally, we present data and new records of jackal density obtained through modern bio-acoustic stimulation and video-trapping in Gura Dobrogei, the control area used in other previous surveys and in other two natural areas which include 4 Natura 2000 sites: 1st in Danube Delta (ROSCI0065) and Danube Delta Razim-Sinoe Complex (ROSPA003) and the 2nd in Defileul Muresului (ROSCI0064) and Defileul Muresului Inferior - Dealurile Lipovei (ROSPA0029). We present data obtained with bio-acoustic stimulation on open field layer and wetlands in 20 calling stations we installed in these areas.

In Romania the golden jackal is present in 28 counties out of the 41 based on the evaluations performed by the hunting units, with estimates between 2 individuals in Caras Severin and 1.595 in Tulcea. The estimated number of individuals at the national level in 2013 is 6.431, and the number of removed jackals in the 2012/2013 hunting season is 2.502 (harvest data). The red fox population of Romania in 2013 is estimated at 38.985 individuals, and in 2012/2013 hunting season the number of reported killed foxes is 17.358.

During three jackal bio-acoustic monitoring surveys, in areas mentioned above, we were able to observe different responsiveness for each area, ranging from no answer to answers of 5 and 7 territorial reproductive jackal groups per calling station. In the control area where we found 5 territorial groups in 2011 we didn't get any response and in a transect of Caraorman region in Danube Delta (cover area of 50 km²) we obtained answers in good density (2,2 territorial groups/10 km²), similar with

densities found in wetlands across Central Europe. This density level corresponds to a well known fishing place.

Additional information needs to be collected to fill in the knowledge and gaps related to the golden jackal situation in Romania and to properly address the conservation of the species. The expansion of the jackals in Romania and Europe seems to be rapid. This brings challenges to both conservationists and game species managers. The legal protection status of the species is ensured by international conventions (CITES and Bern Convention) and the Habitat Directive of the EC, but the management practices are not always in line with this framework. A database about the species distribution and density is needed, even though a rough estimation can be made at the national level based on the evaluations performed by the hunting units.

Keywords: *Canis aureus*, bio-acoustic stimulation, Natura 2000 sites, conservation, Romania

Introduction

Canis aureus (Linnaeus, 1758), or the golden jackal, is a widespread species especially in North and north-east Africa, and in Asia from the Eastern part to Indo-China. It is expanding quickly its range to Europe, being currently present in central, eastern and southern part of the old continent (Arnold *et al.*, 2011). The largest population from Europe seems to occur in Bulgaria (Banea *et al.*, 2012). The presence of golden jackal in Romania is mentioned for first time in 1929 (Calinescu, 1931), but probably species was present in this country for much longer (Banea *et al.*, 2012).

It is fairly common throughout its range with high densities observed in areas with abundant food availability. Due to their tolerance of dry habitats and their omnivorous diet, the Golden Jackal can live in a wide variety of habitats. These range from the Sahel Desert to the evergreen forests of Myanmar and Thailand (Jhala & Moehlman, 2008). Golden Jackals are opportunistic and will venture into human settlements at night to feed on garbage, or speculate newborn cattle during the day. Sometimes the jackal provokes damages in protected areas, in other situation it attacks livestock, or it can be found on hunting areas eating small game-species (Lapini & Banea, 2013). Examined scats in Peljesac Peninsula, Croatia contained dried leaves and grass with the same frequency (24%) as the artificial material (plastic bags, cans, and metal) (Radović & Kovačić, 2010).

Medium-sized canid, considered the most typical representative of the genus *Canis* (Clutton-Brock *et al.*, 1976). There is approximately 12% difference in body weight between sexes (Moehlman & Hofer, 1997). Basic coat colour is golden but varies from pale creamy yellow to a dark tawny hue on a seasonal basis. The pelage on the back is often a mixture of black, brown, and white hairs. Unique lighter markings on the throat and chest

make it possible to differentiate individuals in a population (Macdonald, 1979; Moehlman, 1983). Legs relatively long, and feet slender with small pads. Females have four pairs of mammae (Sheldon, 1992).

Jackals live in pairs, but are sometimes found in loose packs of related individuals. Mated pairs are territorial, and both the female and male mark and defend the boundaries of their territory. Family or pack members communicate with each other by a screaming yell and yapping, or a siren-like howl when a kill is located. Litters number up to six but usually average is two to four. In Romania, mating date seems to be October and gestation from mid February to mid April, 61-62 days.

This study aims to highlight some of the ecological aspects that need to be addressed in Romania concerning the management of the species.

SITUATION IN EUROPE

Golden jackal is becoming a species of great economic impact in south-eastern Europe due to its increasing number and to its influence on game losses (Stoyanov, 2012).

In recent past, distribution boundaries of the golden jackal species in SE Europe fluctuated and two main centres of distribution were identified: 1) Eastern Thrace (Turkey) and Strandja Mountains (Bulgaria). 2) Dalmatia and Northern Greece (Demeter & Spassov, 1993).

The Pannonian population became extinct around the middle of the twentieth century. During the last few decades there has been a great expansion in the Jackal's range within Croatia, Serbia, Bulgaria and Romania, and vagrants occasionally appear far outside the Balkans, in north-eastern Italy, Slovenia, Austria, Hungary and Slovakia (Krystufek *et al.*, 1997).

New records and determined estimates of densities are available in Greece (Giannatos, 2004), Croatia and Slovenia (Krofel, 2006; 2008), Italy (Lapini *et al.*, 2009; 2011), Hungary (Szabó *et al.*, 2007), Serbia (Cirović, 2007 *pers. comm.*), Romania (Banea, 2011; Banea *et al.*, 2012) and new sightings have been recently reported from areas where jackals were completely absent or rare as occurred in Cantons of Waadt, Bern and Freiburg in Switzerland (Kora news, 2012) and in Ghiduleni village, Rezina county in Republic of Moldavia (Radio Orhei news, 2012).

Stable population of jackals occurs in lowlands of Dniester River and Odessa Oblast Southern Ukraine since 1998 (Rozhenko N, 2013 *perscomm*) while in Northern Ukraine were registered as vagrant on 15th of October 2013 (Zagorodniuk I, 2013 *perscomm*).

In Estonia, 2 jackals were killed in 2013, in February and August 2013 (Peep Männil, *pers comm.*). In the vicinity of Salevere N58.70217°, E 023.57977° Läänemaa (West Estonia) was registered at least one territorial group during BALTICA 2013, jackal survey organized by Matsalu National Park Reserve Administration and NGO Crispus Sibiu.

These records show the elusive character of its biogeography, which remains unknown and that jackals are still expanding. Pulsations from regions where species reached good density were incriminated as being the main factor of jackal expansion together with habitat specialist behaviour or human infrastructure. Based on literature and sightings, a cyclic pattern of jackal local dynamic was observed during the last 70 years in Bulgaria (Spasov, 2007) and Romania (Banea *et al.*, 2012) with a period of 10-15 years, while other three big pulsations could be observed in central Europe during 50s, 80s and 2000s (Lapini & Banea, 2013).

Other factors for their dispersal into Central Europe, according to Giannatos (*ex verbis*), could be: plains and low altitude as no barriers, daytime refuge (lowland plantations, few small forest remnants, riverside or channel-side dense vegetation), big rivers catchments (e.g. Danube and tributaries), probably less snowy winters and a large food base from anthropogenic sources (agriculture, livestock, hunting units). While in Greece, Giannatos (2004) concluded that the number of jackals is decreasing and in Hungary the expansion of jackal has been considered “invasive” due to exponential growth (Szabó *et al.*, 2007) remains unclear how the species develops its settlement in other European countries without having data on several years and observing the dynamic on time.

JACKAL’S SITUATION IN ROMANIA

The occurrence of the Jackal on the Walachian Plain (on the left bank of the Danube) was confirmed by Calinescu (1931), however, the status of the species in Romania has remained unclear for many years. For example, Vasiliu (1961) and Vasiliu & Sova (1968) consider it to be an occasional visitor from the Balkan Peninsula, crossing the Danube when frozen during severe winters, whilst Pop & Homei (1973) exclude it from their two volume Mammals of Romania (Krystufek *et al.*, 1997).

Residents appeared in southern Dobrogea at the beginning of the 1970s (the first specimen being killed at Negureni); a decade later the entire Dobrogea area was populated. Since the beginning of the 1990s the Jackal has also been resident in the Walachian Plain south of a line running through Turnu Severin, Craiova, Bucuresti and Sutesti. It seems to be most common in the Oltenia region (Almasan, 1995) (Krystufek *et al.*, 1997).

Information about the ethology, anatomy, morphology, biometry but also jackal ecological network analysis using stomach content and droppings data studies of 68 jackals is collected in one of the valuable books addressed to the jackal species “*Sacalul auriu*” (Angelescu, 2004).

From the 1980s the golden jackal number increased, and we know that in 2008, 1061 jackals were killed in different hunting sessions organized for other game species. During the 2012/2013 hunting season, a total number of 2502 individuals were killed according to the statistics (based on the data published on the website of the Ministry of Environment and Climate

Change, <http://www.mmediu.ro/beta/domenii/paduri/vanatoare/cote-de-recolta/>, 2013).

The population estimated in 2008 through the classical evaluation method was 2045 individuals (Banea, 2011), and for this year (2013) 6431 individuals (<http://www.mmediu.ro/beta/domenii/paduri/vanatoare/cote-de-recolta/>, 2013) (table 1).

This rapid increase of the number of jackal individuals in Romania is questionable. The evaluation method itself is highly debated, one of the issues being that the maximum intervention number endorsed by the Ministry of Environment and Climate Change is directly proportional with the number of individuals estimated by the representatives of the hunting units (Table 1).

LEGAL STATUS OF THE GOLDEN JACKAL SPECIES

In 1996 *Canis aureus* L. 1758 was included in – Lower Risk/Least Concern category (Baillie & Groombridge, 1996 in Jhala & Moehlman 2008). In 2004 it has been included in the Least Concern category of the IUCN Red List of species (Criteria Version 3.1: IUCN, 2001).

The CITES (Convention on International Trade in Endangered Species of the Wild Fauna and Flora, signed in Washington D.C. on 3rd of March 1973) lists the golden jackal in Appendix III. This Appendix contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade.

The EC Habitats Directive (92/43 of 21.05.1992) lists the golden jackal in Annex V. This Annex includes animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures.

The Convention on the Conservation of European Wildlife and Natural Habitats (**Bern Convention**) was adopted by European Environment Ministers in 1979. Appendix III of Bern Convention which includes species that are in need of protection but may be hunted or otherwise exploited in exceptional instances does not include jackal as protected species, but it is mentioned in Annex V of EC Habitats Directive 92/43, as above mentioned derived from the Bern Convention framework. Bern Convention was ratified in Romania on 5th of May 1993 and entered into force on 1st of September 1993.

There is a clear necessity to better address and apply the legal framework on the conservation of golden jackal in European countries, taking into account that in many new-colonized areas data are completely missing and the ecology of the species is often confounded with that of the grey wolf. In Hungary, Serbia and Bulgaria the jackal harvest is becoming exponential, but we do not know if this is due to the continuous population development or to a bad management (Lapini & Banea, 2013).

Unsustainable hunting without comprehensive and reliable monitoring data about the species should be avoided, as requested for the species listed in Annex V of EC Habitats Directive 92/43. When the European jackal is considered a game species, anyway, special measures should be taken, like the prohibition of air-crafts utilisation and of any other motorised vehicles during the hunting sessions (Annex VI of EC Habitats Directive 92/43) and the prohibition of various popular bad hunting practices.

These include:

- Blind or mutilated animals used as live decoys;
- Tape recorders;
- Electrical and electronic devices capable of killing or stunning;
- Artificial light sources;
- Mirrors and other dazzling devices;
- Devices for illuminating targets;
- Sighting devices for night shooting comprising an electronic image magnifier or image converter;
- Explosives;
- Nets which are non-selective according to their principle or their conditions of use;
- Traps which are non-selective according to their principle or their conditions of use;
- Crossbows;
- Poisons and poisoned or anaesthetic bait;
- Gassing or smoking out;

Semi-automatic or automatic weapons with a magazine capable of holding more than two rounds of ammunition (Annex VI of EC Habitats Directive 92/43).

The European Mammal Assessment (EMA) is the first review of the conservation status of all wild mammals in Europe according to IUCN regional Red Listing guidelines (Temple & Terry, 2007). The European Mammal Assessment and consequently this report were requirements of the framework of a service contract with the European Commission (Service Contract No. 070502/2005/414893/MAR/B2). The Red List assessments were made at two regional levels for terrestrial species: for geographical Europe, and for the 25 Member States of the European Union when the EMA was initiated in 2005.

During the European Mammal Assessment, the experts assigned to the golden jackal the category Near Threatened (Appendix 1) in Red List status of European mammals of their report for EU 25 level category. A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future (IUCN, 2011).

METHODOLOGY

We have used more non-invasive methods to collect information:

Data collected from the estimates of the hunting units

A classical method of footprint tracking and direct observations is used by Romanian Game Management Administration as in the case of foxes and other animals. The population sizes of main wildlife species, which populate the hunting units in Romania, are estimated annually. The estimation actions of game species populations are organized from the 2nd of April until the 31st of March (next year). In practice the field identifications and data processing are not transparent. Most part of the data that is reported is coming after a one day inventory and estimates of the population size are not scientifically based. Together with other data of harvested individuals during previous period it is established a hunting quota, or a maximum number of interventions.

Documentation of local data: Data collected not only from hunting associations, but also locals, scientific literature, mass-media, National Game Administration, etc.

Direct methods: Observations during daytime or with spotlight, photography of furs, skulls, hunting trophies.

Indirect methods:

- *Bio-acoustic stimulation.* This method (Fig 1) was introduced in Europe in 2001 by Giannatos and used successfully in different studies of counting and monitoring surveys (Giannatos, 2004; Krofel, 2008; Szabo *et al.*, 2007; Cirovic, 2007 *pers comm*; Lapiniet *al.* 2009; Banea, 2011; Banea *et al.*, 2012; Selanec, 2012 *pers comm*). The best period to perform bio-acoustic monitoring corresponds to the mating period. Bio-acoustic stimulation can be performed as for **grid** style (when we want to calculate density of jackals of a well delineated area, see below Dobrogea) or **transect** of 5 points with 1.5-4 km between them.

- *Photo and video trapping*

- *Searching for dens, tracks and signs:* during the fieldwork of survey stages.

We advise to perform several methods in combination for collecting data, when is considered important to assure species record or to estimate density level in new areas, as e.g. video-trapping with bio-acoustic monitoring or footprint tracking with bio-acoustic monitoring, or a combination of the three. It is recommendable to obtain data on other species as well, like other medium-sized carnivore, waterfowls, prey species, etc. and to register the ecological factors and human related activities in the area in order to investigate the ecological network. Teams are recommended to include ecologists, small mammal specialist, ornithologist, hunter who knows the area and has local knowledge.

RESULTS AND DISCUSSIONS

First estimates of densities in natural areas from Romania showed similarity with other study areas in Croatia, Hungary and Greece (Banea *et al.*, 2012). During 2010-2011 period there were conducted 5 surveys in Romania showing the following data of jackal density: 1.41-1.74 territorial groups/10 km² in Giurgiu area, 0.59-0.73 territorial group/10 km² on hunting units from Calarasi County, 0.46-0.52 territorial groups/10 km² in Dobrogea and 1.56-1.74 territorial groups/10 km² in Danube Delta maritime levees (0.55-0.61 territorial groups/10 km² for Grindul Chituc and 2.36-2.64 territorial groups/10 km² for Grindul Lupilor).

New data on jackal records in Romania, using bio-acoustic stimulation and direct methods

In October 2012 the authors of this review conducted two surveys: In Dobrogea, in the control area used during 2010-2011 (Banea *et al.*, 2012) and in Danube Delta Biosphere Reserve in a very well known fishing area on a channel between Crisan and Caraorman villages. In September 2013 we conducted one survey in Defileul Muresului (ROSCI0064) and Defileul Muresului Inferior - Dealurile Lipovei (ROSPA0029) Natura 2000 sites.

Dobrogea: In the same calling stations used by Banea *et al* (Fig 2) we performed survey from 10 calling stations covering the same area of 95.3-109.3 km². In 2011, Banea *et al.*, recorded response of 5 territorial groups (approx 15 jackals).

The density was estimated in 2011 to 0.46-0.52 territorial groups/10 km². Following the same bio-acoustic monitoring technique, we didn't record any response, but we observed on spotlight 2 individuals near the study site. We assume three possibilities of our findings: jackals moved their territory due to less food resources, increased threats and pressures from humans or they just do not answer to our playback due to unknown circumstances. Their total absence in this area is less probable due to the low hunting activities.

Danube Delta: (Danube Delta ROSCI0065 & Danube Delta and Razim-Sinoe Complex ROSPA0031, Natura 2000 sites). On the 13th of October 2012 we recorded one jackal with video-trapping on Grindul Lupilor. We performed bio-acoustic stimulation on Crisan-Caraorman channel in 5 points in an area of about 50 km² (Fig 3). We found a density of 2,2 territorial groups/10km². Interesting fact was that on first 2 points of the transect between Caraorman and Crisan villages and where high fishing activity was observed we recorded 11 jackal groups (approx 33 jackals). Between this two points we observed by spotlight 1 pair of Raccoon dogs (*Nyctereus procyonoides*).

Defileul Muresului and Defileul Muresului Inferior - Dealurile Lipovei Natura 2000 sites (Fig 4): 44,8 km². We used video-trapping, spotlight and bio-acoustic monitoring methods. Additionally, we tracked footprints, dens

or other signs. By using bio-acoustic stimulation, we recorded one jackal male with typical barking howl, corresponding to a recent settlement and searching for mate (Rozhenko 2013, *pers comm*). There was no presence reported before in the region.

Hunting Bag Data

Jackal estimations in Romania reached 6431 individuals in 2013 with a total of 2502 removed individuals in the period 2011-2012 (<http://www.mmediu.ro/beta/domenii/paduri/vanatoare/cote-de-recolta/>, 2013).

The population of the golden jackals in Romania shows incremental pattern but is still very low in comparison with Red Foxes. Jackal is reported now in 28 counties (Fig 5) based on the evaluations performed by the hunting units, with estimates between 2 individuals in Caras Severin and 1.595 in Tulcea. We analysed data of jackals together with sympatric Red Fox in those counties. (Table 1, Fig 6). In 2011, jackals were reported as having stable clusters only in 5 counties (Banea, 2011). The increase of the population sizes of the two species based on the available information seems to follow a similar pattern. It is an exponential increase from year to year. However, the carrying capacity of the habitats as well as the fluctuations of the number of the prey species should be analysed. The numbers reported by the hunters are highly debated because of the lack of transparency in terms of collecting and interpreting the data. The management of game species should be oriented towards the maintenance of healthy populations. But since reliable and sound information about the distribution, abundance and dynamics of species is not available we do not know what are the consequences of applying the actual active management practices. The level of intervention (Fig 7) might not be adequate, in which case the viability of the animal populations may be severely affected in the future. This can result in a decrease of the level of biodiversity in some areas.

Bio-acoustic monitoring can be very useful to detect species presence in new areas of settlement as occurred in Defileul Muresului during last survey of September 2013. The method is cost effective and can be performed with minimum staff (with at least 2 people) and equipments (megaphone, media player device, mapping/monitoring form). This new record adds another county, Hunedoara, on the list with golden jackal presence. Considering the data coming from the hunting units and this new record, Romania has 29 counties with golden jackal presence.

After reaching enough time of colonization as for every new species we can speculate on dynamic of the population. We cannot misunderstand this growing as being fast if species is not established. Only when with scientific research is demonstrable that species menace a protected species in an area, together with supposed exponential growth we can speculate on naming the jackal as invasive species. The invasiveness character has not yet been assigned to the golden jackal yet (Invasive Specialist Group,

<http://www.issg.org/>, 2013). In comparison, the red fox is causing severe negative impacts especially in Australia (like for e.g. reduction in native biodiversity, eliminating remnant populations of some native rodent and marsupial species) where is considered highly invasive (Invasive Specialist Group, <http://www.issg.org/>, 2013).

When targeting native invasive species in any conservation programme (like for instance in Natura 2000 sites), careful consideration should be given before labelling the species as “invasive”. It is important to clearly distinguish between the invasive character and potential natural processes that might have brought the species in the new habitats. Climate change can modify the distribution pattern of some species - species can migrate/change their distributional range as an adaptation to the environmental changes; before assigning the invasiveness character to a species, we should monitor from the beginning its trend, behaviour, and effect on other native species (Papp *et al.*, 2013).

To date, jackal is strictly protected in several European Countries (e.g. Italy, Slovenia) and on entire range, no area is declared as having the golden jackal as invasive species. For this reason is advisable to use *intruder* or other words when we want to describe recent settlement of the species.

Analyzing IUCN materials on jackals, CITES, Bern Convention and EC Habitats Directive 92/43 we observed differences on categorize jackal species, which is mentioned in Annex V of Habitats Directive. The species benefited from the EU 25 Mammal assessment project and recommendations in 2007, when its status was lifted from LC (Least Concern) to NT (Near Threatened) for 25 countries. We can say that generally in Romania the species belong to Near Threatened category. However, in densely populated areas, the golden jackal can be considered as being Least Concerned. Jackal is classified together with other species like *Rupicapra rupicapra*, *Mustela putorius* and *Martes martes* under the same status. These species are of community special interest and removal from natural areas could be possible only after performing a comprehensive monitoring programme and having a conservation and management plan.

CONCLUSIONS

The number of jackals in Romania is increasing, its expansion been relatively fast, as in many other Eastern European countries. According to the censuses performed by hunting units, there are more than 6400 individuals in 28 counties. We can add one more county to this list - Hunedoara, thanks to the bio-acoustic investigation method that we used during our surveys.

The increase of the number of jackals is going hand in hand with the increase of the red fox individuals. A direct correlation cannot be established due to the lack of data on a longer period of time.

The highest densities of jackals are found outside the Carpathian Mountain range. The map with the distribution of golden jackals at the national level presented in this review highlights this fact.

For more consistent data about the golden jackal, we need to perform monitoring activities on a continuous basis. The monitoring methods should be mixed, systematic visual observations should be combined with indirect methods. Bio-acoustic stimulation can be a valuable method for detecting the presence of the species. The observations of the tracks along the roads should be performed systematically. This should be best done on snow or on mud, following the tracks and determining the species, including the prey species. Also, genetic analysis should be considered in the future in order to have more accurate estimates of the population level and structure.

The protection status of the golden jackal is not clear and harmonised, there is room for interpretation. However, before taking any management measure concerning the jackal population, additional data about its distribution, densities and dynamic should be collected and analysed. The involvement of relevant stakeholders is strongly needed.

Protected areas and Natura 2000 sites can have a great role in collecting additional data about the jackals through sustained monitoring activities and sustainable conservation of the species. Habitat preferences and behaviour in different periods of the year should be further explored.

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ANNEXES

Table 1. Number of golden jackal (CA) and Red Fox (VV) individuals (estimated population and culled individuals) during 2011-2013 period, two hunting periods (based on the figures provided by the Ministry of Environment and Climate Change in 2013).

| | CA EST 2011 | CA EST 2012 | CA EST 2013 | REM 2011-12 | REM 2012-13 | VV EST 2011 | VV EST 2012 | VV EST 2013 | REM 2011-12 | REM 2012-13 |
|----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1 Alba | 16 | 22 | 27 | 2 | 2 | 2631 | 2482 | 2450 | 943 | 972 |
| 2 Arad | 29 | 39 | 95 | 9 | 15 | 1966 | 1883 | 1970 | 949 | 913 |
| 3 Arges | 8 | 16 | 24 | 0 | 2 | 2277 | 2272 | 2771 | 711 | 1396 |
| 4 Bihor | 5 | 17 | 22 | 0 | 1 | 1716 | 1750 | 1814 | 685 | 858 |
| 5 Braila | 137 | 166 | 181 | 14 | 36 | 441 | 494 | 476 | 129 | 168 |
| 6 Buzau | 172 | 241 | 276 | 23 | 40 | 1288 | 1444 | 1460 | 303 | 362 |
| 7 Caras Severi | 0 | 3 | 2 | 0 | 0 | 2077 | 2091 | 2179 | 686 | 784 |
| 8 Calarasi | 357 | 461 | 531 | 251 | 261 | 704 | 754 | 775 | 531 | 519 |
| 9 Constanta | 243 | 299 | 466 | 199 | 206 | 431 | 499 | 542 | 350 | 282 |
| 10 Dolj | 717 | 911 | 963 | 369 | 538 | 1607 | 1739 | 1831 | 928 | 1035 |
| 11 Galati | 17 | 52 | 46 | 3 | 35 | 462 | 538 | 470 | 283 | 379 |
| 12 Giurgiu | 97 | 107 | 141 | 63 | 75 | 472 | 500 | 568 | 289 | 302 |
| 13 Gorj | 26 | 78 | 101 | 5 | 42 | 582 | 691 | 716 | 291 | 345 |
| 14 Harghita | 0 | 0 | 11 | 0 | 0 | 1655 | 1748 | 1735 | 499 | 599 |
| 15 Ialomita | 104 | 190 | 222 | 99 | 178 | 651 | 688 | 728 | 436 | 404 |
| 16 Iasi | 0 | 19 | 13 | 0 | 7 | 1714 | 2091 | 2168 | 658 | 826 |
| 17 Ifov | 0 | 0 | 5 | 0 | 0 | 292 | 289 | 321 | 157 | 151 |
| 18 Mehedinti | 249 | 240 | 274 | 108 | 146 | 717 | 712 | 738 | 276 | 355 |
| 19 Olt | 148 | 197 | 276 | 140 | 186 | 1148 | 1199 | 1371 | 857 | 1033 |
| 20 Prahova | 0 | 0 | 56 | 0 | 0 | 1310 | 1502 | 1748 | 262 | 300 |
| 21 Satu Mare | 0 | 10 | 10 | 0 | 0 | 1287 | 1325 | 1331 | 740 | 830 |
| 22 Sibiu | 0 | 11 | 24 | 0 | 1 | 1879 | 1872 | 1896 | 664 | 705 |
| 23 Teleorman | 399 | 429 | 588 | 169 | 335 | 970 | 1035 | 1191 | 375 | 567 |
| 24 Timis | 39 | 102 | 181 | 1 | 22 | 2773 | 2820 | 2846 | 1338 | 1392 |
| 25 Tulcea | 1192 | 1630 | 1595 | 211 | 292 | 1041 | 1192 | 1233 | 285 | 341 |
| 26 Vaslui | 120 | 200 | 170 | 38 | 72 | 1169 | 1658 | 1647 | 602 | 849 |
| 27 Valcea | 8 | 38 | 93 | 1 | 10 | 974 | 1092 | 1198 | 294 | 457 |
| 28 Vrancea | 0 | 0 | 38 | 0 | 0 | 638 | 785 | 812 | 236 | 234 |
| Total | 4083 | 5474 | 6431 | 1705 | 2502 | 34932 | 37145 | 38985 | 14757 | 17358 |

FIGURES



Fig 1. Caraorman, Danube Delta, September 2012. Photo OC Banea

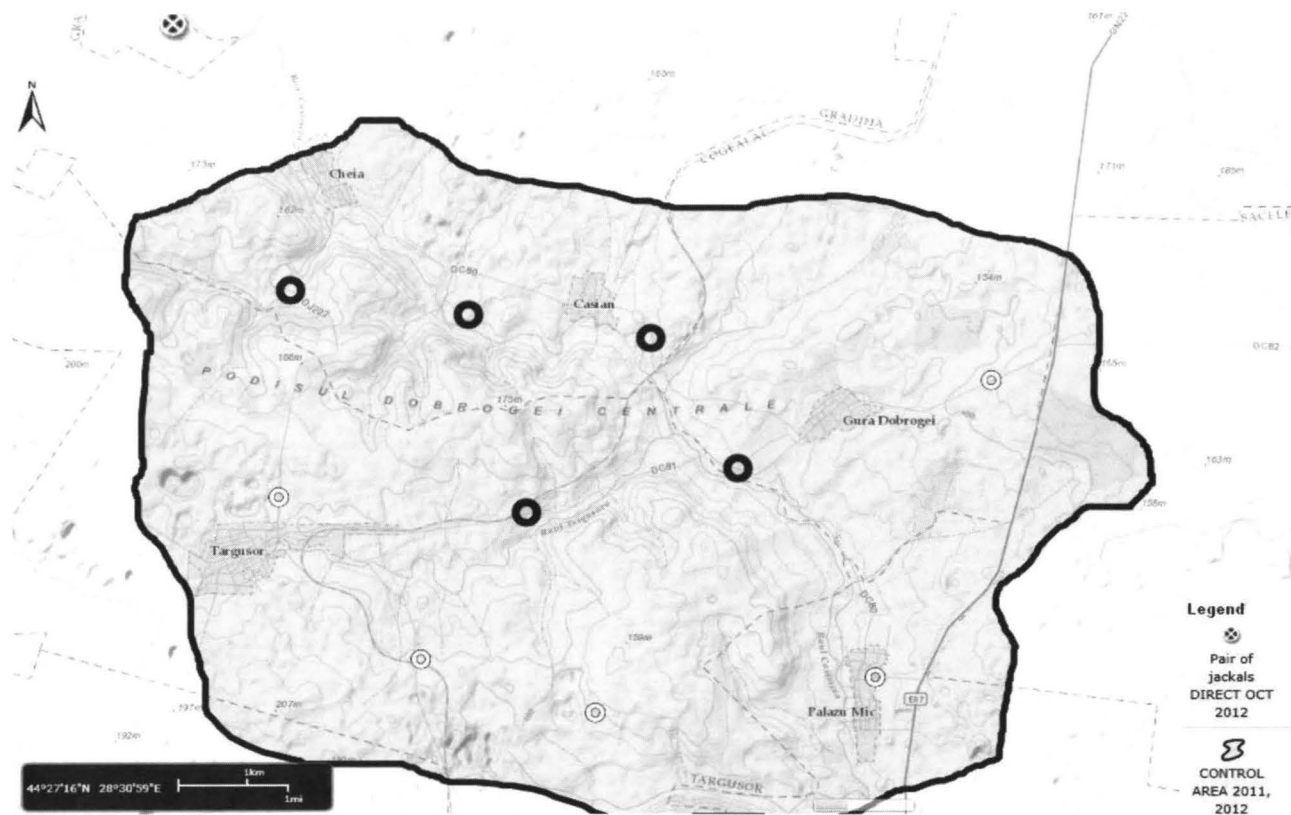


Fig 2 Jackal territorial groups in 2011. In 2012 no answer was recorded, but one pair of jackals was seen near the control area. Filled circles correspond to jackal groups answers in 2011(Banea et al. 2012)

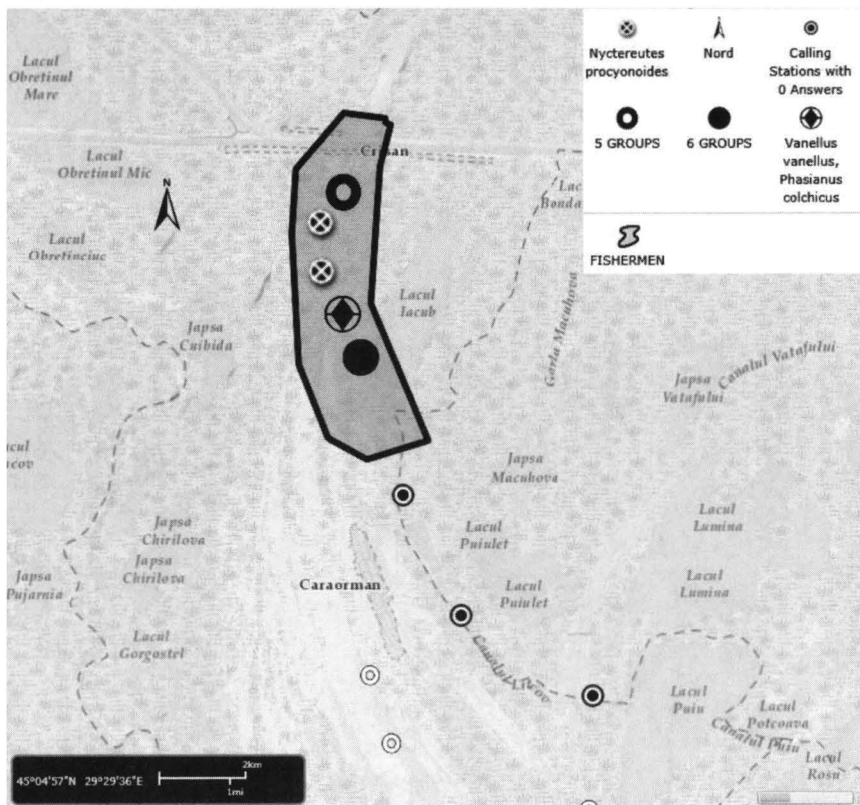


Fig 3. Crisan Caraorman and Jacob channel with highest numbers of jackals, Oct 2012

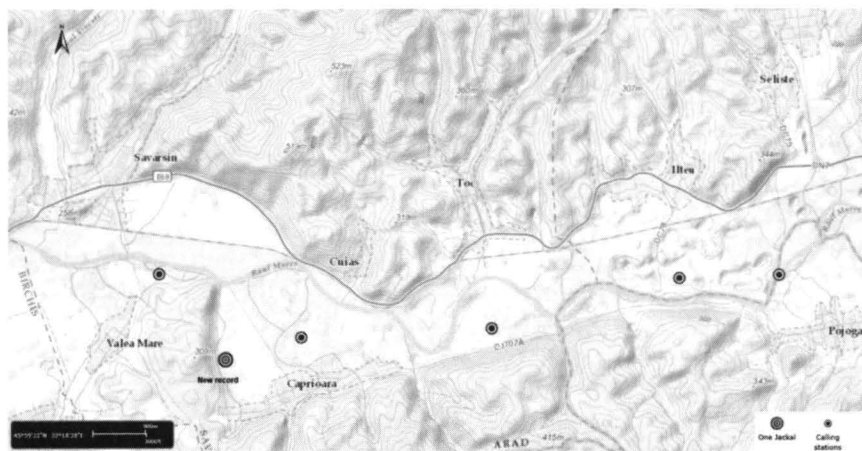
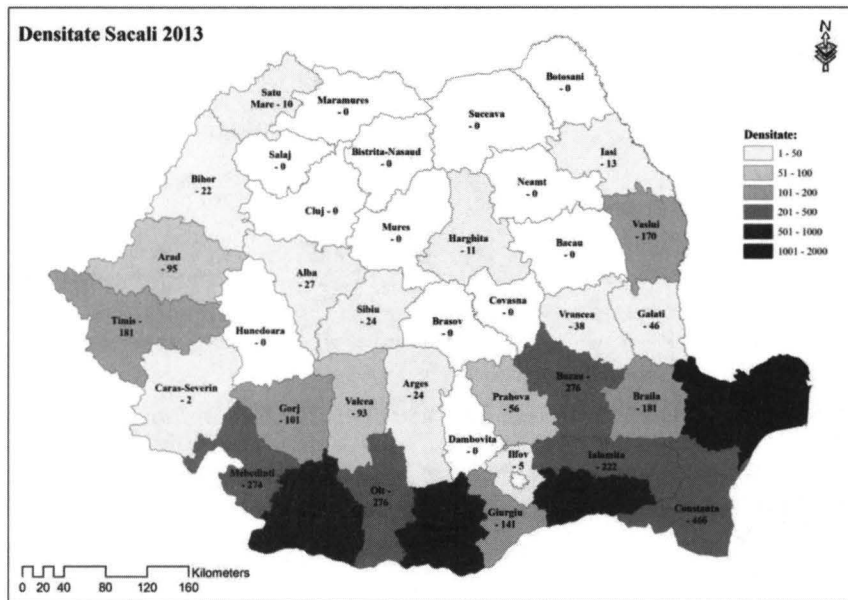
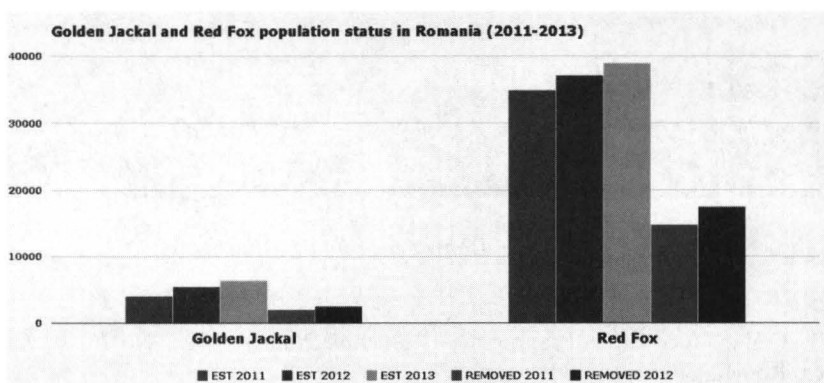


Fig 4 Calling stations and new record of jackal in Defileul Muresului Natura 2000 site.



*Fig 5 Jackal density in Romania in 2013
(based on the information provided by the hunting units)*



*Fig 6. Jackal and Red Fox situation in Romania during 2011-2013 periods
(two hunting seasons)*

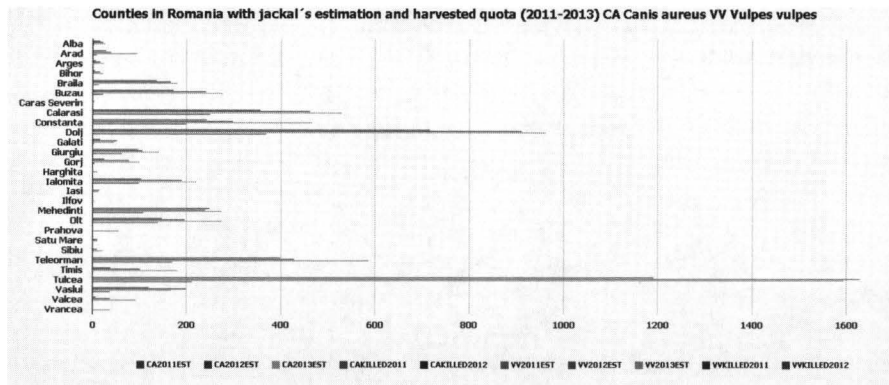


Fig 7 Counties with jackal harvest quota for 2013 in Romania



Fig 8 Golden Jackal in Dobrogea. Photo: MihaKrefel

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