

## RESEARCH ON LONG-TERM COLONIZATION OF GOOSANDER (*MERGUS MERGANSER* LINNEAUS, 1758) WITH REFERENCE TO HABITAT AVAILABILITY

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**Abstract** — This article presents data on long-term colonization of goosander in Western Serbia and Eastern Republic of Srpska (on five oligotrophic reservoirs formed by the Drina River) based on continuous counting since the first observation of nesting in 1987. The total number of breeding pairs and their distribution in neighboring habitats continuously increased from year to year, suggesting that expansion of the population is still below the limit of the habitat. The decrease in population which occurred in certain years was due to environmental or anthropogenic influence.

**Key words:** *Mergus merganser*, population dynamics, new habitats, Serbia, Republic of Srpska

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### INTRODUCTION

The goosander (*Mergus merganser* L.) nested in both Central and Eastern Bosnia until 1908, in Northern Montenegro until 1902, and in Dobrudja until 1969 (Reiser, 1896; Reiser, 1939; Cramp and Simmons, 1977). Since then, nesting of this species has not been noted on the Balkan Peninsula, except for an isolated neo-relict nest (four or five pairs) on Lake Prespa. The goosander is a boreal species (Bauer et al., 1969) maintained on the Balkan Peninsula as a boreal relict. It has been noted in the winter period in Serbia on the Danube and Sava Rivers and on fish ponds in the Vojvodina and Kosovo and Metohija Provinces (adm. by UNMIK), to which it came from Northern Europe to spend the winter.

In the late 1950's, the building of nine hydro-electric power plants on the Drina River created artificial oligotrophic lakes that served as a new habitat which allowed the goosander to colonize areas not lately inhabited by this species.

The results of 20-year monitoring of the population of *Mergus merganser* in the East Dinaric Mountains are presented in this article. Colonization

of the Sjeničko, Zlatarsko, and Radojina Lakes in Serbia by this species and its dispersion on the Zvorničko, Perućac, and Višegradsko Lakes in the Republic of Srpska occurred in this period. The population of goosander is progressive and we suggest that it will expand to other lakes in the region, ones in Montenegro and the Federation of Bosnia and Herzegovina.

### Study Area

The East Dinaric Mountains are situated in the central part of the Balkan Peninsula, with the highest peaks up to 2500 m a.s.l. The whole Dinaric region belongs to the Black Sea basin, and the Drina River catchment area includes rapid highland rivers with a great amount of water. The climate is highland continental in the area of the upper lakes, whereas sub-Mediterranean climatic elements appear in the lower canyons. Coniferous and deciduous forests with refugial habitats in the canyons make up the vegetation cover of the mountain region.

The energy potential of Drina River has been greatly exploited in the past 50 years by the building of nine hydro-electric power plants with artificial lakes. The first of them, Zlatarsko Lake, was formed

in 1952. It is 21 km long, has an area of 7.25 km<sup>2</sup>, and lies at 880 m a.s.l. (UTM DP 1.0; DP 1.1; DP 0.1). Radojina Lake was filled in 1959. This lake is 11 km long, has an area of 0.6 km<sup>2</sup>, and lies at 810 m a.s.l. (UTM CP 2.9; DP 2.0). Sjeničko Lake was formed in 1981. It is 23 km long, has an area of 6 km<sup>2</sup>, and lies at 998 m a.s.l. (UTM DN 1.9; DP 1.0; DP 1.1). Zvorničko Lake was filled in 1955. The lake is 26 km long, has an area of 8.1 km<sup>2</sup>, and lies at 140 m a.s.l. (UTM CQ 50; CQ 51). Perućac Lake is situated upstream from Zvorničko Lake. Filled in 1962, it is 55 km long and has an area of 12.4 km<sup>2</sup> (UTM CP 67; CP 56). Višegradsko Lake was filled in 1989. This lake is 36 km long, has an area of 2.5 km<sup>2</sup>, and lies at 339 m a.s.l. (UTM CP 54). The quality of water in the described lakes is of class I. The water has a pH value of 8 and is home to salmonid species (salmonid-cyprinid in the lower lakes). The lake banks are steep, without vegetation. Zvorničko Lake is shallow, whereas the other lakes are 60 to 100 m in depth. The ichthyofauna is composed of the following species: *Thymallus thymallus*, *Leuciscus cephalus*, *Hucho hucho*, *Salmo trutta*, *Salvelinus alpinus*, *Silurus glanis*, *Stizostedion lucioperca*, *Esox lucius*, *Barbus peteniyi*, *Barbus barbatus*, *Gobius gobio*, *Gobio albipinnatus*, *Phoxinus phoxinus*, *Alburnus bipunctatus*, *Cyprinus carpio*, *Carassius auratus*, *Rutilus rutilus*, *Vimba vimba*, *Chondrostoma nasus*, *Rutilus rutilus*, *Rodeus sericeus*, *Cobitis elongatooides*, *Cobitis taenia*, and *Cottus gobio* (Marić et al., 2003).

#### MATERIAL AND METHODS

The goosander is a large, gregarious, noticeable species which stays in the open area of lakes. Sex differences exist, but it is hard to distinguish females from subadult males. Counting of pairs was performed in the period of courting, while juveniles were counted after hatching, i.e., in the period of nursing. Census taking was conducted with a boat (12 km/h) through a longitudinal transect across the lake. Both the Zvorničko and Višegradsko Lakes were monitored using a car (40 km/h) along a transect on the bank, stopping at those places with the best view, over a distance of 2 km (Bibby et al., 1992). Census taking was done twice a year: in March-April, when pairs were counted; and in May-

August, when juveniles and females were registered. In two years during the period of research (1992 and 2002) a winter census (January; IWC) of water birds in the Dinaric Mountain was conducted, and these results were also incorporated in the present study. Data obtained in the winter census of water birds on the Danube River from 2003 to 2006 (IWC) were also used in the study. All data were entered on maps with UTM grids of 10 x 10 km.

#### RESULTS

The goosander is a nesting species in Western Serbia and Eastern Bosnia, inhabiting large and deep lakes with areas of more than 300 ha (Fig. 1). The first observation in Serbia was in 1986, whereas the first nesting female with eight juveniles was registered in 1987 (Marinković et al., 1989). Eastern Bosnia, i.e., the Republic of Srpska, was colonized by the given species in 2005. This is a population of resident birds that stay in the researched area during the most severe winter period. When the upper lakes become frozen, the birds gather on the lower lakes that are not frozen. During the winter period, 80 birds (11% males) were counted in 1992, 158 birds (10.3% males) in 2002, and 172 birds (28.49 % males) in 2005.

#### *Population dynamics of M. merganser on lakes in Serbia*

**Sjeničko Lake:** The goosander has nested continuously on the researched lake, but not in 1990, when it left the lake because of 'blooming' of the water (Fig. 2, Table 1). Continuous increase of its micropopulation and dispersion to new areas were detected during the period of monitoring.

**Zlatarsko Lake:** Expansion of goosander from the nearby Sjeničko Lake occurred in 1992 (Table 1). Significant decrease in numbers of nesting pairs in the years 1994 and 1998 was caused by 'blooming' of the water of both Sjeničko and Zlatarsko Lakes (Fig. 2). A small decrease in number of nesting pairs, accompanied by increase in the number of juveniles per female (average 8.1; Fig. 2, Table 1), was registered when more than 60% of the water was released from the lake (at the end of 2000 – 2001). Since that period, the population of goosander has increased

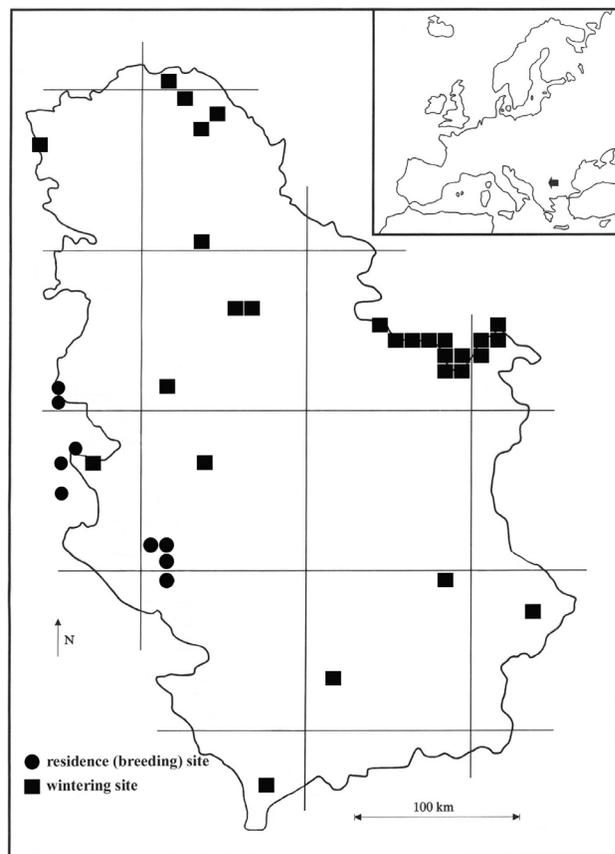


Fig. 1. Records of goosander on map of Serbia and border region of the Republic of Srpska with UTM grids of 10 x 10 km.

continuously, especially in 2005.

**Radojina Lake:** The first nesting on Radojina Lake occurred in 2006, when one female with 11 juveniles and one solitary female were noted.

Nesting usually started from the beginning of April, but the first egg was found on the bank of Zlatarsko Lake on 12 March 2004. The last nests were registered in early May, and juveniles on their mothers' backs were observed at the beginning of June. Males leave the lake in the period of incubation, usually before the end of May. We were not able to find a single male specimen over a range of 150 km around the lakes from May through October. After that period, they appeared on the native lakes. The number of males increased in 2005 in comparison to the number of females and juvenile birds.

Table 1. Change in number of nesting pairs and juvenile birds on Sjeničko Lake and Zlatarsko Lake since the first detection till now.

Year	Sjeničko jezero		Zlatarsko jezero	
	♂♀	♀+juv	♂♀	♀+juv
1985	0	0	0	0
1986	4	0	0	0
1987	1	1+8	0	0
1988	2	2+10,8	0	0
1989	4	3+5,8,4	0	0
1990	0	0	3	0
1991	5	3+4,6,4	0	0
1992	7	4+6,5,8,4	2	2+4,5
1993	4	3+5,11,6	4	3+5,6,6
1994	6	1+5	0	0
1995	8	4+6,5,4,6	6	4+4,8,5,5
1996	10	6+6,9,5,8,5,6	4	4+4,7,6,5
1997	12	7+5,8,14,6,6,4	6	4+6,8,5,7
1998	6	1+4	?	2+5,3
1999	2	2+6,5	2	2+6,5
2000	12	7+8,6,4,5,5,6	8	5+5,5,7,5
2001	10	6+8,12,6,10,7,9	7	4+6,9,8,6
2002	9	6+12,8,5,6,5,4	6	5+7,5,5,4,4
2003	8	7+19,12,5	4	4+5,6,6,4
2004	10	6+7,5,14,6	3	2+4,5
2005	18	3+6,7,5	31	3+5,6,6
2006	6	6+10,10	5	5+18,7,3

Nine nests were found in cavities of calcareous cliffs with a small hole to a depth of 1-0.4 m. One nest was found 8 m distant from the nest of a griffon vulture (*Gyps fulvus*). All nests in cliffs were 3-15 m above the water level, while only one nest was registered at a height of 36 m above the bank. In the breeding period, pairs gathered around cliffs near the lakes. Near banks where cliffs were missing, we were not able to find specimens. Nests were situated from 150 m a.s.l. (Zvorničko Lake) to 1020 m a.s.l. (Sjeničko Lake). The average number of juvenile birds was 6.5 per nest. During the monitoring period of 20 years, 112 pairs with 732 juvenile birds were registered. In the winter, flocks of 20 to 30 birds gather in the area where the lake is widest, usually around the flood-gates or the river mouth. We estimated that one pair occupies 0.30 km<sup>2</sup> of lake, whereas a successful female occupies 1.65 km<sup>2</sup>.

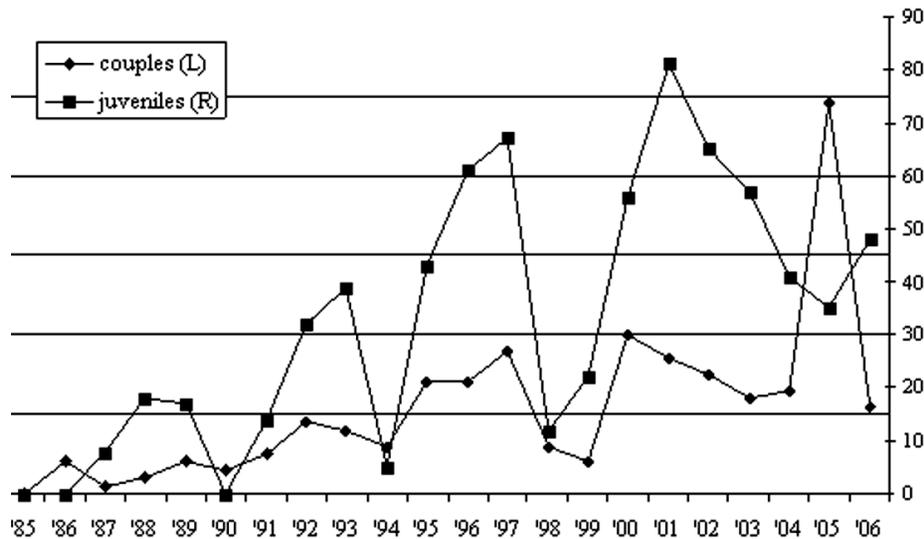


Fig. 2. Dynamics of numbers of couples and juvenile birds on the Sjeničko Lake and Zlatarsko Lake during the period of monitoring.

#### *Population dynamics of M. merganser on lakes in the Republic of Srpska*

**Zvorničko Lake:** The species was registered on 16 November 1992 (two females, one male), on 04 February 2000 (three females, two males), and on 21 April 2003 (four females, two males), but nesting was not registered. In the census conducted on 01 April 2005, two females and three males were registered, while on 12 June 2005, three females with six, seven, and six juveniles and one solitary female were observed.

**Perućac Lake:** The species was noted in 2003, but nesting was not registered until 2005 (three females and three males in the census taken on 03 May). Females with 18 juveniles and 11 subadult females were observed on 14 June 2005.

**Višegradsko Lake:** We registered two females, one male, and one female with six juveniles in the census taken on 29 May 2005.

In monitoring lakes in the Federation of Bosnia and Herzegovina and Montenegro, *M. merganser* was not detected.

#### DISCUSSION

Previous studies on nesting of goosander in

Bosnia and Herzegovina and Montenegro indicated the species to be associated with rapid mountain river habitats (Reiser, 1896; Reiser, 1939). At that time, glacial oligotrophic mountain lakes were not inhabited by fish, but rather by newts and frogs (Cvijić, 1889; Cerović, 1935). Several studies indicated that goosander is a rare species in these regions, nesting in hollow trees. Forest management and wood exploitation caused old trees with holes wide enough for nesting to disappear almost completely. In the middle of the 20th century, the goosander remained only in Dobrudja and on Lake Prespa. The relict range on Lake Prespa is 280 km distant from Serbia and today includes just four or five pairs (Makatasch, 1950; Sage, 1966; Makatasch, 1974; Micevski, 1998). This population did not disperse to a nearby oligotrophic lake (Lake Ohrid) or to the large artificial Mavrovsko, Debarsko, and Tikveško Lakes.

According to previous observations, the goosander formerly resided in Serbia only during the winter (from October to February), on rivers which were usually not frozen (Matvejev, 1950) or on fish ponds in the Vojvodina Province (Rašajski, 1997). There are museum samples that were hunted in Kosovo and Metohija, Montenegro (Lake Skadar) and the Republic of Srpska (Bardača) (Marčetić

et al., 1960; Vasić, 1980; Gergelj et al., 2000; Hulo, 2000; Gašić, 2001; Hulo et al., 2001; Raković et al., 2003; Ružić et al., 2004). One specimen hunted near the Danube River was previously marked in Lithuania (1298 km away) (Štromar, 1973), which indicates that these birds came from Northeast Europe.

In its recent re-colonization of the Dinaric region, the goosander adapted to nesting in cliff holes. It was previously reported that the nests this species were in holes in hills near Lake Prespa (Micevski, 1998). The lack of suitable places for nesting is a limiting factor for increase of the goosander population, as is indicated by its low density and the difference between the number of couples and the number of successful nests on the territory.

It can be concluded that this species is susceptible to environmental changes such as 'blooming' of the water, which causes decrease of the fish population and makes the hunt more difficult. The emptying of lakes which occurred periodically resulted in habitat shrinkage and likewise caused a decrease in the population. However, an increase in the number of juveniles per female occurred simultaneously because of the increased amount of available food. The lack of suitable cliffs for nests on the researched area is obvious. We failed to discover where the males were from May to October in monitoring 150 km around the researched lakes and suggest that they retreat to the southern boundary of the nesting area, which is more than 500 km north of our region. During the winter, males were more numerous in migration flocks on the Danube River in comparison with females or immature birds.

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#### REFERENCES:

- Bauer, K., and U. N. E. Glutz von Glotzheim (1969). *Handbuch der Vögel Mitteleuropas*, Vol. 3. Frankfurt am Main.
- Bibby, C., Burgess, N., and D. Hill (1992). *Bird Census Techniques*. British Trust for Ornithology, Royal Society for the Protection of Birds, London.
- Cerović, V. (1935). Hunting in the area of Durmitor Mountain. In: Durmitor, njegove lepote i prirodno bogatstvo, 54-58. Slobodna Misao, Nikšić.
- Cramp, S., and K. E. L. Simmonms (1977). *The Birds of the Western Palearctic*, Vol. 1. Oxford - London - New York.
- Cvijić, J. (1899). Glacial and morphological studies on the mountains of Bosnia, Herzegovina, and Montenegro. *Glas Srp. Kralj. Akad. Nauka* 55, 1-196.
- Gašić, B. (2001). Supplement to studies on the bird fauna of the Republic of Srpska. *Ciconia* 10, 108-127.
- Gergelj, J., Tot, L., and Z. Frank (2000). Birds of the Tisza area from Kanjiza to Novi Bečej. *Ciconia* 9: 121 - 155.
- Hulo, I. (2000). Rare winter guests in the Subotica area. *Ciconia* 9, 189-190.
- Hulo, I., and J. Gergelj (2001). Checklist of birds of the Lakes Ludas Special Nature Reserve. *Ciconia* 10, 39-51.
- Makatsch, W. (1950). *Die Vogelwelt Macedoniens*. Akademische Verlagsgesellschaft Geest & Portig K. - G., Leipzig.
- Makatsch, W. (1974). *Die Eier der Vögel Europas*, 1. Neumann Verlag. DDR.
- Marčetić, M., and D. N. Andrijević (1960). *Avifauna of Kosovo and Metohija*. Rilindja, Priština.
- Marić, S., Nikolić, V., Hegediš, A., and P. Simonović (2003). *Program for Improvement of Fishing in the Drina Fishing Area in the Period of 2003-2007*, 68 pp. Faculty of Biology, Belgrade.
- Marinković, S., and Lj. Orlandić (1989). The goosander (*Mergus merganser* L.), a new nesting species in Serbia, In: *III Symposium on the Fauna of SR Serbia*, 63. Belgrade.
- Matvejev, D. S. (1950). *Ornithogeographia serbica*. SANU, Belgrade.
- Micevski, B. (1998). *Ornithofauna of Lake Prespa*. Vest, Skopje.
- Raković, M., and B. Novaković (2003). Avifauna of Dokmir fishpond. *Ciconia* 12, 121-129
- Rašajski, J. (1997). *Birds of Serbia*. Prometej, Novi Sad.
- Reiser, O. (1896). *Materialen zu einer Ornithofauna Balcanica*. IV. Montenegro. Bosnisch-Herzegovinisches Landmuseum in Sarajevo, Vienna.
- Reiser, O. (1939). *Materialen zu einer Ornithofauna Balcanica*. I. Bosnien und Herzegovina. Bosnisch-Herzegovinisches Landmuseum in Sarajevo, Vienna.

Ružić, M., Radaković, M., and M. Šćiban (2004). Winter distribution and numbers of waterbirds on the Western Morava River from Čacak to Adrani. *Ciconia* **13**, 105-109.

Sage, B. L. (1966). Recentes observations ornitholoques au lac

Prespa, Macedoine (Yugoslavie). *Alauda* **34** (1), 45-55.

Štromar, Lj. (1973). Ringing of birds in 1970. *Larus* **25**, 5-26.

Vasić, V. (1980). The list of birds of Lake Skadar (Montenegro, Yugoslavia). *Larus* **31-32**, 185-207.

### ИСПИТИВАЊЕ КОЛОНИЗАЦИЈЕ *MERGUS MERGANSER* L. У СРБИЈИ

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У овој студији приказани су подаци о дуготрајној колонизацији *Mergus merganser* L. у западној Србији и у источном делу Републике Српске, и то на пет олиготрофних језера насталих од реке Дрине. Укупан број парова и њихова дистрибуција у околним стаништима

се континуирано повећава из године у годину, што указује на чињеницу да је експанзија те популације још увек испод оптималних граница које дато станиште пружа. Пад бројности популације током ранијих година био је условљен утицајем средине или антропогеним деловањем.