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## POISONING OF SEVENTEEN EURASIAN GRIFFONS (*Gyps fulvus*) IN CROATIA

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**KEY WORDS:** *Eurasian Griffon; Gyps fulvus; carbofuran; conservation; Geocid G-5; insecticide; poisoned bait.*

Laying out poisonous baits in nature is a common method of controlling pest animals that was legally permitted in Croatia until around 1970. In most cases, this poisoning was targeted against certain species that caused material damage to human interests (Konjević et al. 2004). Today use of poison is prohibited by law, but is still illegally applied by some individuals in rural areas to protect cattle and poultry from predators. Because of the undercover nature of this practice, it is often difficult to document poisoning programs directed toward wildlife. For that reason, Croatia has little published data on animal poisoning, and available information is based on the suspicion rather than on direct evidence (Konjević et al. 2004). However, Imperial Eagles (*Aquila heliaca*) and Golden Eagles (*Aquila chrysaetos*) as well as Common Ravens (*Corvus corax*) have been documented to be poisoned by baits containing strychnine and cyanide (Hirtz 1938, Mikulić 1977), and phosphorus (Šooš 1947) in Gorski Kotar. The poison was laid out for wolves (*Canis lupus*) and foxes (*Vulpes vulpes*) (Frković 1973). Possible sources and consequences of poisoning of Eurasian Griffons (*Gyps fulvus*), as well as of other domestic and wild animals in the Kvarner archipelago were discussed by Sušić (1999) and Sušić and Pavoković (2001). Here, I describe a recent incident that resulted in the demise of 17 Eurasian Griffons in Croatia.

The breeding population of Eurasian Griffons is widespread, but patchily distributed throughout 17 southern European countries, including Croatia. The European population is relatively small (<21 000 pairs) and accounts for less than one half of its global range. The population in Europe increased substantially between 1970 and 1990 (BirdLife International 2004). Consequently, this previously *Rare* species is now classified as *Secure*.

The nesting colonies in Croatia is found on the islands of the Kvarner archipelago: Cres (70 pairs), Krk (3 pairs), Prvić (15 pairs), Plavnik (numbers unknown) and occasionally Pag (Sušić 2000; Fig. 1). Sušić (1994) estimated the total population at 90–100 pairs. Recently, the numbers of griffons has decreased and this population is regarded as critically endangered (Radović et al. 2003).

Eurasian Griffons feed on carcasses of medium-sized and large mammals, such as sheep, donkeys, horses, cows, and

deer (*Cervidae*). This diet makes them susceptible to poisoned baits laid out in nature. griffons search for food in groups, which amplifies the mortality if a foraging association finds a poisoned carcass. Typically, griffons forage as far as 50–60 km from their nests (Cramp and Simmons 1979). Within Croatia, this would include foraging on the neighboring islands of the archipelago, namely Rab and Pag.

The objectives of this paper are to document an incident of poisoning of griffons, to inform the international community, to propose a call for the establishment of a national committee to address this problem, and to take action against the illegal use of poison baits.

### METHODS

At Cape Sorinj on the island of Rab, 16 dead and one living Eurasian Griffon, as well as two dead Common Buzzards (*Buteo buteo*), were found on two occasions between 16 and 21 December 2004. The surviving griffon died on 20 December. The postmortem analyses on 17 griffons were conducted by the Faculty at the Department of General Pathology and Pathological Morphology, University of Zagreb. The postmortem consisted of dissection, as well as pathohistological, bacteriological, virological, parasitological, and toxicological analyses on samples of the brain, crop, gizzard, liver, lung, intestine, muscle, and ovary.

### RESULTS AND DISCUSSION

The initial discovery of dead Eurasian Griffons on the island of Rab suggested the possibility of poisoning. This was in an area where G. Sušić (pers. comm.) believed vulture poisoning had occurred in the past, but no evidence had been obtained. However, one case of methomyl poisoning was recorded in October 2004 in a 6-mo-old Eurasian Griffon on the island of Krk. This bird died after showing symptoms of convulsions, vomiting, tremors, seizures, and a lack of coordination (Sabočanec et al. 2005).

**Dissection, Virological, and Toxicological Analysis.** Of 17 griffons, one was identified as a juvenile and the other 16 birds were assumed to be adults. Autochthonous juveniles generally leave their natal areas at the end of September and return in 4–5 yr as sexually mature birds (Sušić 2000). One griffon was ringed in Italy at an age of 3 yr and was ca. 7 yr old at the time of its death on the island of Rab.

This poisoning incident involved 11 females and 6 males (gender determined by dissection). The virological tests excluded avian influenza and Newcastle disease as causes of death in all birds. The results of toxicological analyses showed the presence of carbofuran in internal organs in

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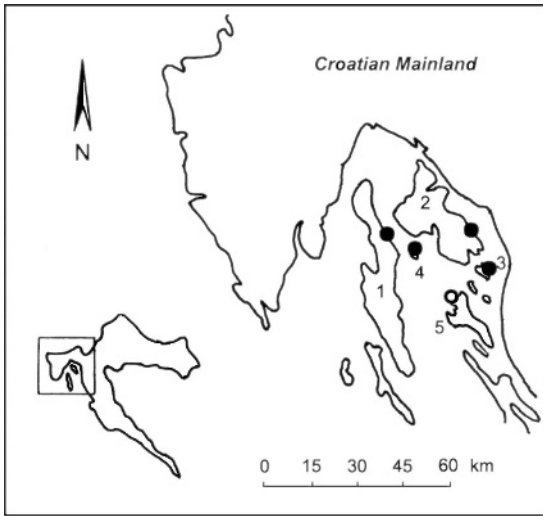


Figure 1. Map of the Kvarner archipelago, Croatia. Islands: 1 = Cres, 2 = Krk, 3 = Prvić, 4 = Plavnik, and 5 = Rab. Solid circles indicate Eurasian Griffon colonies and the open circle marks the location of the poisoning event.

16 birds: 15 birds had carbofuran in their livers, 11 in their crops, nine in their stomachs and four in their intestines.

Carbofuran is a carbamate insecticide and nematicide. It is used against soil-dwelling and foliage-feeding insects as well as nematodes in vegetables. The presence of carbofuran in the digestive tract and liver supports the inference that the vultures died of poisoning. However, the quantity of carbofuran found in the various organs was not indicated in the postmortem laboratory results. In birds, the lethal dose ( $LD_{50}$ ) and lethal concentration ( $LC_{50}$ ) that kill 50% of the observed population for Japanese Quail (*Coturnix japonica*) are 2.5–5 mg/kg and 60–240 mg/kg, respectively (Tomlin 2000).

The surviving Eurasian Griffon, which subsequently died, was found with the first group of 10 carcasses. The body of this griffon contained no organochlorine, organophosphate, carbonate pesticides, or their derivatives. However, it is possible that the poison was decomposed in the course of the illness that lasted several days (Z. Grabarević unpubl. postmortem report, 14 February 2005). Before death, this bird showed signs of abnormal behavior: it could not fly or walk, it stood with the head lowered, and it did not react to the close presence of people (Petrović 2004). In the environment, carbofuran is decomposed in 30–60 d by microbiological degradation (Tomlin 2000), but the time of decomposition in a live bird is unknown.

The concurrent presence of carbofuran in the crop and the liver of some of the Eurasian Griffons indicated that the poison was quickly absorbed into the digestive tract and the birds died while they were still consuming the poison. The fast action of carbofuran in birds has been described by Tataruch et al. (1998). The first signs of poi-

soning may be seen after several minutes and include ataxis, inability to fly, disruption of balance, and tachypnea. Death takes place within 1 hr, which explains why the poisoned birds were found in the immediate proximity of the baits. Also, carbofuran has been documented to cause neurotoxicity in mammals including humans (Satar et al. 2005, Kamboj et al. 2006, Recena et al. 2006).

In Croatia, carbofuran is a component of three insecticides of which just one, Geocid G-5, is freely available at farm pharmacies, as specified in Croatian legislation (Narodne novine 2003). The Croatian Institute of Toxicology includes records that the farm pharmacy on the island of Rab sold Geocid G-5 (Narodne novine 2002). Each sale and each buyer of this product should be registered, but in this case this regulation was ignored. Another reason for suspecting Geocid G-5 in this incident is an earlier record of accidental poisoning with this product by a sheep breeder on the island of Krk (F. Plavšić pers. comm.). Further analyses have shown that the Eurasian Griffons died after consuming poisoned baits laid down by a local sheep breeder. He, as well as some other sheep breeders on the island of Rab, were later discovered by the police to possess Geocid G-5.

**Circumstances of the Poisoning Incident on the Island of Rab.** Eurasian Griffons formerly came to the islands of Rab, Krk, Pag, and other surrounding islands in the Kvarner archipelago to feed on the carcasses of dead sheep and other livestock, which were not buried in the karst terrain. However, animal husbandry is in decline on the archipelago and modern livestock breeding tends to utilize each animal to the maximum extent possible, almost entirely eliminating the possibility of a dead animal being left in nature. Thus, this food source for scavengers has almost completely disappeared.

The circumstances that led to the poisoning of 17 Eurasian Griffons on the island of Rab were related to the appearance of wild boars (*Sus scrofa*) several years before the incident. The wild boar arrived recently on the island of Rab, by swimming from the continent (A. Frković pers. comm.). On the island of Krk, wild boars have been intentionally imported for recreational hunting. Wild boars sometimes destroy the crops and damage the production of farmers, sheep breeders, vine growers, and others. Due to the lack of reliable data, the number of wild boars on the island of Rab and the extent of the damage they cause are unknown. In addition to wild boars, stray dogs disturb the cattle and are considered pests by the agricultural population. The conflicting economic interests of the hunting, tourism, agriculture, and livestock-breeding communities demonstrate the increasing ineffectiveness of the existing legal framework. In these circumstances, some agricultural producers believe that the only way to stop the destruction of the crops is by laying out poisoned baits for wild boars. The lack of education among part of the local population, who do not understand ecological processes in nature, and do not appreciate the risks of poisons to human health contributes to these illegal practices.

**The Impact of Poisoning.** The Eurasian Griffon is a long-lived raptor with a low reproductive rate. High adult survival compensates for a low annual offspring production (Slotta-Bachmayr et al. 2004). This makes the population of this species highly sensitive to a decrease in adult survival. For that reason, the death of 17 adult Eurasian Griffons in a small population that consists of 90 pairs represents a significant negative impact on demographic viability of this population.

**Legislation and Conservation Effectiveness.** All breeding colonies of the Eurasian Griffon in the Kvarner archipelago are located in wildlife reserves. Current legislation consists of at least three relevant laws that makes poisoning griffons illegal. In Croatia, the griffon is a protected species, and killing it, taking its eggs, or disturbing its nest is a criminal offence carrying a fine of € 5,300 (Narodne novine 2005). Furthermore, the use of poisons or toxic baits is prohibited by the article 86 of this law and the article 63 of the Law on Hunting (Narodne novine 1994). Croatia furthermore subscribes to the international conventions, the articles of which are also applicable to the Eurasian Griffon (the European Union directive on the use of poisonous chemical substances, European Union Bird Directive, Bern Convention, and the Convention on International Trade in Endangered Species of Wild Fauna and Flora). In spite of this well-established legal protection on the national and international levels, the main threat to the Eurasian Griffon in Croatia is poisoning by illegal toxic baits.

Based on this event, I recommend two courses of action aimed at protecting birds and the environment as a whole. First, the ranking of causes of the endangerment of birds should be adjusted by making poisoning a priority factor posing the greatest threat to birds of prey. Second, the agricultural population should be educated in ecology and the protection of the natural environment in Croatia. Benson et al. (1990) suggested that the solution to the problem of poisoning Cape Griffons (*Gyps coprotheres*) in South Africa lay in the education of agricultural population, and that the most useful role of establishing feeding sites is the opportunity to educate the farming community.

Further, I recommend the establishment of a national committee in Croatia that would develop and conduct a program to prevent placing of illegal poison baits. This committee and their programs should emphasize (1) education of the population engaged in hunting, livestock breeding, and agriculture and (2) direction of the duties and responsibilities of the law enforcement agencies.

**Poison in Nature and International Cooperation.** Slotta-Bachmayr et al. (2004) provide a detailed overview of the status of and threats to the Eurasian Griffon based on reports from 17 countries. For seven countries, poisoning is a factor that could lead to the extirpation of the species within 20 yr; for five, poisoning is a factor that could cause a decline of <20% of the population in 20 yr or less; and for one country, poisoning is a factor that could lead to a decline of >20% of the population within 20 yr. The fact that the predicted population trend for 13 countries is

downward provides a sound basis for joint international actions to minimize this type of poisoning. Poison in nature, illegal or not, is a global threat, not only for the *Gyps*, but also for other vultures and bird scavengers. In many Mediterranean countries, the use of poisoned bait to control predators is a frequent practice that affects several raptor species, such as Bearded Vultures (*Cybaetus barbatus*) in France and Spanish Imperial Eagle (*Aquila adalberti*), and Cinereous Vulture (*Aegypius monachus*) in Spain (Artes and Hernandez 2003). Outside Europe, cases of secondary poisoning by diclofenac have been recorded for three *Gyps* species in the Indian subcontinent. In these cases, the poisoning caused rapid population decline (Green et al. 2004). Therefore, I recommend the organization of an international convention to address solutions to the illegal use of poison in nature. The founding and organizational center of this convention could appropriately be located in Croatia.

#### ENVENENAMIENTO DE DIECISIETE INDIVIDUOS DE *GYPVS FULVVS* EN CROACIA

**RESUMEN.**—Diecisiete individuos de *Gyps fulvus*, una especie localmente rara y en peligro, murieron en Croacia en 2004 luego de consumir carnadas de carne envenenadas en la Isla de Rab. El veneno fue un insecticida, Geocid G-5, que contiene carbofurán y está disponible en Croacia en las agroquímicas. La muerte de 17 individuos en una población de aproximadamente 90 parejas es significativa. Este incidente de uso ilegal de carnadas envenenadas en la naturaleza ha provocado un número de cuestionamientos relacionados con la ineficiencia de la legislación de protección ambiental, con la falta de coordinación entre los cazadores y los agricultores y con la falta de educación de las poblaciones locales. Para proteger el ambiente y prevenir el uso de veneno en Croacia, recomiendo el establecimiento de un comité nacional y de una convención internacional para abordar este problema.

[Traducción del equipo editorial]

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