

# Testing of EFI index in context of small mountain streams in Kosovo quality assessment

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**Abstract-** As the WFD requires carrying out regular quality assessment of fish population, in the frame of this study sampling was done in 3 sites along Lumbardhi i Pejes river.

A list of species composition is completed. Altogether 9 fish species and lamprey (*Eudontomyzon stankokaramani*) were present in catch. The classification of the ecological status is done by using EFI index. The Lumbardhi i Pejes River is an ecosystem with relatively favorable ecological conditions for the development of ichthyofauna but because of direct negative anthropogenic impact in different forms ( as gravel excavation etc), the development of ichthyofauna is on the decline..

**Index Terms-** : WFD, fish composition, ecological status, Lumbardhi i Pejes River

## I. INTRODUCTION

The implementation of the Water Framework Directive of the European Union among others requires future routine assessment of the ecological status of rivers using physical, chemical and biological quality components. Among the latter, fish communities referring to their species compositions, abundances, and age structure have to be considered as biological indicators. However, large scale assessment of abundance and age structures of fish communities require a much higher sampling effort and quality, than it has been achieved so far by common fish-faunistic field work in the Republic of Kosovo.

Consequently, not only suitable standard sampling approaches but also an assessment method fulfilling the requirements of the WFD is lacking. Type specific fish-faunistic references, (which according to the WFD are needed for the fish-based river assessment), do not exist yet in our country. Thus, the necessity of fundamental research work covering all mentioned aspects is obvious.

It is well known that fish species vary in the extent of their adaptation to, or dependence on environmental conditions. If pristine river conditions change due to anthropogenic alternations, the minimum requirements of particular sensitive fish species may no longer be fulfilled. This can lead to significant decreases of population size, or even to species extinction. On the other hand, tolerant fish species may profit from human- induced impacts and become more abundant. Consequently fish species composition and population structure change as a result of habitat degradation, due to physical, chemical or biological impairments. However, the sensitivity of fish reaction to river impact differs from one species to the other and moreover is dependent on the kind of pressures and the dimension of the impact.

### **River General conditions**

The Drini i Bardhë River springs from a solid rocky hill close to Radavc village, 580 m above sea level, about 12 km south of Peja town. The length of the Drini i Bardhë river in Kosovo is 154 km, while its total length is 175 km. When the river leaves Kosovo it possesses a flow average of 60 m<sup>3</sup>/sec and for this criteria it is the richest stream in the territory of Kosovo. One of the main tributaries of this river basin is Lumbardhi i Pejes River. This river springs are at 2.243 m above sea level and thus it is a mountain stream. Total length of the stream is 62 km from source until the discharge to Drini i Bardhë River. The distance from source (2,243m) to mouth in Drini i Bardhë River (365m) shows that the slope of the river is very high,.

### **Selection of sites and frequencies**

A fieldtrip carried out on beginning of June 2008 have helped in selecting more precisely the monitoring stations.

For this purpose it is proposed to collect biological information on 5 sampling and to carry out parallel data collection for physico-chemical analysis on the same 5 stations plus one additional

The following map summarises the sites location, and the types of analyses that was conducted during this study

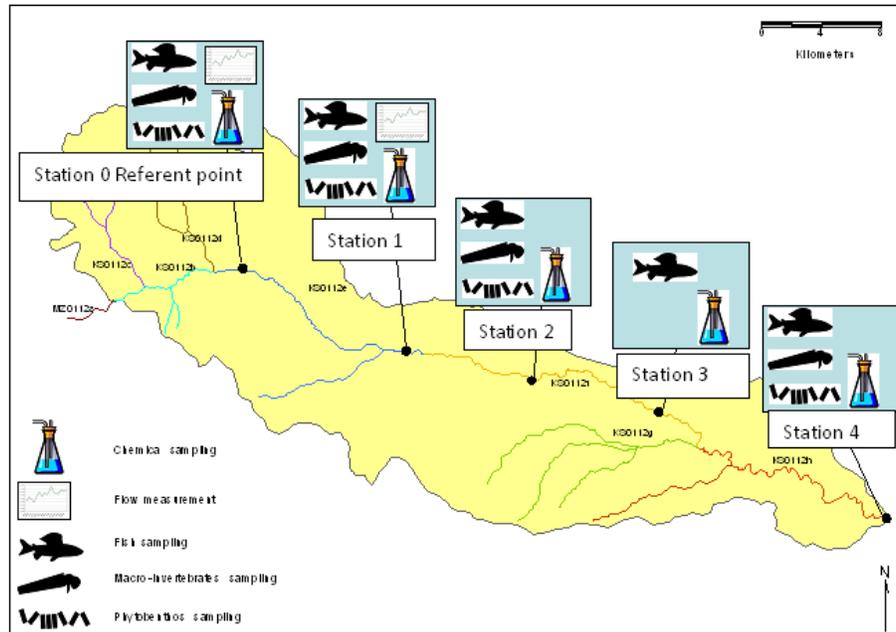


Figure 1. The sites location and the types of analyses

## II. MATERIAL AND METHODS

As the WFD requires carrying out regular quality assessment of fish population, it is necessary in the future to include such analysis in monitoring networks.

In the frame of this project the sampling was done in 3 sites (1 in June 2008, 2 in September 2008). There was no fish in Station 1 while in station 2 it was impossible to sample due to the lack of water. Station 1 is inside the Peja town and the lack of fish is because of the pollution

The electrofishing is used as sampling method. This is particularly useful method in situation where other techniques, such as netting, may be ineffective due to the nature of habitat. The sites were fished by wading using electrofishing equipment ([Hans Grassl GmbH](#)). The wetted width in electrofishing survey varied from 4m to 20m and the size of catchments (upstream of sampling site) was < 100 km<sup>2</sup>. The altitude varied between 364 m and 1073 m above sea level.

The type of electrical current used during survey is direct current (DC). Direct current (DC) always flows in the same direction and enables positive and negative outputs of a power source to be identified.

### Species identification

Many fishes are certainly identified in the field. However, for verification of their identification and some difficulties, from each fish species examples are preserved and send in laboratory for clarification.

In laboratory the best available keys for identifications are used as European Freshwater Fishes by M. Kottelat and J. Freyhof; Ribe Srbije by P. Simonovic; Slatkovodne Ribe Jugoslavije by T. Vukovic; N.Rakaj Ihtiofauna e Shqiperise.

All fish species are identified to species level. Some of difficulties of species identifications are verified with pictures, published descriptions, known geographic range or have the specimen identified and verified by specialist. Identity of those fish is confirmed further more in IGB, Institute of Inland fisheries and aquaculture

### EFI Index calculation

Currently, different fish based methods are used in Europe. The successful implementation of the WFD depends on the provision of reliable and standardized assessment tools. The European Fish Index (EFI) produced by the FAME-project aimed to develop, evaluate and implement a fish-based assessment method for the ecological status of European rivers to guarantee coherent and standardized monitoring throughout Europe ([fame.boku.ac.at](#)).

In our case EFI – index was preliminary tested for ecological classification of the reference locality (in our case in Kuqishte-Lumbardhi i Pejes River). EFI index is not yet calibrated for Kosovar conditions. EFI uses information about the site location (ecoregion, river region) and 12 environmental variables (geology, size, altitude, flow regime, lakes upstream, air temperature, slope, distance from source, wetted width, sampling strategy and method, and fished area) to predict the reference values for fish assemblage. The ecological status is expressed as an index ranging from 1 (high ecological status) to 0 (bad ecological status).

### III. RESULTS

The results are presented for only three of general five study reaches. The reason for that is that in two study areas there was a lack of water and river bed was almost dry. There was no fish species in those reaches.

A list of species composition is completed. Altogether 9 fish species and lamprey (*Eudontomyzon stankokaramani*) were present in catch.

Within each sampling site the amount of species present varied between 1 species (in Sampling site 0), to 5 and 8 species in other two sampling sites. The other two sampling sites had rather similar fish assemblage structure. Sampling site 3 which is electrofished during September had the highest fish density of the entire electrofished river. This was mainly due to high density of *Phoxinus lumaireul* (59 samples) and *Barbatula barbatula* (22 samples).

The more detailed catch statistic for all sampling station is given in table 1.

Table 1: **Detail fish catch statistic for sampling station**

<i>Fish species</i>	<i>Sampling Date</i>	<i>Sampling site Station code</i>	<i>Number of individuals</i>
<i>Salmo farioides,</i>	05/09/2008	1 Rugova Valey St.cod 0	41
<i>Chondrostoma nasus</i>	05/06/2008	Grabanice e eperme St.cod 4	15
<i>Barbus rebeli</i>	05/06/2008	Grabanice e eperme St.cod 4	18
	05/09/2008	Gllaviqica irrigation dam St.cod 3	5
<i>Leuciscus cephalus</i>	05/06/2008	Grabanice e eperme St.cod 4	13
	05/09/2008	Gllaviqica irrigation dam St.cod 3	14
<i>Alburnoides bipunctatus</i>	05/06/2008	Grabanice e eperme St.cod 4	10
<i>Pachychilon pictum</i>	05/06/2008	Grabanice e eperme St.cod 4	11
<i>Barbatula barbatula</i>	05/06/2008	Grabanice e eperme	1
	05/09/2008	Gllaviqica irrigation dam St.cod 3	22
<i>Rhodeus sericeus</i>	05/06/2008	Grabanice e eperme St.cod 4	1
	05/09/2008	Gllaviqica irrigation dam St.cod 3	3
<i>Phoxinus lumaireul</i>	05/09/2008	Gllaviqica irrigation dam St.cod 3	59
<i>Eudontomyzon stankokaramani</i>	05/06/2008	Grabanice e eperme St.cod 4	3

In sampling station 0 which was selected as referent point the EFI index is equal with 0.51 which refer to good ecological status, in sampling station 3 the EFI index is 0,42 and this refers to moderate ecological status and by the end in station 4 EFI- index is 0.50 which points also good ecological status (Table 2).

Table 2: Calculation of EFI index

Rivername	Sitename	Date	EFI - Index	Status
Lumbardhi i Pejes	Station 0	2008	0.51	Good
Lumbardhi i Pejes	Station 3	2008	0.42	Moderate
Lumbardhi i Pejes	Station 4	Friday, June 06, 2008	0.5	Good

The EFI should not be used (or only used with caution) in e.g. Mediterranean rivers with high proportion of endemic species or in the rivers of the south-eastern part of Europe which support fish communities that differ greatly in species composition. (FAME CONSORTIUM, 2004). In our case three species are not present in the species list of the software used to calculate EFI. For *Barbus rebelli* we have used corresponding value of another species of the same genus, *Barbus meridionalis*. The identity of the *Phoxinus lumaireus* populations from Drin drainages requires further investigation (Freyhof, J. & Kottelat, M. 2008) and thus for this species we have used corresponding value of *Phoxinus phoxinus*. For *Eudontomyzon stankokaramani* which is endemic for Drini i Bardhe basin (Karaman 1974, Renaud 1982; Holci & Renaud 1986; Soric, 1998) to which belongs Lumbardhi i Pejes River and thus we have used corresponding value of a species from the same genus *Eudontomyzon marinus*.

However, concerning the fish composition, we have tried that fish species of Peja River-Drini I Bardh basin to categorize into ecological guild, which is also highly relevant for the river assessment according to the WFD (see table 3).

Table 3. Ecological classification of fish species occurring in Peja River- Drini I Bardhe basin

Fish species	Ecological guild				
	Habitat	Reproduction	Trophic range	Migration distance	Migration type
<b>Petromyzonidae</b>					
<i>Eudontomyzon stankokaramani</i>	rheophilic	lithophilic	filtering	Short/medium	anadromus
<b>Salmonidae</b>					
<i>Salmo farioides</i>	rheophilic	lithophilic	Inverti-piscivorus	short	anadromus
<b>Cyprinidae</b>					
<i>Chondrostoma nasus</i>	rheophilic	lithophilic	herbivorus	medium	potamodromus
<i>Barbus rebelli</i>	rheophilic	lithophilic	invertivorus	medium	anadromus
<i>Leuciscus cephalus</i>	rheophilic	lithophilic	omnivorus	short	potamodromus
<i>Alburnoides bipunctatus</i>	rheophilic	lithophilic	invertivorus	short	anadromus
<i>Pachychilon pictum</i>	rheophilic	lithophilic	omnivorus	short	potamodromus
<i>Rhodeus sericeus</i>	Indifferent	ostracophilic	omnivorus	short	potamodromus
<i>Phoxinus lumaireul</i>	rheophilic	lithophilic	invertivorus	short	potamodromus
<b>Balitoridae</b>					
<i>Barbatula barbatula</i>	rheophilic	psammophilic	invertivorus	short	potamodromus

Fish species are grouped according to their preference to flow conditions. Three major habitat guilds can be distinguished based on the degree of rheophilic behavior:

So, the sampling point 0 and 4 correspond with results coming up from EFI fish index; only rheophilic fish species were found there. The indifferent species which are more tolerant to water conditions were found in sampling station 3 and, that also correspondent with findings of fish index results.

#### IV. . DISCUSSION AND CONCLUSIONS

The results of this research work, besides helping to use freshwater fish as ecological indicators in all Kosovo rivers, also illustrates some pressures that freshwater ecosystems suffer in this region. In two sites we were faced with drought events which have a negative consequence on the river and their biota. The interpretation of drought is in fact to complicate because very accurate analysis could be necessary to know if the sites found dry usually are due to human or natural causes. Many authors suggest that restoration or preservation of native stream biota will require maintenance or restoration of natural flow regimes (Power et al. 1996; Stanford et al. 1996; Poff et al. 1997). Therefore, in order to preserve the native biota it is necessary not only the absence of pollution in the water but also the river should have natural discharge and natural flow regime again. Consequently, comprehensive hydrological studies for all Kosovo rivers are needed and it is also urgent to apply the policies, strategies and managements to respect the natural stream flow regime. Only in this way we will be able to preserve the integrity of the ecosystem functioning of Kosovo streams and their biota.

Another of the great problems to develop metrics and EFI index in Kosovo rivers is lack of reference areas to test the metrics. Chovarec et al. (2000) suggest that "reference condition is the state that has existed before the human interferences, or at least without human influences that have altered significantly their natural characteristics". Owen et al. (2001) considers that the "reference condition is when physical-chemical, hydromorphologic and biological values corresponding to the area without human alternation". So even the concept of reference condition is widely known and used, in our case study we have actually sampled from site that have not been influenced, or have been influenced only minimally, by humans (Karr & Chu 1999).

During this research it is shown that freshwater fish can be a valuable ecological indicator, so they could be used in all other Kosovo rivers and streams. So we showed that fish provided different information than more traditional physicochemical or other biological indices.

As described in the WFD the terms "species composition", "species abundance" and "age structures" of the fish communities have to be taken into account for fish based river assessment. So, during this research the inventory list is fulfilled, and concerning abundance and age structure still it has to be discussed and decided which metrics will be taken and are more appropriate for Kosovo conditions.

Finally, the timing of the sampling is an important issue. Seasonal changes of fish assemblage composition are well known and verified during our sampling in early summer and autumn. Fishes reflect shift between winter and summer habitats. Therefore, a representative survey would require three surveys per year at different seasons, in small rivers at least two, one in spring and one in autumn.

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