

THE DIPPER (*CINCLUS CINCLUS*) AS THE INDICATOR OF WATER QUALITY IN CREEKS OF HUNGARY

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ABSTRACT

In the last century the Dipper was still very frequent in the foothills of the Carpathians. Nowadays the number of Dippers has become very rare. The aim of this paper is to explore the causes of the decrease in the number of Dipper and to examine the relationship between the Dipper's presence and the creeks' water quality.

We studied the macrofauna and water quality along three model creeks (Jósua-, Apátkút-, Eger-creek) in relation to with the Dipper's decennial presence.

The Dipper is an excellent indicator of water quality, as its feeding habits show.

INTRODUCTION

Several researchers considered with the Dipper's Carpathian basin habitat (Creutz 1986, Hudetz 1983, Horváth 1992 etc.). The recent scientific literature examines its food (Horváth-Andrikovics, 1991). At the beginning of this century it was common in the Alps and in the Carpathians, where it still lives, but the actual numbers are unknown. In the Hungarian mountains there have always lived only peripheral populations. Their numbers have never been large. According to surveys done in the North of Hungary, several pairs nested in the creeks of Bükk, Pilis, Mátra, Aggteleki Karszt, Tokaj, Börzsöny and Medves mountains (Horváth, 1993). Their numbers decreased in all known habitats in the following mountains: Bükk (the Szinva-creek), Pilis (the Apárkút-creek), Aggteleki Karszt (the Jósua-creek) and Börzsöny (the Kemece-creek) (Horváth, 1988). Morphometric and food biological

examinations were done on the existing stock (Horváth-Andrikovics 1991, Rékási 1984). The aim of these was to study the "health" of the endangered Hungarian population on the basis of food supply.

We compared the Central European Dipper's food content with that of the Northern European Dipper population. We observed and measured the most important features of water quality and of bed formation in creeks where the Dipper no longer lives and also where some pairs found good nesting places. On the basis of the results, we try to answer the following questions: What are the causes of the decrease in the number of Dippers in Hungary? What change in water quality is associated with the decrease?

MATERIALS AND METHODS

We studied the Eger-creek in the Bükk Mountains, the Apátkúr-creek in the Pilis-Visegrád Mountains and the Jósza-creek in the Aggteleki Karszt. We studied the changes of bed formation during regular visit to the creeks and we measured the water quality in the field and in the laboratory. We have made regular invertebrate macrofauna surveys in all three creeks for years and the results have been published (Andrikovics-Hadnagy 1994, Andrikovics 1989, Uherkovics-Nógrádi-Andrikovics 1992). These results provide an accurate picture of the invertebrates along the creeks and give an account of larva examinations and the results of light traps.

The **Tables 2-3**, concerning the Eger-creek and the Aggteleki Karszt show the details of our macrofauna investigations done in 1994.

We applied two methods to estimate the food eaten by the Dipper. We can examine the undigested chitin remains in the Dipper's pellet or animal remains in its excreta.

First we examined a Dipper pair in the Aggtelek National park (Horváth-Andrikovics, 1991). We repeated these examinations at the end of 1994 and we measured the quantity of food eaten by the Dipper. Food items can be identified easily from the pellets. Determination of food items from the excreta remained unsuccessful.

RESULTS AND DISCUSSION

The most important water quality parameters of the three creeks are compiled in **Table 1**. Those three creeks where the Dipper nested had excellent water quality from the point of view of total salt content, nutrients agents or decomposing. On the other hand the Eger-creek is seriously polluted according to several indices.

Table 1: The most important water quality parameters of the three creeks

	Eger-creek	Jósza-creek	Apátkút-creek
Conductivity $\mu\text{S/cm}$	1177	748,0	
pH	7,78	7,8	7,2
Dissolved O_2 (mg/l)	12,2	8,6	20,0
Total hardness nk	19,32	18,9	10,0
Calcium (mg/l)		125,8	
Magnesium (mg/l)		8,6	
Hydrocarbonate (mg/l)		445,0	
Sulphate (mg/l)	159,0	33,0	
Chloride (mg/l)		5,2	
Nitrate (mg/l)	13,8	10,5	
Nitrite (mg/l)	0,4	0,02	
Chemical oxygen (COC)	15,0	3,0	
BOD-load	8,0	3,0	

The chemical analyses were made in the Dipper's habitat. An examination of each creek's full length reveals useful information. The Eger-creek begins above Balaton (a village) and after 60 kilometres it flows into the river Tisza. There is a short, relatively clean section above Eger. The creek receives households sewage at its upper reaches and industrial sewage downstream. The source of the creek is about 320 metres above sea level (**Figure 1**). The control of the bed does not often go with the region.

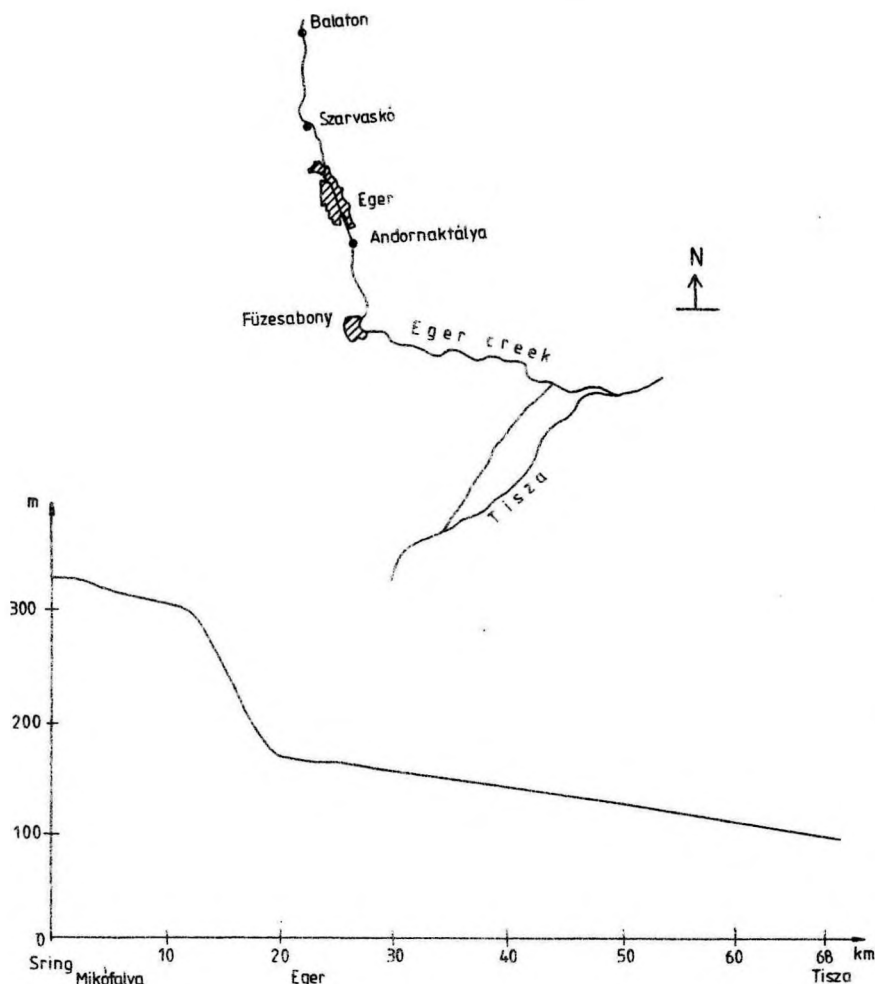


Figure 1: The Eger-creek's topography, slope graph and the nesting places of the Dipper. The bird does not nest in this region anymore

The Jósua-creek originates at Jósfaő, and after 13 kilometres it flows into the Bódva. Its upper reaches were channeled in 1938. Lake Tengerszem, above which the Dipper's nest can be found (**Figure 2**). The water is fast-flowing along the creek. The creek receives a great deal of pollution (artificial fertilizer) at Szinpetri (a village) which is about 6 km from the

spring. In spite of the artificial conditions the Dipper nest is quite stable here. On the other hand the considerable tourist traffic endangers the stock.

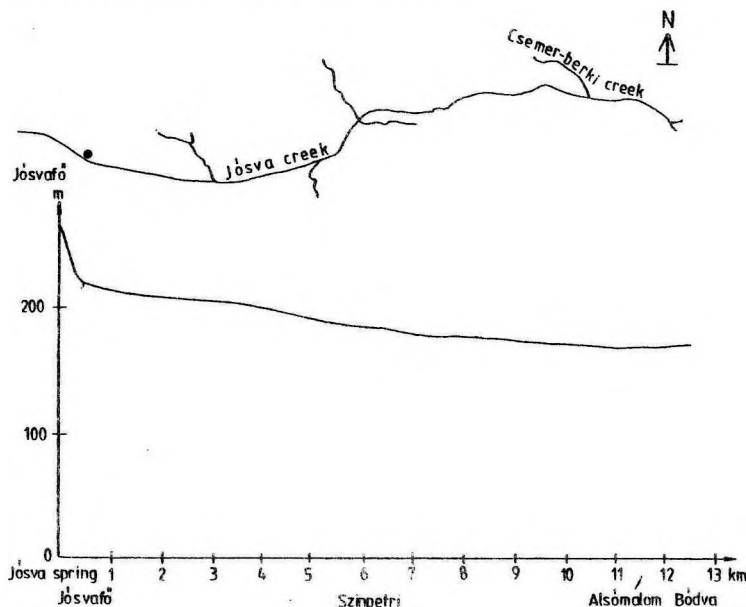


Figure 2: The Jósva-creek's topography, slope graph and the nesting places of the Dipper

The Apárkút-creek originates at Pilisszentlászló where it immediately receives of a considerable quantity of water. After ten kilometres in paved bed it flows into the Danube (**Figure 3**). It receives a little sewage again at Visegrád. The Dipper's nest was at Magda spring far away from Pilisszentlászló. **Figure 3** shows the changes in water speed and dissolved oxygen content which are favorable. The **Tables 2-3** show the results of surveys of invertebrate macrofauna elements in the Eger, Jósva, and Apárkút creeks.

According to a survey done in 1994, 35 invertebrate macrofauna taxa were found in the Eger creek. **Table 2** shows that on the very long section of the creek there are only Chironomida, Tubifex larvae which are not suitable food for the Dipper. Mayflies, stoneflies and caddis flies occur only on the upper reaches of the creek. There are Amphipods on the upper part but suitable nesting places cannot be found even here.

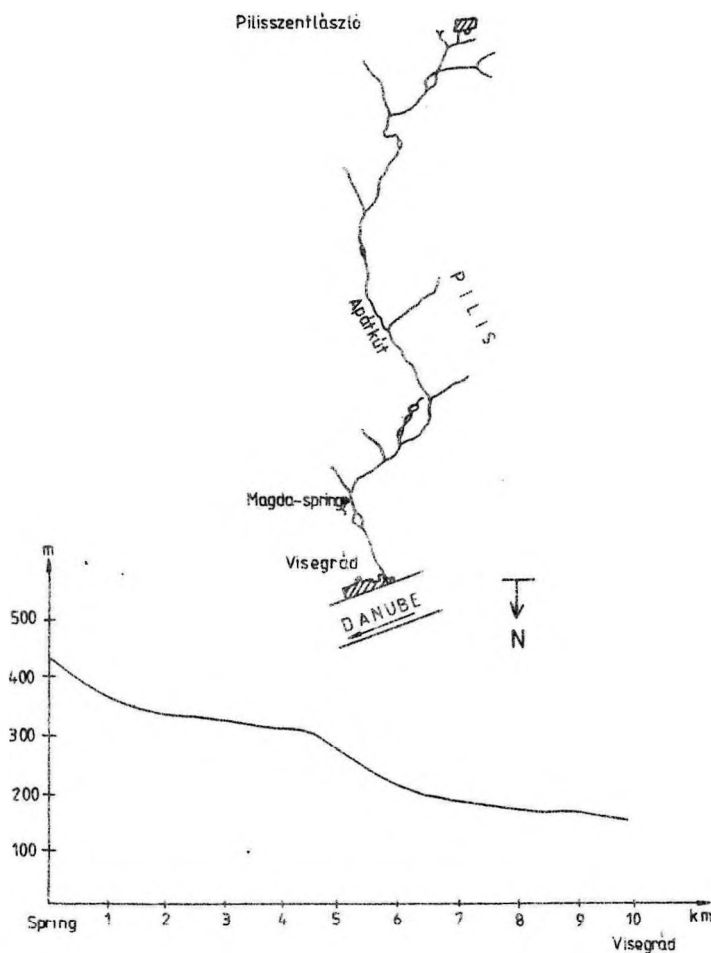


Figure 3: The Apátkút-creek's topography, slope graph and the nesting places of the Dipper

In the Jósva-creek there were many Amphipodas and Trichopteras. In contrast with our expectations there are few mayflies and stoneflies. Large numbers of *Sadleriana pannonica* (Mollusca) cover the creek-bottom in many places. **Table 3** summarizes the macrofauna elements in the area. The table does not contain the Amphipods and snails. The Trichopteras were collected by light trap.

Table 2: Imported food taxons along the Eger-creek

Turbellaria	<i>Dendrocolium lacteum</i>
Hirudinoidea	<i>Policelis nigra</i>
	<i>Dina lineata</i>
Oligochaeta	<i>Tubifex sp.</i>
Gastropoda	<i>Bithynia tentaculata</i>
Amphipoda	<i>Gammarus rhoeseli</i>
	<i>Chaetogammarus tenellus</i>
Isopoda	<i>Asellus aquaticus</i>
Ephemeroptera	<i>Baetis rhodani</i>
	<i>Baetis vernus</i>
	<i>Baetis sp. juv.</i>
	<i>Cloeon simile</i>
	<i>Electrogena lateralis</i>
	<i>Electrogena sp. (juv.)</i>
Plecoptera	<i>Nemoura cf. cambrica</i>
	<i>Nemoura cf. cinerea</i>
	<i>Nemoura sp.</i>
Coleoptera	<i>Helodes hausmani</i>
	<i>Noterus crassicornis</i>
Trichoptera	12 spp.
Diptera	<i>Simulium larvae</i>
	<i>Simulium nuph.</i>
	Chironomidae

Table 3: Imported food taxons along the Jósval-creek

Ephemeroptera	<i>Cloeon dipterum</i>
	<i>Caenis horaria</i>
	<i>Caenis robusta</i>
	<i>Ephemerella ignita</i>
	<i>Baetis rhodani</i>
	<i>Baetis fuscatus</i>
	<i>Baetis sp. (juv.)</i>
	<i>Electrogena lateralis</i>
	<i>Ecdyonurus submontanus</i>
	<i>Epeorus sylvicola</i>
Odonata	<i>Agrion splendens</i>
	<i>Aeschna cyanea</i>
Plecoptera	<i>Nemoura flexuosa</i>
	<i>Protonemoura aestiva</i>
Trichoptera	47 spp.

Table 4: Important food taxons along the Apátkut-creek

Decapoda	<i>Astacus torrentium</i>
Amphipoda	<i>Gammarus rhoeseli</i>
	<i>Gammarus fossarum</i>
Ephemeroptera	<i>Ephemera danica</i>
	<i>Baetis rhodani</i>
	<i>Cloeon dipterum</i>
	<i>Proclotron bifidum</i>
	<i>Centropetium luteolum</i>
	<i>Proclotron sylvicola</i>
	<i>Rhytrogena semicolorata</i>
	<i>Electrogena lateralis group</i>
	<i>Ecdyonurus starmachi</i>
	<i>Ecdyonurus sp.</i>
	<i>Ephemerella ignita</i>
	<i>Habroleptoides modesta</i>
	<i>Caenis robusta</i>
	<i>Caenis horaria</i>
Trichoptera	32 spp.

Plecoptera	<i>Capnia bifrons</i>
	<i>Leuctra pseudosignifera</i>
	<i>Leuctra digitata</i>
	<i>Leuctra hippopus</i>
	<i>Protoneomura intricata</i>
	<i>Nemoura flexuosa</i>
	<i>Nemoura scriums</i>
	<i>Nemoura cambria</i>
	<i>Nemuelia pictetti</i>
	<i>Isoperla tripartita</i>
	<i>Isoperla grammatica</i>
	<i>Chloroperla tripunctata</i>
	<i>Perla burmeisteriana</i>
Coleoptera	Elmidae
Megaloptera	<i>Sialis fuliginosa</i>
Diptera	Empididae
	Simuliidae
	Tabanidae

The invertebrate macrofauna in the Apátkút-creek is rich and varied. Here the main elements are also the Amphipods and the Trichopteras, but the number of Molluscs is insignificant. Apart from polluted zones, the mayfly and the stonefly fauna is richer than average both in number of species and in number of individuals (Table 4). The number of aquatic invertebrates can reach 250 ind/m² (Figure 4). The Amphipods had the largest percentage in the Dippers' food. Next in abundance were the Hydropsyche and Rhyachophila species from the caseless caddis fly. *Silo pallides* and the different Lmnephilidae species from the case bearing caddis flies, were also present

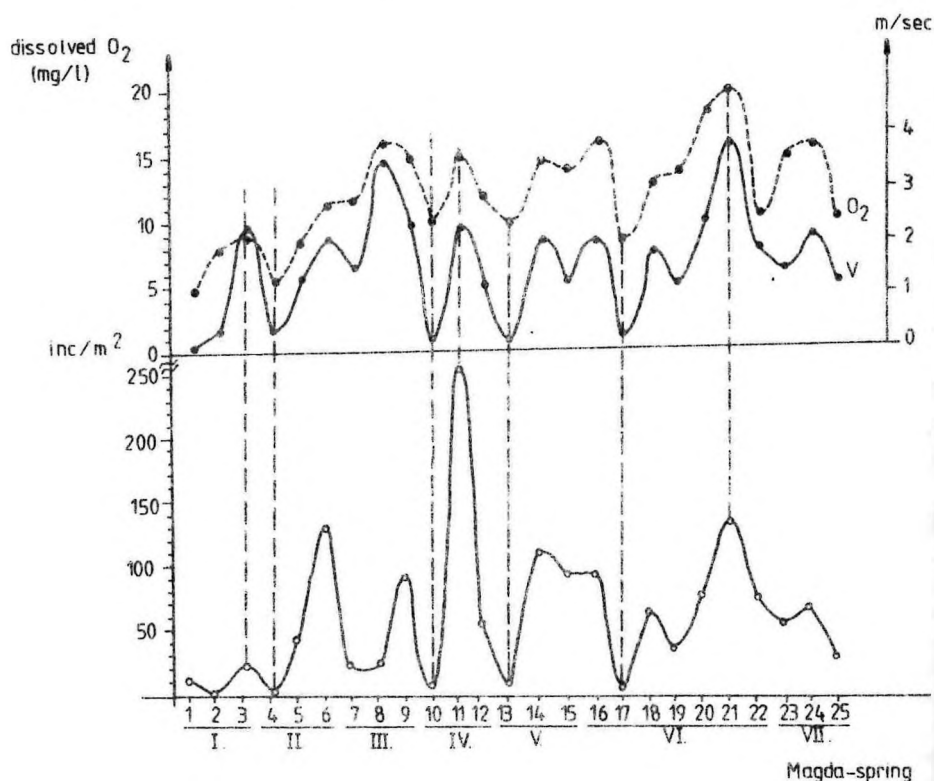


Figure 4: The changes of water speed (V), dissolved oxygen (O₂) and the number of aquatic invertebrates along the Apátkút-creek

According to real number of individuals the Dipper eats *Sadleriana pannonica*, too. There were water beetles and diptera larvae only in small in the analysis of the spittles. The Amphipoda-Trichoptera dominance found in the diet of Hungarian Dippers differs considerably from Western Europeans results. For example Dippers living in England eat mainly Ephemeroptera, Plecoptera and Trichoptera larvae (Ormerod, 1985).

We can state that the Dipper's disappearance is associated with the water quality which is going from bad to worse, but other factors, like stream bed-control, continuous water shortage and the disturbance caused by tourists also can have an important effect as our sketch shows (Figure 5).

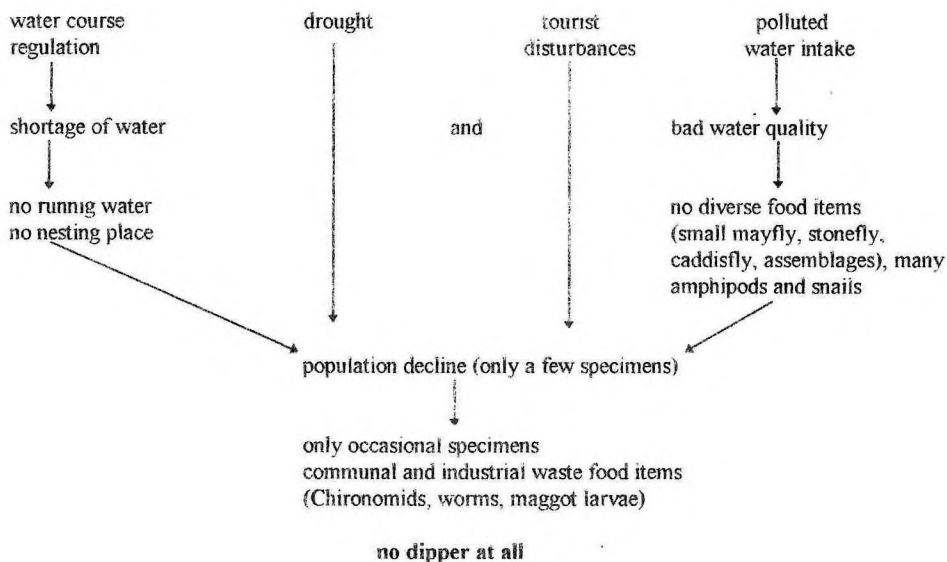


Figure 5: The simplified process diagram of ecological factors causing the disappearance of the Dipper

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