

Fishes of the River Vjosa – an annotated Checklist

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Based on a combination of intensive fieldwork for a period of thirteen years (2004–2017), literature review and review of museum specimens, we hereby provide an updated checklist of the fishes of Albanian part of River Vjosa. Our results show that there are at least 31 species of fishes inhabiting the river system, of which 27 are native, including eight species endemic to the Balkans. With 11 species, *Cyprinidae* are by far the most specious family, followed by *Mugilidae* (five). *Salmonidae* and *Acipenseridae* are represented by 2 species each. The remaining ten families are represented by a single species. At least four species (*Pseudorasbora parva*, *Oncorhynchus mykiss*, *Carassius sp.*, *Gambusia holbrooki*) were introduced into the Vjosa basin. The provided list includes the distribution of each species in River Vjosa, as well as annotations referring to introductions, taxonomic and their conservation status.

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Die vorliegende Checkliste der Fische der Vjosa basiert auf Felduntersuchungen über eine Periode von 13 Jahren (2004–2017), einer kritischen Literaturanalyse und dem Studium von Belegmaterial in Museen. 31 Arten konnten für die Vjosa belegt werden. Von den 27 autochthonen Arten sind 8 Arten endemisch für den Balkan. *Cyprinidae* sind mit 11 Arten die umfangreichste Gruppe, gefolgt von *Mugilidae* (5 Arten), sowie *Salmonidae* und *Acipenseridae* mit jeweils 2 Arten. Mindestens 4 Arten, (*Pseudorasbora parva*, *Oncorhynchus mykiss*, *Carassius spp.*, *Gambusia holbrooki*) wurden eingesetzt. Die Liste gibt Angaben über die Verteilung in der Vjosa, sowie Hinweise über Herkunft, taxonomischen Status und Naturschutz Status der einzelnen Arten.

Keywords: Checklist, native species, threatened species, marine, freshwater, lagoon.

Introduction

According to the criteria for large rivers Annex II of the WFD (European Commission, 2000), the Vjosa, with a catchment area of 6710 km², is a large transboundary river in the South Balkan Peninsula (SCHWARZ 2012,). It is the only river that originates in Greece and descends to Albania with its estuary in the Adriatic Sea. The hydrological regime of the river reflects the Mediterranean climate of its basin with characteristic discharge extremes in late summer-autumn and in late winter-spring (LAZARIDOU-DIMITRIADOU et al. 2002, SCHIEMER et al. 2018 this volume).

This contribution provides a complete list of fish species inhabiting River Vjosa and its tributaries, including lower river reaches, adjacent channels, and brackish waters of Narta Lagoon and associated human constructed water connections. All the data excluding species of the genus *Acipenser* and lamprey are first and last author's data collection in the period of 2004–2017, so there is a combination of own and published data. The intention is to produce an annotated list that can be regularly updated and reviewed based on new surveys and experts opinion. This list is an important prerequisite for biodiversity conservation purposes and management decisions for one of the last geomorphologically intact river systems threatened by plans for the construction of hydropower dams and other human pressures. Our contribution provides data on zoogeographical distribution based on original records, specific biology patterns of individual species and several validations of fish names and taxonomic clarifications necessary due to changes during the last dec-

ade. The list contains standardized information on species' taxonomy, distribution, habitat, and conservation status, while it also helps to interpret nomenclature and taxonomic problems.

The River Vjosa fish fauna is of particular importance as a national heritage, due to its diversity and high degree of endemism, which is clearly demonstrated by the present publication. The species diversity is mainly the result of the complex geological and climatic condition, that allowed intensive colonization from outside the area and diverse freshwater and transitional habitats. Further there is an intersection among the biogeographical regions of southeastern Europe and Mediterranean Basin.

Research on the Albanian fish fauna, including first investigations of River Vjosa started with the pioneering works of POLJAKOV et al. (1958), RAKAJ (1995) and DHORA (2010). The latter publication is also the first and only available checklist of Albanian freshwater fishes.

Although the knowledge and understanding of the diversity and distribution patterns of freshwater fishes in most of the European Mediterranean has increased considerably, the freshwater fish fauna of Albania is still poorly known. Whereas for the surrounding areas updated information exists (MRAKOVČIĆ et al. 2006, ECONOMOU et al. 2007) such data on Albanian species are missing, apart from recent publications on loaches (Cobitidae and Nemacheilidae) (ŠANDA et al. 2008), salmonids (SNOJ et al. 2009) and barbels (genus *Barbus*; Cyprinidae) (MARKOVÁ et al. 2010). The only available sources of information are the general works of POLJAKOV et al. (1958) who included 36 freshwater species and RAKAJ (1995) listing 77 species. The difference between the coverage in these two publications is probably in part due to inclusion of newly introduced species, but more so by changes in the taxonomic status of many species. The deficiency in the knowledge of the diversity of freshwater fishes of Albania has been confirmed by recent descriptions of many new species from the area (ECONOMIDIS 2005, KOVAČIĆ & ŠANDA 2007, MILLER & ŠANDA 2008, ZUPANČIĆ et al. 2010, BOGUTSKAYA et al. 2010).

Material and methods

The species in the following list are compiled based on two different sources of information: the data supplemented by old and more recent publications dealing with species present in the area and the first and last author surveys conducted from 2004 to 2017. Voucher specimens are deposited in the Agricultural University of Tirana and National Museum, Prague. The previously published data from POLJAKOV et al. (1958) and RAKAJ (1995) are taken as a baseline. In addition, information on fish distribution in FishBase was evaluated (FROESE & PAULY 2015). Additional fish records published during the last decade were added, and some doubtful species appearing in previous publications were evaluated, and either verified or excluded from the present list. We follow the family classification of VAN DER LAAN et al. (2014), with orders, families and subfamilies arranged systematically, but genera and species alphabetically within each family. English names of fish follow FROESE & PAULY (2015), while the Albania names of fish follow RAKAJ (1995).

In the present checklist, we include only those fish species which spend some parts of their life or their entire life cycles in freshwater, including some marine species entering freshwater habitats during part of their life cycle.

Results

The present checklist includes 31 fish species inhabiting River Vjosa and its tributaries. They are assigned to 2 classes, 10 orders and 14 families (Tab. 1). Dominant in the overall fauna is the order Cypriniformes with 13 species or 41.6% of the total fauna, followed by Perciformes with 6 species (19.2% of total). Other orders with more than one species are the Salmoniformes (2), Cyprinodontiformes (2) and Acipenseriformes (2). The families with the highest species numbers are the Cyprinidae (11), followed by Mugilidae (5), Salmonidae (2) and Acipenseridae (2). All other families (Cobitidae, Gobiidae, Petromyzontidae, Anguillidae, Clupeidae, Nemacheilidae, Atherinidae, Poeciliidae, Cyprinodontidae, Moronidae and Pleuronectidae) are represented by a single species.

Tab. 1: Number and relative share (%) of families/subfamilies and species in each order and families/subfamilies of fishes present in the River Vjosa basin. – Tab. 1: Zahlen und relativer Anteil (%) von Familien, Subfamilien und Arten von Fischen im Vjosa Fluss System.

| Taxa | Families | % | Species | % |
|---------------------|-----------------|----------|----------------|----------|
| Petromyzontiformes' | 1 | 6.6 | 1 | 3.2 |
| Petromyzontidae | | | 1 | 3.2 |
| Acipenseriformes | 1 | 13.2 | 2 | 6.4 |
| Acipenseridae | | | 2 | 6.4 |
| Anguilliformes | 1 | 6.6 | 1 | 3.2 |
| Anguillidae | | | 1 | 3.2 |
| Clupeiformes | 1 | 6.6 | 1 | 3.2 |
| Clupeidae | | | 1 | 3.2 |
| Cypriniformes | 3 | 19.8 | 13 | 41.6 |
| Cyprinidae | | | 11 | 33 |
| Cobitidae | | | 1 | 3.2 |
| Nemacheilidae | | | 1 | 3.2 |
| Salmoniformes | 1 | 6.6 | 2 | 6.4 |
| Salmonidae | | | 2 | 6.4 |
| Atheriniformes | 1 | 6.6 | 1 | 3.2 |
| Atherinidae | | | 1 | 3.2 |
| Cyprinodontiformes | 2 | 13.2 | 2 | 6.4 |
| Poeciliidae | | | 1 | 3.2 |
| Cyprinodontidae | | | 1 | 3.2 |
| Perciformes | 2 | 13.2 | 6 | |
| Moronidae | | | 1 | 3.2 |
| Mugilidae | | | 5 | 16 |
| Pleuronectiformes | 1 | 6.6 | 1 | 3.2 |
| Pleuronectidae | | | 1 | 3.2 |
| Total | 14 | | 31 | |

Following the Albanian red list (MoE 2013) there are three species considered as endangered (*Acipenser sturio*, *A. naccarii* and *Aphanius fasciatus*) and further two as vulnerable (*Petromyzon marinus* and *Platichthys flesus*). According to IUCN (FREYHOF & BROOKS 2011) three species (*Acipenser sturio*, *A. naccarii*, *Anguilla anguilla*) are considered as critically endangered. Additionally *Gobio skadarensis* is evaluated as endangered. For the Bern convention three species are considered as strictly protected fauna species (Annex II) (*Acipenser sturio*, *A. naccarii*, *Aphanius fasciatus*) and four as Protected fauna species (Annex III) (*Petromyzon marinus*, and *Pachychilon pictum*). Both *Gobio skadarensis* and *Squalius platyceps* listed in this publication are still with unclear status and need further investigations.

Tab. 2: List of fish species found in RiverVjosa, their national and IUCN conservation status (Critically Endangered (CR), Endangered (EN), Lower Risk (conservation dependent) (LR/cd), Lower Risk (near threatened) (LR/nt), Vulnerable (VU), Least Concern (LC)), their listing in Annex II (strictly protected fauna species) and Annex III (Protected fauna species) in the Bern convention. – Tab. 2: Liste der Fischarten, die im Vjosa Fluss-System vorkommen. Angegeben ist der Schutzstatus nach IUCN und der Bern Konvention (Annex II, streng geschützte Tierarten, und Annex III, geschützte Arten).

| Species | Habitat | Occurrence | National red list | IUCN Red list | Bern convention |
|------------------------------------|-------------|------------|-------------------|---------------|-----------------|
| <i>Petromyzon marinus</i> | Anadromous | native | VU | LC | III |
| <i>Acipenser sturio</i> | Anadromous | native | EN | CR | II |
| <i>Acipenser naccarii</i> | Anadromous | native | EN | CR | II |
| <i>Anguilla anguilla</i> | Katadromous | native | - | CR | - |
| <i>Alosa fallax</i> | Anadromous | native | - | LC | - |
| <i>Alburnoides aff. prespensis</i> | Freshwater | native | - | - | III |
| <i>Alburnus scoranza</i> | Freshwater | native | - | LC | - |
| <i>Barbus prespensis</i> | Freshwater | endemic | LRcd | LC | - |
| <i>Carassius spp.</i> | Freshwater | introduced | - | - | - |
| <i>Chondrostoma ohridana</i> | Freshwater | endemic | LRcd* | NT | III* |
| <i>Gobio skadarensis</i> | Freshwater | endemic | LRnt* | EN | - |
| <i>Luciobarbus albanicus</i> | Freshwater | endemic | - | LC | - |
| <i>Pachychilon pictum</i> | Freshwater | endemic | - | LC | III |
| <i>Pelagus thespoticus</i> | Freshwater | endemic | - | NT | - |
| <i>Pseudorasbora parva</i> | Freshwater | introduced | - | LC | - |
| <i>Squalius platyceps</i> | Freshwater | endemic | - | LC | - |
| <i>Cobitis ohridana</i> | Freshwater | endemic | LRcd | LC | - |
| <i>Oxynoemacheilus pindus</i> | Freshwater | endemic | - | VU | - |
| <i>Oncorhynchus mykiss</i> | Freshwater | introduced | - | - | - |
| <i>Salmo farioides</i> | Freshwater | native | - | - | - |
| <i>Chelon aurata</i> | Saltwater | native | - | - | - |
| <i>Chelon labrosus</i> | Saltwater | native | - | LC | - |
| <i>Chelon ramada</i> | Saltwater | native | - | - | - |
| <i>Chelon saliens</i> | Saltwater | native | - | - | - |
| <i>Mugilcephalus</i> | Saltwater | native | - | LC | - |
| <i>Atherinaboyerii</i> | - | native | - | LC | - |
| <i>Gambusia holbrooki</i> | Freshwater | introduced | - | LC | - |
| <i>Aphanius fasciatus</i> | Freshwater | native | EN | LC | II |
| <i>Dicentrarchus labrax</i> | Saltwater | native | - | LC | - |
| <i>Platichthys flesus</i> | Saltwater | native | VU | LC | - |

List of species

Class CEPHALASPIDOMORPHI
Order PETROMYZONTIFORMES
Family PETROMYZONTIDAE

Lampreys are jawless, scaleless, eel-like vertebrates with a cartilaginous skeleton, a single nostril on the top of the head, five to seven gill pores (not supported by gill arches), and a toothed bearing oral disk that is used by the lamprey as a tool for both feeding and attaching itself to solid substrates and fish (BARBIERI et al. 2015). RAKAJ (1995) is describing two lampreys for Albania i.e. *Lampetra fluviatilis* and *Petromyzon marinus*. They inhabit both fresh and saltwater environments, and some species are anadromous.

Petromyzon marinus (Linnaeus, 1758) [N], Sea lamprey/Kavalli i detit/, occurs at the Adriatic coast of Albania, entering rivers for reproduction, including the River Vjosa basin. A very rare species in the coastal parts of Albania, its presence in the country is poorly documented (PLOJAKOV et al. 1958, RAKAJ 1995, DHORA 2010, FREYHOF & BROOKS 2011). The presence of species has been reported by PLOJAKOV et al. (1958), RAKAJ (1995) and DHORA (2010).

Class ACTINOPTERYGII
Order ACIPENSERIFORMES
Family ACIPENSERIDAE

Sturgeons are primitive bony fishes with a cartilaginous skeleton; they are scaleless, with five rows of bony scutes along the body. According to RAKAJ (1995) there are four surgeon species present in Albania. They are large-bodied and long-lived with a long triangular snout, toothless mouth and four barbels in front. Some are anadromous, others restricted to freshwaters. All but one European species are Critically Endangered, mainly due to over-fishing, damming, hydrological changes and pollution (BARBIERI et al. 2015).

Acipenser sturio (Linnaeus, 1758) [N], Sturgeon/Blini/, occurs at the Adriatic coast of Albania, mostly in the northern part. (RAKAJ 1995, PLOJAKOV et al., 1958, CRIVELLI 1996, DHORA, 2010, FREYHOF & BROOKS 2011). The presence of the species has been reported by PLOJAKOV et al. (1958), RAKAJ (1995) and DHORA (2010).

Acipenser naccarii (Linnaeus, 1758) [N], Adriatic Sturgeon/Blini i bardhe/, occurs at the Adriatic coast of Albania, mostly in the northern part (RAKAJ 1995, PLOJAKOV et al. 1958, CRIVELLI 1996, DHORA 2010, FREYHOF & BROOKS 2011). The presence of species has been reported by PLOJAKOV et al. (1958), RAKAJ (1995) and DHORA (2010).

Order ANGUILLIFORMES
Family ANGUILLIDAE

Catadromous fishes, spending juvenile and adult life in fresh or brackish water, with adults returning to the sea to spawn (BARBIERI et al. 2015). The members of this family have elongated, snake-shaped bodies with continuous dorsal, caudal and anal fins. They lack pelvic fins. Its presence in the entire Vjosa river has been reported (SHUMKA, unpublished data).

Anguilla Anguilla (Linnaeus, 1758) [N], European eel/Ngjala/. Occurs in all drainages of Albanian Adriatic and Ionian watersheds. Present in all River Vjosa sections. The available habitats for the species in Albanian inland waters have decreased dramatically in the last decade, mainly due to the construction of dams and other hydraulic structures that obstruct fish migration. There is also alarming evidence of declining trends in eel landings from inland waters, which is attributed to anthropogenic impacts and/or to reduced arrival rates of young eels (glass eels) from the sea (RAKAJ 1995, PLOJAKOV et al. 1958, CRIVELLI 1996, SHUMKA et al. 2010). The high abundances of this critically endangered species highlights the importance of an undisturbed longitudinal river continuum at river Vjosa at an European scale (JACOBY & GOLLOCK 2014, EC. 2007).

Order CLUPEIFORMES

Family CLUPEIDAE

Usually fusiform body with silvery coloration, head without scales and pelvic fins placed far back, below dorsal fin. Mostly marine, but some species enter lowland freshwaters; most form large schools (BARBIERI et al. 2015). Important edible species, such as sardines and herrings, are included in this family. According to RAKAJ (1990) there are two species found in freshwaters in Albania.

Alosa fallax (LaCepède, 1803) [N], Italian shad/Kubla/. Occurring at all coasts of the Albanian watersheds including Vjosa coastal section; mainly concentrated in River Buna and Lake Shkodra (KOTTELAT & FREYHOF 2007, RAKAJ 1995, PLOJAKOV et al. 1958).

Order CYPRINIFORMES

Family CYPRINIDAE

A large, diverse and widely distributed family, including over 2.400 species in Europe, Asia, Africa and North and Central America (BARBIERI et al. 2015). Cyprinids inhabit mainly fresh or brackish waters.

Alburnoides aff. prespensis (Bloch, 1782) [N], Sprilint/Barkegjera/ is present in River Vjosa and all its tributaries (KOTTELAT & FREYHOF 2007, RAKAJ 1995, PLOJAKOV et al. 1958, BOGUTSKAYA et al. 2010, SHUMKA et al. 2010, STIERANDOVÁ et al. 2016, GIEGER et al. 2014). Its taxonomic status is unclear. According to STIERANDOVÁ et al. (2016) it belongs to the *Alburnoides prespensis* complex.

Among *Alburnoides* besides the well identified populations from the Ohrid Drini System (*Alburnoides ohridanus*) and Lake Prespa (*Alburnoides prespensis*), the status of the remaining populations is unclear. BOGUTSKAYA et al. (2010) described from the Semani basin two new species: *Alburnoides fangfangae* Bogutskaya, Zupančič & Naseka 2010 from the upper River Osumi and *Alburnoides devolli* Bogutskaya, Zupančič & Naseka 2010 from the upper River Devolli. Although the authors described some difference between the two new taxa and *A. prespensis* from Lake Prespa, the differences are slight, and the ranges overlap.

Alburnus scoranza (Bonaparte, 1845) [N], Skadar Bleak/Gjuca or cironka e Shkodres. The species is present in River Vjosa and all its tributaries. It is endemic to the central western Balkan rivers from the Drin drainage, including lakes Skadar and Ohrid. The species prefers larger and deeper river water bodies and still waters (KOTTELAT & FREYHOF 2007, RAKAJ 1995, CRIVELLI 1996, SHUMKA et al. 2010, BARBIERI et al. 2015)). In Albania it is widely present within the central and northeastern part. It can reach 16 cm TL.

Barbus prespensis (Karaman, 1924) [E], Prespa barbel/Mrena or Mustaku i Prespes/. *Barbus prespensis* is present in the Vjosa and all its tributaries. The species has been formerly thought to be endemic to Prespa Lakes and their tributaries. Now it is considered to have a wider distribution in rivers of southern Albania and northwestern Greece. (CRIVELLI 1996, MARKOVÁ et al. 2010, KOTTELAT & FREYHOF 2007, SHUMKA et al. 2010)

Carassius spp. (Bloch, 1782) [I], Gibel carp/Karasi/, is widespread in Albania, and occurs occasionally in the Vjosa (RAKAJ 1995, PLOJAKOV et al. 1958, FRICKE et al. 2007, KOTTELAT & FREYHOF 2007, SHUMKA et al. 2008). The taxonomic status is unclear and the morphological differentiation of introduced Carassius species is difficult (KALOUS et al. 2013). Genetic data from surrounding areas confirm the presence of *Carassius auratus*, *Carassius langsdorfi* as well as *Carassius gibelio*.

Chondrostoma ohridanum (Karaman, 1924) [E], Ohrid nasse/Njila or skobusi i Ohrit/ a species widespread in Albania, present in River Vjosa and all its tributaries. It inhabits river sections with fast-flowing waters with rocky to stony substrate (CRIVELLI 1996, CRIVELLI 2006, KOTTELAT & FREYHOF 2007, SHUMKA et al. 2010). Previous records of *C. vardarensense* from Vjosa river basin were misidentifications. The genetic studies have assigned the Vjosa population to *C. vardarensense* (ZARDOYA & DOADRIO 1999, DOADRIO & CARMONA 2004, ROBALO et al. 2007). GEIGER et al. (2014), however, identified this population as *C. ohridanum*, a species present in the Drin drainage, including Lakes Shkodra/Scadar and Ohrid. Therefore, the Vjosa nase population should be considered as distinct from the *C. vardarensense* Greek populations, and thus deserves further studies. The study of MARIĆ & ŠORIĆ (2009) confirmed the validity of *C. ohridanum* and GEIGER et al. (2014) its presence in the Vjosa river basin.

Gobio skadarensis (Karaman, 1937) [E], Skada gudgeon/GurneciiShkodres/ is present in River Vjosa and all its tributaries. This species, widespread in River Drino (3 km from confluence with the Vjosa), inhabits streams and rivers with moderate flow, and substrate consisting of sand, pebble and boulders. Based on our data it is of low abundance in Vjosa (CRIVELLI 1996, KOTTELAT & FREYHOF 2007, MILLER & ŠANDA 2008, ŠANDA et al. 2006, SHUMKA et al. 2010). The taxonomic assignment is provisional and makes further investigations of gudgeons from Albania necessary.

Luciobarbus albanicus (Steindachner, 1870) [E], Albanian barbel/Mustaku shqiptar/, is endemic to Southern Albania and western Greece, and very rare in the River Vjosa and its tributaries (RAKAJ 1995, PLOJAKOV et al. 1958, CRIVELLI 1996). The species has recently been transferred to the genus *Barbus* (under which it was originally described) and presented as being valid under the name “*Barbus albanicus*” (ESCHMEYER 2014; FROESE & PAULY 2014). In the above species accounts, the closely related *Luciobarbus graecus* was retained in the genus *Luciobarbus*. On the basis of available genetic and morphological evidence (TSIGENOPOULOS et al. 2003, KOTTELAT & FREYHOF 2007, GEIGER et al. 2014), we consider the species sufficiently distinct from other species of the genus *Barbus* to justify its inclusion in the genus *Luciobarbus*.

Pachychilon pictum (Heckel & Kner, 1858) [E], Albanian roach/Skorti i zi/. Present in River Vjosa and all its tributaries. It inhabits slow-flowing rivers, canals and backwaters (CRIVELLI 1996, KOTTELAT & FREYHOF 2007, RAKAJ 1995, PLOJAKOV et al. 1958, SHUMKA et al. 2010).

Pelasgus thesproticus (Stephanidis, 1939) [E], Minnow (Epiros minnow/Peshkguri/. Present in central part of River Vjosa and its tributaries. It inhabits springs, streams and various ponds; usually found in shallow water with slow flow and dense vegetation (KOTTELAT & FREYHOF 2007, RAKAJ 1995, PLOJAKOV et al. 1958, ECONOMOU et al. 2007).

Pseudorasbora parva (Temminck & Schlegel, 1846) [I], Stone moroko/Notaku/ is a non-indigenous species from eastern Asia, spreading rapidly in Albanian lakes and rivers. It is widespread in the Vjosa basin (KOTTELAT & FREYHOF 2007, RAKAJ 1995, SHUMKA et al. 2008, SHUMKA et al. 2010).

Squalius platyceps (Zupančič, Marić, Naseka & Bogutskaya, 2010) [N], Chub/Kleni or Mlyshi/. The species inhabits rivers and streams with slow- to moderate-flowing waters and is common in various stream habitats. Recorded from the Vjosa and its tributaries (KOTTELAT & FREYHOF 2007, RAKAJ 1995, GEIGER et al. 2014, SHUMKA et al. 2010). The taxonomic status provisionally follows GEIGER et al. (2014); further evaluation is required.

Family COBITIDAE

A family of small-sized fish with a unique elongated body form. They have a small bottom-facing mouth with three to six pairs of barbells (BARBIERI et al. 2015). The pigmentation pattern is important for species identification. No final data on the number of species present in Albania.

Cobitis ohridana Karaman, 1928 [E], Ohridspined loach/Gurneci i Ohrit/present in River Vjosa and all its tributaries (CRIVELLI 1996, KOTTELAT & FREYHOF 2007, ŠANDA et al. 2008, SHUMKA et al. 2010).

Family NEMACHEILIDAE

The stone loaches are widely distributed in Asia, Europe and parts of Africa (BARBIERI et al. 2015). Their elongated body form and inferior mouth position are highly adapted for benthic living. They have three pairs of mouth barbels and, in contrast to spined loaches (Cobitidae), they lack a spine below the eyes. The most spread species within Albanian freshwaters system is the Pindus stone loach.

Oxynoemacheilus pindus (Economidis, 2005) [E], Pindus stone loach/Gurneci i Pindusit/ Present in River Vjosa and all its tributaries (CRIVELLI 1996, KOTTELAT & FREYHOF 2007, RAKAJ 1995, PLOJAKOV et al. 1958, SHUMKA et al. 2010).

Order SALMONIFORMES

Family SALMONIDAE

Salmonids are medium- to large-sized with a spotted body, an adipose fin and with a single row of sharp teeth in their mouths. They are predators, feeding on small crustaceans, aquatic insects and smaller fish (BARBIERI et al. 2015). The taxonomy of riverine trouts in the Adriatic and Ionian Sea basins is far from resolved. Genetic analysis has confirmed they form a monophyletic group but does not provide clear data to resolve exactly the taxonomy (SUŠNIK et al. 2007, SNOJ et al. 2009). This applies also with regard to their morphology, with most of the trout populations yet to be identified by genetic analysis. On the one hand, KOTTELAT & FREYHOF (2007) propose most Adriatic and Ionian popula-

tions belong to *Salmo farioides* Karaman, 1938, while on the other, they accept the validity of many local endemic taxa.

Oncorhynchus mykiss (Walbaum, 1792) [I], Rainbow trout/Trofta e ylberte/Main culture fish in freshwater both rives and dams, introduced to all parts of Albania including Vjosa (RAKAJ 1995, PLOJAKOV et al. 1958, KOTTELAT & FREYHOF 2007, SHUMKA et al. 2008).

Salmo farioides (Karaman, 1938) [N], Brown trout/Trofta e murrme/. The species is present in upper part of the Vjosa basin (RAKAJ 1995, PLOJAKOV et al. 1958, CRIVELLI 1996, KOTTELAT & FREYHOF 2007, SNOJ et al. 2009, SHUMKA et al. 2010).

Order SYNBRANCHIFORMES

Family MUGILIDAE

Chelon aurata (Risso, 1810) [N], Golden gray mullet/Qefulli i arte/. Coastal part of Adriatic Sea, lower part of the Vjosa river and brackish waters (RAKAJ 1995, PLOJAKOV et al. 1958, KOTTELAT & FREYHOF 2007, SHUMKA et al. 2010).

Chelon labrosus (Risso, 1827) [N], Thicklip grey mullet/qefulli buzetrashe/. Coastal part of the Ariatic Sea, lower part of the Vjosa and brackish waters. (KOTTELAT & FREYHOF 2007, RAKAJ 1995, PLOJAKOV et al. 1958)

Chelon ramada (Risso, 1827) [N], Thinlip mullet/Qefull ibuzeholle/. A widespread euryhaline species in the coastal part of the Adriatic Sea, lower and middle part of the Vjosa and brackish waters (KOTTELAT & FREYHOF 2007, RAKAJ 1995, PLOJAKOV et al. 1958).

Chelon saliens (Risso, 1810) [N], Leaping mullet/Qefulli i Vjeshtes/. A widespread euryhaline species in the coastal part of the Adriatic Sea, lower and middle part of the Vjosa and brackish waters (KOTTELAT & FREYHOF 2007, RAKAJ 1995, PLOJAKOV et al. 1958).

Mugil cephalus (Linnaeus, 1758) [N], Flathead mullet/Qefulli i zakonshem/. A widespread euryhaline species in the coastal part of the Adriatic Sea, lower and middle part of the Vjosa and brackish waters (KOTTELAT & FREYHOF 2007, RAKAJ 1995, PLOJAKOV et al. 1958).

Order ATHERINIFORMES

Family ATHERINIDAE

Subfamily ATHERININAE

Atherina boyeri (Risso, 1810) [N], Big-scale sand smelt/Aterina/. The section of Adriatic coast, confluence with River Vjosa and brackish waters in Narta Lagoon (RAKAJ 1995, PLOJAKOV et al. 1958, KOTTELAT & FREYHOF 2007).

Order CYPRINODONTIFORMES

Family POECILIIDAE

Subfamily POECILIINAE

Gambusia holbrooki (Girard, 1859) [I], Holbrook's mosquito fish/Peshku mushkonje/. Introduced and widespread in the River Vjosa basin and surrounding water (KOTTELAT & FREYHOF 2007, RAKAJ 1995, SHUMKA et al. 2008, SHUMKA et al. 2010).

Family CYPRINODONTIDAE

Aphanius fasciatus (Valenciennes, 1821) [N], Mediterranean banded killifish/Peshkuçelik/. Mediterranean Sea watersheds, present in the mouth and channels of lower part of the Vjosa and in Narta lagoon (RAKAJ 1995, CRIVELLI 1996, KOTTELAT & FREYHOF 2007, SHUMKA et al. 2010).

Order PERCIFORMES

Family MORONIDAE

Dicentrarchus labrax (Linnaeus, 1758) [N], European seabass/Levrekü/. A coastal species of the Mediterranean and Eastern Atlantic Ocean. A marine species, occasionally entering Narta lagoon, the mouth and lower reaches of the Vjosa (RAKAJ 1995, SHUMKA et al. 2010).

Order PLEURONECTIFORMES

Family PLEURONECTIDAE

Platichthys flesus (Linnaeus, 1758) [N], The European flounder/Ushojze e zeze/. A marine species that locally enters Narta and low reaches of the Vjosa and adjacent channels (RAKAJ 1995, PLOJAKOV et al. 1958, SHUMKA et al. 2010).

Discussions

A high fish diversity and the presence of eleven species endemic to the Balkans highlight the importance of the Vjosa river system (*Alburnoides* aff. *prespensis*, *Alburnus scoranza*, *Barbus prespensis*, *Chondrostoma ohridanum*, *Gobio skadarensis*, *Luciobarbus albanicus*, *Pachychilon pictum*, *Pelagus thespoticus*, *Squalius platyceps*, *Cobitis ohridana* and *Oxynoemacheilus pindus*). Habitat degradation, pollution originating from households and agriculture, introduction of non-native fishes and other anthropogenic influences are the main threats to this unique fish fauna. Hydropower plants, already present in the watershed of Lengarica stream, and those planned seems to be the most threatening factor of the native fish fauna. The River Vjosa is a large migration corridor for both anadromous and katadromous species as well as other saltwater species entering the system. The river potentially provides habitat and spawning sites for anadromous sturgeons (*Acipenseridae*) such as the critically endangered *A. sturio* or *A. naccarii*, which were found at the Albanian coast and its rivers (RAKAJ 1995, PLOJAKOV et al. 1958, CRIVELLI 1996, FREYHOF & BROOKS 2011). This highlights the need for specific conservation measures.

The construction of impoundments changes river systems ecologically by disrupting the connection between the river and their lateral backwaters, changing the shore line, stabilizing previously dynamic water levels etc. (SCHIEMER & WAIDBACHER 1992). Heavy morphological alterations for navigation, flood protection and hydroelectric power generation as well as the disconnection of tributaries resulted in riverine habitat degradation and fragmentation, especially in large rivers all over Europe (DUDGEON et al. 2006, MORLEY & KARR 2002, SCHIEMER 2000). These habitat modifications affect the integrity and diversity of freshwater biota (ALLAN & FLECKER 1993, KARR et al. 1985). Therefore, a massive decline in abundances of typical riverine fish community as well as the disappearance of several species can be expected. Additionally, the rest of the upstream

River Vjosa will be cut off for anadromous and catadromous species migrating upstream from the sea.

At the current circumstances the planned construction of dams in the River Vjosa basin is a major concern for fish biodiversity conservation in the future. Hydropower is considered as a green technology, its catastrophic effects on biodiversity being voluntarily ignored (FREYHOF 2012). The construction of dams in the Vjosa will prohibit the migration of eels and other marine species to the upstream sections of the river.

The free-flowing river ecosystem of the River Vjosa provides appropriate habitats for the critically Endangered European Eel, *Anguilla anguilla*, allowing for a viable population along the River Vjosa.. The available habitats for the European eel (*Anguilla anguilla*) in Albanian inland waters have been significantly affected and reduced in the last several decades, mainly due to the construction of dams. There are clearly declining trends in eel landings from inland waters, which is caused by anthropogenic impacts or reduced recruits (SHUMKA 2015, JACOBY & GOLLOCK 2014, EC. 2007).

Gambusia holbrooki (BAIRD & GIRARD 1853) and *Pseudorasbora parva* (Temminck & Schlegel 1846) are two invasive species reported from many parts of Albania (SHUMKA et al. 2008) and were also listed in the previous studies (RAKAJ 1996). *Gambusia holbrooki* probably has been confused with *G. affinis* and it needs further study to validate the occurrence of *G. affinis* for inland waters of Albania (SHUMKA et al. 2008).

The endemic fish species, such as the endangered Skadar gudgeon (*G. skadarensis*), Pinus loach (*O. pindus*), Prespa barbel (*B. prespensis*), Albanian barbel (*L. albanicus*), Albanian roach (*P. pictum*), Epiros minnow (*P. thesproticus*), migrate to habitats connected to river with slow and moderate water velocity and vegetation covered substrate to spawn (BARBIERI et al. 2015). There is an unclear conservation status for two species listed under the annex III of Bern convention (*C. ohridana* and *P. pictum*).

Knowledge and understanding on the diversity of the freshwater fish fauna for a specific ecosystem is crucial for experts of the field, policymakers, natural resources managers as well as for the wider public to increase the understanding and evaluate the current and potential impact of human activities on the fauna within the entire river basin. This checklist may provide a basis for further studies of the freshwater fish fauna of the River Vjosa and entire Albania.

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