Slovak Rapt J 2008, 2: 37–52. 10.2478/v10262-012-0017-3.
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Colour ringing of the Spotted Eagles (*Aquila pomarina*, *Aquila clanga* and their hybrids) in Europe – a review

Označovanie orlov (*Aquila pomarina*, *Aquila clanga* a ich hybridov) farebnými krúžkami v Európe – prehľad

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Dravecký M, Sellis U, Bergmanis U, Dombrovski V, Lontkowski J, Maciorowski G, Maderič B, Meyburg B-U, Mizera T, Stój M, Treinys R & Wójciak J 2008: Colour ringing of the Spotted Eagles (*Aquila pomarina*, *Aquila clanga* and their hybrids) in Europe – a review. Slovak Rapt J 2: 37–52.

Abstract: During the years 2000–2008 1377 Spotted Eagles (SE) (*Aquila pomarina*, *Aquila clanga* and their hybrids) have been colour ringed in Europe. Out of these, 1303 (94.6 %) were young birds and 74 (5.4 %) were adults. Out of the total, 1290 (93.7 %) were the *Aquila pomarina* Lesser Spotted Eagles (LSE) – 1229 (95.3 %) young and 61 (4.7 %) adults, 50 (3.6 %) were the *Aquila clanga* Greater Spotted Eagles (GSE) – 44 (88.0 %) young and 6 (12.0 %) adults and 37 (2.7 %) were the *Aquila pomarina* × *Aquila clanga* hybrids (LSE×GSE) – 30 (81.1 %) young and 7 (18.9 %) adults. With respect to the individual European countries the following SE species and numbers were ringed: Slovakia 636 (46.2 %), Poland 333 (24.2 %), Estonia 153 (11.1 %), Germany 116 (8.4 %), Lithuania 68 (4.9 %), Latvia 45 (3.3 %) and Belarus 26 (1.9 %). In the article authors presents a review on Spotted Eagle colour ringing programmes running in individual European countries.

Abstrakt: V období rokov 2000–2008 sa v Európe označilo farebnými krúžkami 1377 orlov (*Aquila pomarina*, *Aquila clanga* a ich hybridov), z toho mláďat 1303 (94,6 %) a adultných vtákov 74 (5,4 %). Z orlov krikľavých sa označilo 1290 (93,7 %), z toho mláďat 1229 (95,3 %) a dospelých jedincov 61 (4,7 %), orlov hrubozobých 50 (3,6 %) z toho mláďat 44 (88,0 %) dospelých jedincov 6 (12,0 %) a ich hybridov 37 (2,7 %), z toho mláďat 30 (81,1 %) a dospelých jedincov 7 (18,9 %). V jednotlivých krajinách v Európe sa okrúžkovali nasledovné počty jedincov: Slovensko 636 (46,2 %), Poľsko 333 (24,2 %), Estónsko 153 (11,1 %), Nemecko 116 (8,4 %), Litva 68 (4,9 %), Lotyšsko 45 (3,3 %), Bielorusko 26 (1,9 %). V článku autori prezentujú prehľad programov farebného označovania *A. pomarina, A. clanga* a ich hybridov v jednotlivých krajinách Európy.

Key words: Lesser Spotted Eagle, *Aquila pomarina*, Greater Spotted Eagle, *Aquila clanga*, hybrids, colour-ringing, SECR

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Introduction

Birds have already been ringed for more than a hundred years in Europe, which has enabled us to study and learn about plenty of aspects of their biology. The number of reported recoveries is generally very low and hardly reaches 0,5–3,0 %. What is more, almost all these data come from found perished birds. Frequent recoveries are reported for some bird species only e.g. *Cygnus olor* according to neck rings. There are not many recoveries in birds of prey, which means that plenty of individuals must be ringed in order to obtain a quantitatively sufficient sample for analyses. This is clearly a much more challenging task in birds of prey than in other bird groups. Regardless of their scarcity, a relatively good status of knowledge has been achieved within a short period of time. Besides the fact that birds of prey are not an easy target to observe in the wild, the situation gets further complicated for migratory species that fly to Africa for wintering where the social-economic situation (illiteracy, poverty) contributes to the fact that few recoveries make it back to the ringing stations. One of the methods enabling an increase in the number of recoveries is using the rings, which can be read with binoculars from a great distance. For example thanks to colour rings establishment, the numbers of *Haliaeetus albicilla* recoveries has risen significantly. The standard method (applying a metal rings with an address) has contributed only 1–3 % of recoveries, which in correspondence with a low number of ringed *Haliaeetus albicilla* birds gave a quantitatively non-significant sample for analyses. The species has been colour ringed since 1976 an in the period 1976–2000 8335 individuals have been colour ringed (Helander 2003), which has promoted a significant increase of knowledge of species biology from the ring recovery data. In Finland and in Sweden, where ornithologists are equipped with high-powered binoculars, *H. albicilla* is observed at the feeding sites during winter, which increased the number recoveries significantly once the colour ringing was launched. Only in Sweden, there have been more than 7000 colour ring recoveries. It is likely such a magnitute of recoveries will never be possible in *A. pomarina* as the species spends half a year off his breeding range. The eagles fly away to their wintering grounds in Africa and only a few data on ringed birds comes from there. An analysis based on the data from the European ringing stations showed that out of a total of 1649 ringed *A. pomarina* in the years 1904–1994 there were recoveries only for 41 individuals (2,5 %) (Danko et al. 1996). The results might be considered relatively high, as in the first half of the 20th century hunting on birds of prey was quite common in Europe, which increased the number of reported recoveries. For example in Poland, where 1592 individuals of *A. pomarina* were ringed in the years 1989–2008 and hunting on birds of prey has cut down, there have been only 14 reported recoveries (0,9 %; J. Wójciak & M. Stój in verb.). The objective of bird ringing is to find out about the age, breeding maturity, the onset of reproduction, philopatry, life span etc., on which there have been a lack of data so far (Meyburg et al. 2005a). Colour ringing has also been used to observe LSE×GSE hybrids in Poland, where the Biebrza valley is inhabited by both species, *A. pomarina* and *A. clanga*. Although adult *A. clanga* birds were spotted in the area long before, the first report on nesting of the species comes from the year 1979. A thorough monitoring of both species has been conducted there since 1990 (Mizera et al. 2005, Maciorowski et al. 2005). Coexistance of both species as well as changes in the environment have caused that some birds form mixed pairs, which are most frequently consisting of *A. pomarina* male and *A. clanga* female (Meyburg et al. 2005c, Maciorowski et al. 2005a). Such pairs are fertile and can rear offsprings. Chicks coming from the interspecific breeding of genetically "pure" *A. pomarina* and *A. clanga* are concidered hybrids. A detailed description of plumage of young hybrid individuals of phenotypically "pure" *A. pomarina* and *A. clanga* is a subject of a separate publication (Lontkowski & Maciorowski in prep.). Having reached sexual maturity the hybrids can form a pair with "pure" *A. pomarina* and *A. clanga* with an unknown portion of *A. clanga* genes. They create pairs with both species, *A. pomarina* and *A. clanga*. A genetic study focused on DNA of the species is a subject to research (Väli et al. in prep.). Recognition of each marked individual is hence crucial for further investigation and research. In order to design effective methods of conservation for this endangered European eagle, a multitude of data is also needed. The objective of ringing is not to study the aspects of migration as these are studied using satellite telemetry (Meyburg et al. 1993, 1995, 2000, 2001, 2002, 2004, 2006, 2007, Meyburg & Meyburg 2007). The presented article presents an overview of colour rings used in Spotted Eagles and it aims to increase the number of reported recoveries, especially within the species breeding range in Central Europe.

Methods

In 2000, colour rings (yellow) have started to be used for *A. pomarina* for the first time in Slovakia. Subsequently, they have been used in Germany and Poland. Method for *A. pomarina* colour ringing and its beginnings in Europe bind to Slovakia in 1999 (Maderič 2000). Later on, the first information on using colour rings was published in

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Tab. 1. Countries in Europe involved to the SECR programme with agreed colour and codes for every individual country
Tab. 1. Krajiny v Európe zahrnuté do programu SECR s odsúhlasenou farbou a kódmi pre každú jednotlivú krajinu

Country / Krajina	Programme beginning / Začiatok programu	Colour ring / Farebný krúžok
Estonia	2006	white with black code / biely s čiernym kódom
Latvia	2007	orange with black code / oranžový s čiernym kódom
Lihuania	2007	green with white code / zelený s bielym kódom
Poland	2007	red with white code [out of Biebrza Marshes area] / červený s bielym kódom [mimo oblasť Biebrza]
Belarus	2007	dark blue with white code / tmavomodrý s bielym kódom
Russia	2007	black with white code / čierny s bielym kódom
Slovakia	2008	light blue with black code / svetlomodrý s čiernym kódom

Slovakia and incorporated in short reports during the years 2000–2008 (Maderič 2005; Dravecký et al. 2006; Dravecký 2007, 2008). In 2006, other countries have launched colour ringing of SE within the Spotted Eagles Colour Ringing Programme (SECR). This programme was initiated as a result of several international meetings [Biebrza, 3B+B (3 Baltic states and Belarus) etc.]. Financial support for ordering the rings (except Latvian rings, ordered by Teici Nature Reserve) was provided by the EAGLELIFE project of Estonian Ornithological Society. It was a single financial aid to initiate SECR Programme for better Spotted Eagles conservation in future and to establish international co-operation. Further rings are to be obtained by each country itself. First set of rings, like the Slovak yellow rings, is ordered from Canada (Pro-Touch Engraving). In 2006, 200 white rings were ordered for Estonia and 300 light-blue rings for Slovakia. After 3B+B meeting in Latvia in 2007, it was decided to enlarge SECR Programme and Latvia, Lithuania, Poland, Belarus and Russia have joint in.

Colour rings can be made of plastic or metal. While metal rings are more durable and resistant to weather conditions, plastic ones are not expensive and easy to wear. Therefore majority of colour ringing programmes uses plastic rings, which can last for ten and even more years, but five years is the minimum. Spotted Eagles colour ringing programmes use mainly plastic rings; metal rings are used in Germany. The number of characters used in codes and colours represent the limiting factors for colour rings. When using two character combinations it is possible to make less than 1000 rings, if the similar characters (like B, S and 8) are not to be used. Colour ringing is a reasonable collateral activity e.g. when the nest is checked and climbed anyway or when an adult individual is trapped.

One colour ring on a leg

Yellow rings. Colour ringing programme on *A. pomarina* in Slovakia was accepted on an annual meeting of the Raptor Protection of Slovakia (RPS) in 1999 and put to practice in the year 2000, when the following rules and suggestions (Maderič 2000) were agreed on:

- a readable plastic yellow ring with black alpha-numerical (of two digits) code (combination of two letters, numbers or letter and number) is to be used. The reading direction of a ring is upwards (down-up);
- *A. pomarina* adults: yellow ring – left leg (tarsus); common metal ring of the national ringing scheme – right leg (tarsus);
- *A. pomarina* chicks on nests (Fig. 1): yellow ring – right leg (tarsus); common metal ring of the national ringing scheme – left leg (tarsus).

Spotted Eagles Colour Ringing Programme (SECR). This programme was initiated in 2006 by Slovakia and Estonia, and it was joined by Latvia, Lithuania, Poland, Russia and Belarus in 2007. For the ring codes of the countries see Tab. 1. Ringing regulations are as follows:

- left leg (tarsus) – coloured ring (Fig. 2);
- right leg (tarsus) – ring of the national scheme.

The reading direction of a ring is upwards. The empty space (about 3 mm) should be on the upper edge of a ring (tarsus feathers may cover a bit of the ring).

Metal readable rings. It has been confirmed that an adult male has succeeded to remove a yellow colour ring, metal rings for young birds have started to be used in Germany (Fig. 3) since 2007.

Orange rings – introduction of Latvian chicks. Orange colour rings (SECR) have been used since 2007 for nestlings introduced from Latvia to Germany together with a common metal ornithological ring corresponding with the German ringing scheme.

Two colour rings on a leg

Poland. As the marshy region of the Biebrza valley in NE Poland is inhabited by both species, *A. pomarina* and *A. clanga*, the method of placing two colour rings on



B. Maderič

Fig. 1. *A. pomarina* young, yellow ring on right and ornithological ring on left leg (Slovakia).
Obr. 1. Mláďa *A. pomarina,* žltý krúžok na pravej nohe a ornitologický na ľavej nohe (Slovensko).



U. Sellis

Fig. 2. System of Spotted Eagles colour ringing in SECR programme in Europe.
Obr. 2. Systém označovania *A. pomarina, A. clanga* a hybridov v programe SECR v Európe.



B-U Meyburg

Fig. 3. Young *A. pomarina* with German metal (aluminium) readable ring, Germany.
Obr. 3. Mláďa *A. pomarina* s kovovým odčítacím (hliníkovým) krúžkom, Nemecko.

a tarsus was used. All the young and adult *A. clanga* eagles were ringed with 2 colour rings on a left leg (Fig. 4). A combination of 4 colours was used: white, yellow, blue, red. Each ring bears an alpha-numeric code e.g. 3S repeated three times. A code combination consisting of a number and a letter was used for *A. clanga* and GSE×LSE hybrids (Tab. 2). It enables a relatively easy code reading regardless of the posture of a bird and observer's position. What is more, in case one of the colour rings gets lost, identification of the individual is still possible thanks to the remaining ring. In the Biebrza region hybrids must also be taken into consideration. Some of them have been trapped (Tab. 5). The Biebrza *A. pomarina* are similarly to *A. clanga* also marked with two colour rings. However, in order to be able to distinguish between the two species easily, the rings are placed on a right leg in *A. pomarina* (Fig. 5). The same applies to young and adult birds A code combination consisting of a number / number was used for *A. pomarina* (Tab. 3).

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Fig. 4. *A. clanga* juvenile ringed with two coloured rings. Biebrza Marshes, Poland, 25 July 2008.
Obr. 4. Mláďa *A. clanga* krúžkované dvomi farebnými krúžkami. Biebrza Marshes, SV Poľsko, 25. júla 2008.


G. Maciorowski

Fig. 5. All *A. pomarina* were ringed with two rings on right leg . Biebrza Marshes, NE Poland, 25 July 2008.
Obr. 5. Všetky *A. pomarina* sa okrúžkovali dvomi krúžkami na pravej nohe. Biebrza Marshes, SV Poľsko, 25. júl 2008.

Tab. 2. GSE and GSE×LSE hybrids colour ringing system, overview of colour combinations, localisation and codes combinations (Biebrza Marshes, 2005–2008)
Tab. 2. Systém označovania farebnými krúžkami GSE a hybridov GSE×LSE, prehľad farebných kombinácií, umiestnenie a kombinácie kódov (Biebrza Marshes, 2005–2008)

Two rings / Dva krúžky	**Codes / Kódy**						
white over red / biely nad červeným	1A	2A	3 S	4 S	5 A	6 A	8 S
white – blue / biely – modrý	1B	2B	3 P	4 P	5 B	6 B	8 P
white – yellow / biely – žltý	1C	2C	3 M	4 M	5 C	6 C	8 M
red – white / červený – biely	1D	2D*	3 L	4 L	5 D	6 D	8 L
red – blue / červený – modrý	1F	2F	3 K	4 K	5 F	6 F	8 K
red – yellow / červený – žltý	1P	2P	3 J	4 J	5 H	6 H	8 J
yellow – white / žltý – biely	1H	2H	3 H	4 H	5 J	6 J	8 H
yellow – red / žltý – červený	1J	2J	3 F	4 F	5 K	6 K	8 F
yellow – blue / žltý – modrý	1K	2K	3 D	4 D	5 L	6 L	8 D
blue – white / modrý – biely	1L	2L	3 C	4 C	5 M	6 M	8 C
blue – yellow / modrý – žltý	1M	–	3 B	4 B	5 P	6 P	8 B
blue – red / modrý – červený	1S	2S	3 A	4 A	5 S	6 S	8 A

* only white / len biely

Russia. The data on 8 rings from Russia were not provided and hence are not included in a total survey of all the colour ringed eagles (*Aquila pomarina*, *Aquila clanga* and their hybrids) for the period of years 2000–2008.
Slovakia. In Slovakia common aluminium rings received from the National Ringing Centre have the following engravement: BL number N. MUSEUM BRATISLAVA SLOVAKIA. A database on colour rings was served by B. Maderič (2000–2004) and continuously by M. Dravecký (2005–2008).
Estonia. A common aluminium ring is eared and two sizes of common rings (A and R series) are being used, in Spotted Eagles. Above the ring number, there is an engravement saying: ESTONIA MATSALU.
Lithuania. R. Treinys has become its national coordinator. The Eagle Club Estonia has also provided colour rings for Lithuania. Common stainless rings in Lithuania are received from the National Ringing Centre and have the following engravement: ZOOL.MUSEUM KAUNAS LITHUANIA KAUNAS MA 1120.
Latvia. Bergmanis has arranged colour rings for Latvia in person with the producer Pro-Touch Engraving, CANADA. U. Bergmanis has also become a national coordinator for *A. pomarina* colour-ringing in Latvia. Latvia together with other countries has been participating in the SECR since 2007.

Tab. 3. LSE colour ringing system, overview of colour combinations, localisation and codes combinations (Biebrza Marshes, 2005–2008)
Tab. 3. Systém označovania farebnými krúžkami LSE, prehľad farebných kombinácií, umiestnenie a kombinácie kódov (Biebrza Marshes, 2005–2008)

Two rings / Dva krúžky	Codes / Kódy						
white over red / biely nad červeným	10	20	41[1]	42	65	66	99
white – blue / biely – modrý	11	21	40[2]	43	64	67	98
white – yellow / biely – žltý	12	22	39	44	63	68	97
red – white / červený – biely	13	23	38	45	62	69	96
red – blue / červený – modrý	14	24	37	46	61	80	95
red – yellow / červený – žltý	15	25	36	47	60	81	94
yellow – white / žltý – biely	16	26	35	48	59	82	93
yellow – red / žltý – červený	17	27	34	49	58	83	92
yellow – blue / žltý – modrý	18	28	33	50	57	84	91
blue – white / modrý – biely	19	29	32	51	56	85	90
blue – yellow / modrý – žltý	–	–	31	52	55	86	89
blue – red / modrý – červený	–	–	30	53	54	87	88

[1]red over white / červený nad bielym; [2]blue over white / modrý nad bielym

Belarus has also received colour rings for SECR from the Eagle Club Estonia were in 2007. Dark-blue colour was agreed for Belarus and V. Dombrovski has become a national coordinator there as he is the only ringer of Spotted Eagles with colour rings in Belarus.

Review of preliminary results

Colour ringing in Europe has been conducted under several programmes (Tabs 4 and 5). In the years 2000–2008 1377 eagles (*Aquila pomarina*, *Aquila clanga* and their hybrids) were colour ringed in Europe (Tab. 5). Out of this there were 94.6 % young birds and 5.4 % adults. Out of this, there were 93.7 % *A. pomarina* (95.3 % young birds and 4.7 % adults), 3.6 % *A. clanga* (88.0 % young birds and 12.0 % adults) and 2.7 % hybrids (81.1 % young birds and 18.9 % adults).

In Slovakia (2000–2008) only *A. pomarina* were ringed as *A. clanga* doesn't breed here and even its observations are very rare. Out of 636 ringed *A. pomarina*, there were 97.6 % young birds and 2.4 % adults. In Poland (2000–2008), 333 individuals of all three taxa were colour ringed altogether. Out of this, there were 86.5 % *A. pomarina* (97.6 % young and 2.4 % adults), 6.9 % *A. clanga* (73.9 % young and 26.1 % adults) and 22 hybrids (77.3 % young and 22.7 % adults). In Estonia (2006–2008), 153 individuals of all three SE taxa were ringed in total. Out of this, there were 90.8 % *A. pomarina* (97.1 % young and 2.9 % adults), 2.0 % *A. clanga* (all were young) and 7.2 % LSE×GSE hybrids (91.0 % young and 9.0 % adult). In Germany (2000–2008), 116 Spotted Eagles were marked with colour rings in total. Out of this, there were 98.3 % *A. pomarina* (81.6 % young and 18.4 % adults) and 1.7 % hybrids (1 young and 1 adult). In Lithuania there is no record of *A. clanga* breeding, hence only *A. pomarina* were colour ringed. A total of 68 *A. pomarina* was ringed there since 2007–2008. All the ringed eagles were young birds. Only *A. pomarina* was marked with colour rings and wing tags in Latvia in the years 2007–2008. 45 individuals were marked altogether (68.9 % young birds and 31.1 % adults). In Belarus (2007–2008) colour ringing was focused primarily on *A. clanga*. Out of the total of 26 ringed eagles, there were 92.3 % *A. clanga*, all of them were ringed as chicks on the nests, and 7.7 % LSE×GSE hybrids, which were young birds, too.

S l o v a k i a

During the period 2000–2008 636 *A. pomarina* were colour ringed. Two series of colour rings were used: yellow – used from 2000–2008, 631 *A. pomarina* were ringed with these rings (Figs 6, 7) and light-blue – used in 2008 for the first time, were obtained from Estonia through SECR programme and 5 young *A. pomarina* were ringed with them (Fig. 8). In Slovakia only *A. pomarina* were colour ringed. Common ornithological rings from Czech and Slovak Ringing Scheme were used together with colour rings. A detailed summary on colour ringing (2000–2008) in Slovakia have been published by Dravecký et al. (2008).

G e r m a n y

A. pomarina colour ringing in Germany started in the year 2000, when the adults trapped to be fitted with satellite transmitters were ringed. Trapping adults started in

1994 and will continue for at least the next four years. It was performed by B.-U. Meyburg, who has also started a colour ringing programme there. Colour ringing was used especially for *A. pomarina* and *A. pomarina* × *clanga* hybrids. Since 2000–2008 from total 116 Spotted Eagles 21 adults and 94 nestlings including one hybrid nestling *A. pomarina* were colour ringed. One of the adults, a female trapped in 2008, might be a hybrid, but DNA analysis is pending. B-U Meyburg is a national coordinator of this program in Germany. The following colour rings were used in Germany: yellow rings from Slovakia since 2000 (Fig. 9), German metal (aluminium) colour rings for German nestlings since 2007 (Fig. 3) and orange rings from Latvia for introduced Latvian nestlings since 2007 as well. Hence three different colour rings are being used in Germany at present. Using yellow rings for all adults and in a few cases also for nestlings continues though it was found out that sometimes even they are difficult to spot in a flying adult bird. However, digital photos help to notice the ring and sometimes even read it. One adult male has completely removed his yellow ring. The bird was recognized by its satellite transmitter. Ever since glue is used to fasten a yellow ring. However, it is suspected that some birds may remove them still. Some adult birds are even strong enough to remove harnesses of satellite transmitters. Therefore metal colour rings have started to be used for young birds. Remarkable is the first confirmed sighting in Germany of a one-year-old Lesser Spotted Eagle by Ulf Kraatz (in verb.) on July 21, 2005 in Randow valley, north-east Brandenburg, not far from its birthplace. The colour-ring (9 B) on the left leg could be read clearly through a telescope at a distance of 40 m. The eagle was hunting in loose companionship with a number of other Lesser Spotted Eagles, among which there was at least one other non-fully coloured individual (Meyburg et al. 2005).

P o l a n d

Colour rings started to be used in Poland in the years 2000–2005 in the region of the Biebrza marshes. During the research conducted in co-operation with B.-U. Meyburg, adult birds were netted. 8 *A. clanga* (3 ad and 5 pull) and 1 adult *A. pomarina* were marked with yellow rings and also equipped with satellite transmitters PTT (Meyburg et al. 2005b). For the first time migration of the entire *A. clanga* family (male, female and eaglet) was observed. A detailed report on the issue was published by Meyburg et al. (1998, 2005b). The system of two colour rings on a leg is used in the Biebrza marshes since 2005 (Figs 10–13). The latest colour ringing data has brought information on a young *A. clanga* (2D red/white) in his first year that perished in France and on a GSE×LSE hybrid (2S blue/red) in its second year that was observed in Germany by B.-U. Meyburg. However, it remains unknown where the individual spent the spring of 2008. An adult GSE×LSE male trapped at its breeding site in 2005 was observed at the same site in 2006 as well and was re-trapped there in 2008 again. Another adult *A. clanga* (9P) male was observed to occupy the same territory in the years 2002–2008. A *A. clanga* female (1B) trapped in 2005 was observed to change a territory. She changed her breeding partner and formed a new pair with a male 9P. A record of *A. pomarina* nestling from the year 2005 observed in the Biebrza marshes in July 2006 is also interesting. Plenty of recoveries are expected in SE Poland in the closest years as 1574 *A. pomarina* eaglets were ringed there by the members of the Eagle Conservation Committee [Komitet Ochrony Orłów – KOO]. Out of this number, 259 chicks were colour ringed in correspondence with SECR programme (Tab. 6). Red rings were used (Fig. 14).

E s t o n i a

Spotted Eagles have been ringed with colour plastic rings since 2006 after several international events. Estonia uses white rings with black codes (Figs 15, 16). During 2006–2008 139 *A. pomarina* – 135 young birds and 4 adults, 3 young *A. clanga* and 11 LSE×GSE hybrids – 10 young birds and 1 adult were ringed.

L i t h u a n i a

Due to strict rules applying to ringing protected species in the country, only two people are entitled to conduct the activity. During the years 2007–2008 68 chicks were ringed on the nests with green rings with white letters (Fig. 17). No *A. clanga* breeding pairs were observed in Lithuania, but a few hybrids of first or latter generations could be reared regularly. It is very problematic to identify hybrids in the field just based on plumage and morphometric features. As genetic identification for ringing purposes is not really feasible, all ringed spotted eagles were formally attributed to *A. pomarina* species in order to avoid speculation on species identity. Ringing reports are sent to the SECR coordinator and to the National Ringing Centre coordinator.

L a t v i a

During the years 2007–2008 31 juveniles and 14 adults (Figs 18, 19) *A. pomarina* were colour ringed. As the programme has been running for a year only no colour

Tab. 4. Types of coloured rings, ring combinations, programmes, ringed LSE, GSE and hybrids in individual countries in Europe
Tab. 4. Typy farebných krúžkov, kombinácie krúžkov, programy, krúžkované LSE, GSE a hybridy v jednotlivých krajinách Európy

Ring / Krúžok	Country / Krajina	Period / Obdobie	Species / Druh	Number of ringed birds / Počet okrúžkovaných vtákov Pull.	Ad.	∑	Organisation National coordinator Contacts Language for communication / Organizácia Národný koordinátor Kontakty Komunikačný jazyk
One ring on one leg / Jeden krúžok na jednej nohe							
	**SLOVAKIA**	2000–2008 Yellows	LSE	**621**	**15**	**631**	Raptor Protection of Slovakia (RPS) **Miroslav Dravecký** Rovnikova 8, 04012 Košice, Slovakia e-mail: dravecky.miroslav@t-com.sk mob: +421 908 325 218 com: Czech, English, Russian
	**SLOVAKIA**	2008– SECR	LSE	**5**	**0**	**5**	
	**GERMANY**	2000–2008 Yellows	LSE LSE×GSE	**14** **1**	**21** **1***	**35** **2**	
	**GERMANY** [metal] [kovový]	2007–2008	LSE	**70**	**0**	**70**	World Working Group on Birds of Prey **Bernd–Ulrich Meyburg** Wangenheimstrasse 32, 14193 Berlin, Germany e-mail: BUMeyburg@aol.com, schreiadler@aol.com phone: +49 30 893 881 33 com: English, French
	**GERMANY**	2007–2008 LSE INTROD LATVIA	LSE	**9**	**0**	**9**	
	**POLAND** [letter / number] [písmeno / číslica]	2000–2004 Yellows	LSE GSE LSE×GSE	**0** **5** **0**	**1** **3** **0**	**1** **8** **0**	**Tadeusz Mizera** **Grzegorz Maciorowski** **Bernd-Ulrich Meyburg** e-mail: tmizera@au.poznan.pl com: English
	**POLAND**	2007–2008 SECR	LSE GSE LSE×GSE	**259** **2** **1**	**0** **0** **0**	**259** **2** **1**	Eagle Conservation Committee **Jan Lontkowski** Sienkiewicza 21 50–335 Wroclaw, Poland e-mail: jlont@biol.uni.wroc.pl mob.: +48 691 025 750 com: English
	**ESTONIA** [internat. coordinator] [medzin. koordinátor]	2006–2008 SECR	LSE GSE LSE×GSE	**135** **3** **10**	**4** **0** **1**	**139** **3** **11**	Estonian Eagle Club **Urmas Sellis** Hauka, Valgjarve side, Polvamaa 63406, Estonia e-mail: urmas@kotkas.ee com: English, Russian, German

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Tab. 4. continued / pokračovanie

Ring / Krúžok	Country / Krajina	Period / Obdobie	Species / Druh	Number of ringed birds / Počet okrúžkovaných vtákov Pull.	Ad.	∑	Organisation National coordinator Contacts Language for communication / Organizácia Národný koordinátor Kontakty Komunikačný jazyk
	**LITHUANIA**	2007–2008 SECR	LSE	**68**	**0**	**68**	**Rimgaudas Treinys** Taikos 37–8, LT–28167, Utena, Lithuania e-mail: rimga.t@gmail.com mob.: +370 615 124 55 com: English, Russian
	**LATVIA**	2007–2008 SECR	LSE	**31**	**14**	**45**	Teici Nature Reserve **Ugis Bergmanis** Aiviekstes 3, Laudona, LV–4862, Madonas raj., Latvia e-mail: ugis.bergmanis@teici.gov.lv mob: +371 294 858 51 com: German, English, Russian
	**BELARUS**	2007–2008 SECR	GSE LSE×GSE	**24** **2**	**0** **0**	**24** **2**	APB–BirdLife Belarus **Valery Dombrovski** a/c 306, Minsk, 220050, Belarus e-mail: valdombr@rambler.ru, valera@biobel.bas-net.by com: Russian, French, English,
	**RUSSIA**	2007–2008 SECR	LSE GSE LSE×GSE				
Two rings on one leg / Dva krúžky na jednej nohe							
	**POLAND** [right leg number / number] [pravá noha číslica / číslica]	2005–2008 Biebrza Marshes	LSE	**22**	**6**	**28**	University of Live Sciences, Zoology Department **Grzegorz Maciorowski** ul. Wojsk Polskiego 71 c, PL–60–625 Poznań, Poland e-mail: gmaqc@au.poznan.pl com: English, Russian
	**POLAND** [left leg number / letter] [ľavá noha číslica / písmeno]	2005–2008 Biebrza Marshes	GSE LSE×GSE	**10** **16**	**3** **5**	**13** **21**	

Yellows – yellow rings used since 2000 mainly Slovakia, Germany and Poland / žlté krúžky používané od roku 2000 na Slovensku, v Nemecku a Poľsku; SECR – The Spotted Eagles Colour Ringing Programme organised by Eagle Club Estonia since 2006 / Program označovania orlov *A.pomarina* a *A.clanga* farebnými krúžkami organizovaný od roku 2006 organizáciou Eagle Club Estonia; LSE INTROD LATVIA – young *A. pomarina* (Abels) introduced from Latvia to Germany / mláďatá orlov krikľavých (Ábelovia) introdukované z Lotyšska do Nemecka; LSE – Lesser Spotted Eagle / orol krikľavý (*Aquila pomarina*); GSE – Greater Spotted Eagle / orol hrubozobý (*Aquila clanga*); LSE×GSE – Lesser Spotted Eagles and Greater Spotted Eagles hybrids / hybdridy orla krikľavého a orla hrubozobého; * one adult female trapped in 2008 in Germany, might be a hybrid, but DNA analysis is outstanding / jedna dospelá samica odchytená v roku 2008 v Nemecku, pravdepodobne hybrid, ale DNA analyza nie je ukončená

Tab. 5. Spotted Eagles (*Aquila pomarina*, *Aquila clanga* and its hybrids) colour ringing in Europe since 2000–2008
Tab. 5. Označovanie orlov (*Aquila pomarina*, *Aquila clanga* a ich hybridov) farebnými krúžkami v Europe v rokoch 2000–2008

Colour / Farba	Country / Krajina Coordinator / Koordinátor	Programme / Program	Species / Druh	2000		2001		2002		2003		2004		2005		2006		2007		2008		2000–2008		
				pull.	ad.	pull.	ad.	pull.	ad.	pull.	ad.	pull.	ad.	pull.	ad.	pull.	ad.	pull.	ad.	pull.	ad.	pull.	ad.	∑
One ring on one leg / Jeden krúžok na jednej nohe																								
yellow[1]	Slovakia / Dravecky M	Yellows[10]	LSE	107	7	58	0	61	2	41	0	96	2	56	0	59	2	71	2	67	0	616	15	631
light-blue[2]		SECR		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	0	5
yellow[1]	Germany / Meyburg B-U	Yellows[10]	LSE	0	2	0	3	0	1	0	0	4	2	2	3	6	2	0	2	2	6	14	21	35
			LSE×GSE	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1*	1	1	2
metal[3]		GER	LSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	46	0	70	0	70
orange[4]		Introd		0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	6	0	9	0	9
yellow[1]	Poland [Biebrza] / Mizera T, Meyburg B-U, Maciorowski G	Yellows[10]	LSE	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
			GSE	0	1	0	0	1	1	1	0	3	1	0	0	0	0	0	0	0	0	5	3	8
red[5]	Poland / Wójciak J, Stój M, Lontkowski J	SECR	LSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	120	0	139	0	259	0	259
	Poland / Maciorowski G		GSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	2
	Poland / Wójciak J		LSE×GSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1
white[6]	Estonia / Sellis U	SECR	LSE	0	0	0	0	0	0	0	0	0	0	0	0	55	0	28	0	52	4	135	4	139
			GSE	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	3	0	3
			LSE×GSE	0	0	0	0	0	0	0	0	0	0	0	0	5	1	2	0	3	0	10	1	11
orange[4]	Latvia / Bergmanis U	SECR	LSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3	27	11	31	14	45
green[7]	Lithuania / Treinys R	SECR	LSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0	44	0	68	0	68
dark-blue[8]	Belarus / Dombrovsky V	SECR	GSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	12	0	24	0	24
			LSE×GSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2	0	2
black[9]	Russia / Ptselintsev V	SECR	LSE	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0		0			
Two rings on one leg / Dva krúžky na jednej nohe																								
	Poland [Biebrza] / Maciorowski G		LSE	0	0	0	0	0	0	0	0	0	0	3	0	7	2	6	0	6	4	22	6	28
			GSE	0	0	0	0	0	0	0	0	0	0	4	2	2	1	2	0	2	0	10	3	13
			LSE×GSE	0	0	0	0	0	0	0	0	0	0	3	2	6	3	3	0	4	0	16	5	21
∑			LSE	107	9	58	4	61	3	41	0	100	4	61	3	127	6	280	7	394	25	1229	61	1290
			GSE	0	1	0	0	1	1	1	0	3	1	4	2	3	1	15	0	17	0	44	6	50
			LSE×GSE	0	0	0	0	0	0	0	0	0	0	4	2	11	4	6	0	9	1	30	7	37
				107	10	58	4	62	4	42	0	103	5	69	7	141	11	301	7	420	26	1303	74	1377
All taxa / všetky taxóny				117		62		66		42		108		76		152		308		446		1377		1377

LSE – Lesser Spotted Eagle / orol krikľavý (*Aquila pomarina*); GSE – Greater Spotted Eagle / orol hrubozobý (*Aquila clanga*); LSE×GSE – Lesser Spotted Eagles and Greater Spotted Eagles hybrids / hybdridy orla krikľavého a orla hrubozobého

[1] žltá; [2] svetlomodrá; [3] kovová; [4] oranžová; [5] červená; [6] biela; [7] zelená; [8] tmavomodrá; [9] čierna; [10] žlté krúžky; SECR – Program označovania orlov *A.pomarina* a *A.clanga* farebnými krúžkami; GER – used only in Germany / používané len v Nemecku; Introd – young *A. pomarina* (Abels) introduced from Latvia to Germany / mláďatá *A. pomarina* (Ábelovia) introdukované z Lotyšska do Nemecka

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ringed eagle has been observed yet. In order to rescue the second *A. pomarina* chick, 9 were incubated and hatched from second eggs in Latvia in 2007 and 2008. These chicks were marked with orange colour rings and transported to Germany where they were placed to natural *A. pomarina* nests and successfully fledged.

Belarus

Research and ringing activities are focused mostly on ringing *A. clanga* juveniles (Fig. 20) on the nest in Polesie region (south Belarus). During the years 2007–2008 24 *A. clanga* juveniles and 2 LSE×GSE hybrids (Fig. 21) were ringed. The first observed colour ringed *A. clanga* (wearing a blue ring with the letters AD on its left leg and a metal ring from Belarus on its right leg) was spotted on November 23, 2007 in Northern Israel (North of Haifa, towards Acre) by Ohad Hatzofe. The eagle was suspected to be poisoned and was treated in the Israeli Wildlife Medical Centre. This bird was ringed near Beloozersk (Bereza District, Brest Region, south-western Belarus) on July 28, 2007 as a chick (about 50 days) on the nest.

Russia

In correspondence with SECR, 8 colour rings (black rings with white letter were agreed for Russia) were sent to Russia in 2007 by the Eagle Club Estonie. Vasilij Ptselintsev has become a national coordinator. No results were received so far.

Conclusion

Colour ringing of Spotted Eagles (*Aquila pomarina*, *Aquila clanga* and their hybrids) was conducted in eight European countries within their breeding range, i. e. in Slovakia, Poland, Germany, Estonia, Latvia, Lithuania, Belarus and Russia, in the period 2000–2008. Colour ringing of Spotted Eagles hasn't started in Ukraine, Romania and Hungary so far (Domashevsky, Daroczi & Horváth in verb.). Colour ringing has so far been conducted under 3 ringing programmes: The first programme used yellow colour rings and has been conducted in the years 2000–2008 in Slovakia, Germany and Poland, the second programme applying two colour rings on a leg has been conducted in Poland in the Biebrza marshes in the years 2005–2008 and the third, large-scale colour ringing programme, has been launched in Estonia (Eagle Club Estonia) and consequently spread to other European countries (Slovakia, Poland, Latvia, Lithuania, Belarus and Russia). It has been conducted in the years 2006–2008. This survey is important for the countries where colour ringing has already been conducted as well as for the countries planning to start



M. Riník

Fig. 6. *A. pomarina* adults in Slovakia were ringed with yellow rings. Krivošťany, 23 May 2006. "window" in the wing is visible.
Obr. 6. Dospelé *A. pomarina* na Slovensku boli krúžkované žltými krúžkami. Krivošťany, 23. máj 2006. Viditeľné "okno" v krídle.



B. Maderič

Fig. 7. During 2000–2008 *A. pomarina* in Slovakia were ringed with yellow rings. Makovce, 5 July 2008.
Obr. 7. V rokoch 2000–2008 *A. pomarina* na Slovensku boli krúžkované žltými krúžkami. Makovce, 5. júl 2008.



M. Dravecký

Fig. 8. *A. pomarina* colour-ringing have started with light-blue rings (SECR) in Slovakia. Obišovce, 15 July 2008.
Obr. 8. Označovanie *A. pomarina* svetlomodrými krúžkami (SECR) začalo na Slovensku. Obišovce, 15. júl 2008.

Tab. 6. According to SECR, overview of ringed **LSE** with red coloured rings during 2007–2008 in Poland
Tab. 6. Prehľad počtu krúžkovaných **LSE** v rokoch 2007–2008 červenými farebnými krúžkami v Poľsku v náväznosti na program SECR

Ringer / Krúžkovateľ	Species / Druh	2007		2008		∑		Region / Oblasť
		pull.	ad.	pull.	ad.	pull.	ad.	
Wójciak J	LSE	78	0	99	0	177	0	Lublin area / okolie Lublinu
Stój M	LSE	39	0	34	0	73	0	south-eastern Poland / juhovýchodné Poľsko
Maciorowski G	LSE	0	0	5	0	5	0	Biebrza Marshes / Biebrza mokrade
Lontkowski J	LSE	2	0	0	0	2	0	Silesia / Sliezsko
Pitucha G	LSE	1	0	1	0	2	0	Bieszczady Mts / Beskydy
Wójciak J	LSE×GSE	0	0	1	0	1	0	Lublin area / okolie Lublinu
Maciorowski G	GSE	0	0	2	0	2	0	Biebrza Marshes / Biebrza mokrade
	LSE	120	0	139	0	259	0	
∑ Poland	LSE×GSE	0	0	1	0	1	0	
	GSE	0	0	2	0	2	0	

LSE – *Aquila pomarina*, GSE – *Aquila clanga*, LSE×GSE – hybdrid



B-U Meyburg

Fig. 9. Adult *A. pomarina* with yellow colour ring and ringing station ring beeing fitted with satellite transmitter, Germany.
Fig. 9. Dospelý *A. pomarina* so žltým krúžkom a krúžkom krúžkovacej stanice pri osádzaní satelitnej vysielačky, Nemecko.



G. Maciorowski

Fig. 11. *A. clanga* × *A. pomarina* hybrid adult male with two rings on left leg. Code 1S. NE Poland, 22 June 2006.
Fig. 11. Dospelý samec hybrid *A. clanga* × *pomarina* s dvomi krúžkami na ľavej nohe. Kód 1S. SV Poľsko, 22. jún 2006.



G. Maciorowski

Fig. 10. *A. pomarina* adult male ringed with two rings on right leg. Code 16 (number-number). Biebrza Marshes, NE Poland, 20 June 2006.
Fig. 10. Dospelý samec *A. pomarina* krúžkovaný dvomi krúžkami na pravej nohe. Kód 16 (číslo-číslo). Biebrza Marshes, SV Poľsko, 20. jún 2006.

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G. Maciorowski

Fig. 12. *A. clanga* adult male with code 1L (number-letter). Biebrza Marshes, NE Poland, 20 June 2006.
Obr. 12. Dospelý samec *A. clanga* s kódom 1L (číslo-písmeno). Biebrza Marshes, SV Poľsko, 20. jún 2006.



J. Wójciak

Fig. 14. According to SECR *A. pomarina* in Poland were ringed with red rings. Strzelce, Eastern Poland, 19 July 2007.
Obr. 14. Podľa programu SECR boli *A. pomarina* v Poľsku krúžkované červenými krúžkami. Strzelce, Východné Poľsko.



G. Maciorowski

Fig. 13. *A. clanga* juvenile ringed with system of 2 colour rings on one leg. Biebrza Marshes, 23 July 2008.
Obr. 13. Juvenil *A. clanga* označený systémom dvoch farebných krúžkov na jednej nohe. Biebrza Marshes, 23. júl 2008.



U. Sellis

Fig. 15. *A. clanga*, fledged juvenile with white ring and tagged with GPS transmitter.West Estonia, 21 September 2008.
Obr. 15. Vyletený juvenil *A. clanga* s bielym krúžkom a satelitným GPS vysielačom. Západné Estónsko, 21. september 2008.



U. Sellis

Fig. 16. *A. pomarina*, pull with white plastic ring from Pikknurme, Central Estonia, 15 July 2006.
Obr. 16. Mláďa *A. pomarina* s bielym krúžkom z Pikknurme, Stredné Estónsko, 15. júl 2006.



V. Cirulis

Fig. 18. *A. pomarina,* female captured to the net colour ringed and marked with wing tags. Latvia, 3 August 2007.
Obr. 18. Samica *A. pomarina* okrúžkovaná oranžovým krúžkom a označená krídelnými značkami. Lotyšsko, 3. august 2007.



R. Treinys

Fig. 17. *A. pomarina* young with green coloured ring. Birzai Wood, Lithuania, 19 July 2007.
Obr. 17. Mláďa *A. pomarina* so zeleným krúžkom. Birzai, Litva, 19. júl 2007.



U. Bergmanis

Fig. 19. Detail on orange coloured and metal rings from Latvian Ringing Scheme. Latvia, 14 August 2008.
Obr. 19. Detail oranžového a kovového krúžku Lotyšskej Krúžkovacej stanice. Lotyšsko, 14. august 2008.

colour ringing in the future. In colour ringing schemes it is extremely important to make sure the database on ringed birds is available to check the ringing data easily (at least through national ringing centres). Luckily current photo documentation allows high quality pictures which enable reading a colour ring from the taken image. Also bird watching tourism is developing quickly and it uses high-powered telescopes, too.

Colour ringing is a useful method for building a database providing data for research on demography, migration, ecology, ethology etc. Using colour rings additionally to or instead of common metal rings enhances ringing efficiency remarkably. Reading the rings without the need to manipulate with animals by hand reduces the impact of stress onto animals. What is more, the ring can be read relatively easily and many times during bird's life, which implies more data and good studies.

Experience from Slovakia clearly proves the importance of digital photography in colour ringing as it significantly increases the number of recoveries. It is fairly common that the ring on an eagle, whose picture was randomly taken in the wild, is noticed just when watching the pictures on a PC monitor. Three cases from Slovakia in the last two years also show that it is even possible to read a common ornithological ring from a picture taken by a digital camera.

In the end, it is important to stress that colour ringing of *A. clanga*, *A. pomarina* and their hybrids in Europe requires a correlative co-operation, uniform methodology, mutual approach and exchange of information among the

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V. Dombrovski

Fig. 20. *A. clanga* ringed with dark-blue colour ring in Soutern Belarus. 28 July 2008, Olmany Marshes.
Obr. 20. *A. clanga* krúžkovaný tmavomodrým krúžkom na juhu Bieloruska. 28. júl 2008, močiare Olmany.


M. Dravecký

Fig. 21. *A. pomarina* × *A. clanga* hybrid ringed with dark-blue ring (SECR) in southern Belarus, 5 July 2008.
Obr. 21. Hybrid *A. pomarina* × *A. clanga* krúžkovaný tmavomodrým krúžkom (SECR) na juhu Bieloruska, 5. júl 2008.

national co-ordinators or co-ordinators of various programmes. Plenty of chicks e.g. in Slovakia were ringed in border regions and it is likely these birds can also nest in e.g. Hungary, Ukraine or Poland. During migration to their wintering grounds, eagles from the northern Europe (Estonia, Latvia, Lithuania, Germany, Belarus) fly across the other states (Poland, Slovakia, Hungary, Ukraine, Romania etc.), where they can be observed by other ornithologists or bird-watchers. In order to be able to get to these data, it is important to inform about the ringing programmes, even in the form of an article like this one.

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