



**Western Balkans Investment Framework
Infrastructure Project Facility
Technical Assistance 6 (IPF6)**

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WB17-ALB-ENV-02

**Shkodra/Skadar Lake area, Villages of Shiroka and Zogaj, Water Supply and Sewage
Systems and Improvement of Waste Management: Feasibility Study and ESIA**

GAP ANALYSIS AND BIODIVERSITY ASSESSMENT



IPF6 Consortium

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The Infrastructure Project Facility (IPF) is a technical assistance instrument of the Western Balkans Investment Framework (WBIF) which is a joint initiative of the European Union, International Financial institutions, bilateral donors and the governments of the Western Balkans which supports socio-economic development and EU accession across the Western Balkans through the provision of finance and technical assistance for strategic infrastructure investments. This technical assistance operation is financed with EU funds

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SUB-PROJECT DATA SUMMARY

ACTION	Shkodra/Skadar Lake area, Villages of Shiroka and Zogaj, Water Supply and Sewage Systems and Improvement of Waste Management: Feasibility Study and ESIA
PROJECT CODE	WB17-ALB-ENV-02
BENEFICIARY	Municipality of Shkoder
SECTOR	Environment
COUNTRY	Albania
LEAD IFI	EBRD
GAF budget	400,000 EUR
IPF6 Budget	395,200 EUR
Assigned to IPF6	12 July 2018
Non-Objection by CA	19 November 2018
Commencement date	5 December 2018
Duration (months)	9 months
Due date for completion	5 September 2019
IPF6 Key Expert responsible	Carlos Cisneros

LIST OF ABBREVIATIONS

ADF	Albanian Development Fund
ALB	Albania
Bank	EBRD, which is the involved IFI in the Project
CBA	Cost Benefit Analysis
CD	Conceptual Design
DD	Detailed Design (also referred to as Main Design - MD)
DG NEAR	EC DG Neighbourhood Policy and Enlargement Negotiations
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMMP	Environmental and Social Management and Monitoring Plan
ESP	Environmental and Social Policy
EU	European Union
EUD	European Union Delegation
FS	Feasibility Study
GoA	Government of Albania
IBA	Important Birds Area
IFI	International Financial Institution
IFICO	IFI Coordination Office
IPA	Instrument for Pre-Accession
IPA	Important Plant Area
IPF	Infrastructure Project Facility
IPF6	Infrastructure Project Facility – Technical Assistance 6
IUCN	International Union for Conservation of Nature
MIS	Management Information System (WBIF)
MoM	Minutes of Meeting
MR	Monthly Report
MS	Municipality of Shkoder
MTE	Ministry of Tourism and Environment
NAPA	National Agency of Protected Areas
NEA	National Environment Agency
NIPAC	National IPA Coordinator
NM	Nature Monument
NTS	Non-Technical Summary
PA	Protected Area
PCM	Project Cycle Management
PD	Preliminary Design
PS	Pre-feasibility studies
PESIA	Preliminary Environmental Impact Assessment

PFS	Pre-feasibility study
PR	Project Requirement
RAP	Resettlement Action Plan
RAPA	Regional Agency of Protected Areas
REA	Regional Environmental Agency
SEP	Stakeholders Engagement Plan
TA	Technical Assistance
ToR	Terms of Reference
UKS	Water Utility Shkoder
WB	World Bank
WB6 Countries	Albania, Bosnia & Herzegovina, FYRoM, Kosovo, Montenegro, Serbia
WBIF	Western Balkans Investment Framework
Wastewater Treatment Plant	WWTP
WFD	Water Framework Directive (2000/60/EC)

1 Introduction

1.1 The Project and the present document

The Government of Albania received in 2017 from WBIF, a grant¹ for the “*preparation of feasibility study, preliminary design and ESIA for water supply and sewage systems and improvement of waste management in villages Shiroka and Zogaj, Shkodra Municipality*”. This project (called hereinafter “the Project”) will contribute to the local and regional development and is in line with the National Strategy for Sustainable Development, the National Development Territorial Plan, the General Local Development Plan for Shkodra Municipality, and the Management Plan for the Environmentally Protected Area of Shkodra Lake.

The promoter is the Ministry of Finance and Economy, while the beneficiary is the Municipality of Shkoder (MS), in the territory of which lies the project area. The implementation agency is the Albanian Development Fund (ADF), a public agency specialized in similar interventions. The lead IFI is the European Bank for Reconstruction and Development (EBRD). The Feasibility Study (FS) and ESIA will be prepared by a team selected by the consortium SUEZ - IPF6 (hereinafter called “the Consultant”).

Activity 3: Environmental and Social Impact Assessment (ESIA) includes five main tasks:

- Task 3.1: Review of Available Data and Site Visit;
- Task 3.2: Environmental and Social Assessment and Audit;
- Task 3.3: ESIA Reporting;
- Task 3.4: Biodiversity Assessment; and
- Task 3.5: Biodiversity Analyses Reporting

The purpose of Activity 3: ESIA is to identify and assess the potentially significant existing and future adverse environmental and social impacts associated with the Project (current status and proposed activities for all infrastructure measures), assess compliance with applicable national laws and the EBRD *Environmental and Social Policy (ESP)* and a range of Performance Requirements (*PRs*), determine the measures needed to prevent or minimize and mitigate the adverse impacts, and identify potential environmental and social opportunities, including those that would improve the environmental and social sustainability of the Project.

Due to the fact that Lake Shkoder (Skadar) is an internationally recognized important biodiversity site and bearing in mind the nature protection status of the Project area, carrying out a substantial biodiversity assessment as part of the ESIA is necessary to better understand the potential project related risks and impacts.

Hence, Tasks 3.4 and 3.5 will implement a biodiversity assessment to assist the EBRD in ensuring that the Project is structured to comply with the applicable national laws, EBRD *PR6* and good international biodiversity conservation and management practices. Specifically, the assessment will fully take into account all applicable local, national and regional requirements, including those related with environmental and social impact assessments; the EBRD *ESP*, EBRD *PR6* and relevant EU requirements, including, but not limited to the EU *EIA*, *Habitats* and *Birds Directives*;

¹ Shkodra/Skadar Lake area, Villages of Shiroka and Zogaj, Water Supply and Sewage Systems and Improvement of Waste Management: Feasibility Study and ESIA of the Western Balkans Investment Framework (WBIF) Grant Application WB17-ALB-ENV-02.

and relevant international conventions and protocols relating to environmental and social issues, as transposed into national legislation (e.g. Bern Convention, Ramsar Convention).

1.2 Project's Purpose & Objectives

1.2.1 Purpose

The purpose of the Project is to restore, enhance and promote infrastructure and services that encourage use of environmental-friendly tourism offers and valorized assets in the target area.

1.2.2 Overall objective

The overall objective of the Project is to improve the existing communal water supply, sewerage systems and solid waste management in the villages of Shiroka and Zogaj and the Roma settlement adjacent to Lake Shkoder, through Technical Assistance, by preparing relevant supporting technical documentation to prepare the Action for investment financing.



Figure 1.2.1. Location of the Project area:
1 - Shiroka; 2- Zogaj; 3 - Liria settlement; 4 - Shiroka Waste Water Treatment Plant

1.2.3 Specific Objectives

The specific objectives of the Project are as follows:

- Result 1: Feasibility Study completed in compliance with national and EBRD requirements comprising a technical, financial and economic assessment related to water supply, sewerage and waste management.
- Result 2: Environmental and Social Impact Assessment Study (ESIA) completed in compliance with national, EU and EBRD requirements based on the feasibility study and

preliminary designs for water supply, sewerage, wastewater treatment/disposal and waste management investments.

- Result 3: Preliminary designs, completed in compliance with national requirements, of the measures proposed for water supply, sewerage, wastewater treatment/disposal and solid waste management, including data collection and pre-design requirements such as site surveys, quality and quantity parameters, etc.

1.3 Project Stakeholders

Table below gives the main Project’s stakeholders and their roles and responsibilities, as identified at the beginning of the FS preparation. The updating of this table with other stakeholders is reflected in the SEP.

Table 1.2.1: Roles and responsibilities of the main stakeholders

Principal project stakeholders	Role
European Bank for Reconstruction and Development (EBRD)	Lead IFI. The lead IFI having responsibility for assignment implementation coordination and approval of outputs.
National IPA Coordinator (NIPAC)	Responsible for the coordination of IPA funds and a key stakeholder of WBIF projects.
Municipality of Shkoder (MS)	Main Beneficiary. Main planning body and owner of water/sewerage/wastewater and solid waste assets.
Water & Sewerage Utility Shkoder (UKS)	Co-Beneficiary. Responsible for water supply and wastewater management in Shkoder Municipality territory.
Shiroka & Zogaj villages	End recipients. Ultimate end recipients of the Project.
Ministry of Finance and Economy	Responsible Authority – Project promoter.
Albanian Development Fund (ADF)	Implementing Agency (IA). Public Agency specialized in regional development and multi-donor financing. Responsible for implementing Project and approval of Project outputs.
WBIF Albania Representative & European Union Delegation to Albania	Observers for use of WBIF funds. IPA II contributes grant funding to the WBIF. The EUDs are responsible for managing IPA II for the programming period 2014-2020.
Ministry of Tourism and Environment	Competent authority for environmental affairs.
National Environment Agency	Responsible for approval EIA related procedures.
National Agency for Protected Areas	Responsible for managing the protected areas in national level.
Regional Agency for Protected Areas	Responsible for managing the protected areas in local level.

1.4 Purpose of this document

This document relates to Task 3.4: Biodiversity assessment and specifically the deliverable: Gap Analysis and Biodiversity Assessment, summarizing the key findings of a data review, gap analysis, priority biodiversity features and critical habitat screening.

The report includes: scope of gap analysis and biodiversity assessment with the relevant methodology; description of the project area; environmental context of the project area; baseline information with a synthesis about habitat and species diversity; species of conservation concern;

habitats of conservation concern; critical habitats and species in the project area; and the report closes with main findings, gaps and suggestions.

2 Scope of Gap Analysis and Biodiversity Assessment

2.1 Methodology

As indicated in the ToR and Inception Report, March 2019, the gap analysis and biodiversity assessment will be based on guidance provide in EBRD *PR6*, 2014. As indicated in EBRD *PR6* (paragraph 12), some areas that may be affected by the Project may be considered “priority biodiversity features” which include:

- (i) threatened habitats;
- (ii) vulnerable species;
- (iii) significant biodiversity features identified by a broad set of stakeholders or governments (such as Key Biodiversity Areas in general and for specific groups that are of a special importance for Lake Shkodra, such as macrophytes, benthic invertebrates, fish and birds); and
- (iv) ecological structure and functions needed to maintain the viability of priority biodiversity features described above.

The gap analysis and biodiversity assessment covers the following:

- Review all existing relevant documentation, supporting baseline information and any other relevant reports / datasets to assess the adequacy of this information;
- Determine the area – Area of Influence (AOI) - likely to be affected by impacts from the Project and confirm the potential Project related impacts and risks to biodiversity within the Project AOI;
- Based on existing information, complete a Critical Habitat / Priority Biodiversity Features screening to help identify whether (i) habitats and or species of conservation importance could be impacted by the Project and (ii) additional baseline surveys are warranted. It will also be identified whether there are any other material gaps within the existing biodiversity impact assessment that need to be addressed; and
- Propose a supplemental biodiversity assessment survey programme that will address any gaps identified by the screening. If relevant, complete a supplemental biodiversity assessment within the Action/Study Area (including the project footprint) in accordance with Good International Practices to confirm whether there are any potential habitats and/or species of conservation importance that could be considered critical habitat / priority biodiversity features.

Additional activities will include identifying potential mitigation measures that will be part of ESIA and a Biodiversity Management Plan (BMP), which can be incorporated into project’s ESMP with the aim of minimizing impacts to the environment during construction and operations. Should critical habitat and/or priority biodiversity features be identified as a result of the biodiversity assessment, the Consultant will identify potential measures to be further investigated by the Client to ensure no net loss, preferably a net gain, of these features.

2.1.1 *Definition of critical habitat*

EBRD *PR6* specifically define critical habitats as the most sensitive biodiversity features, which comprise one of the following: (i) highly threatened or unique ecosystems; (ii) habitats of

significant importance to endangered or critically endangered species; (iii) habitats of significant importance to endemic or geographically restricted species; (iv) habitats supporting globally significant migratory or congregatory species; (iv) areas associated with key evolutionary processes; or (v) ecological functions that are vital to maintaining the viability of biodiversity features described above.

2.1.2 Criteria for Identifying key biodiversity features

As indicated in the ToR and Inception Report, the following criteria are proposed to identify the key biodiversity features (habitats and species) and were prioritized in the gap analysis and assessment.

Habitats:

- Included in the EU Habitats Directive – Annex 1 Priority Habitats
- Core and suitable habitats for species that meet the criteria indicated below:

Species:

- Listed in EU Birds Directive (Annexes 1, 2.1 and 2.2);
- Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats – Annexes I, II and III);
- CITES Convention (Convention on International Trade in Endangered Species of Wild Fauna and Flora – Annexes I, II and III);
- Included in the IUCN Red List at Global level;
- Included in the IUCN Red List at European level;
- Threatened species at Mediterranean level (after the IUCN criteria);
- Included in EU Habitats Directive (Annexes 2, 4 and 5), noting any priority species (priority species means species for the conservation of which the Community has particular responsibility in view of the proportion of their natural range which falls within the territory referred to in Article 2; these priority species are indicated by an asterisk (*) in Annex II);
- Species included in the National Red List (with an IUCN status); and
- National or regional (Balkan) endemic species.

3 Project Area

3.1 Shkodra Lake Protected area

3.1.1 Location and general geo-physical characteristics

Shkodra Lake is situated in the western part of the Balkan, in the border between Albania and Montenegro, between 42°21'54" and 19°09'52" in the north (Malo Blato, Sinjac), 42°03'15" and 19°30'00" in the south (Bojana/Buna spring), 42°03'15" and 19°30'00" in the east (near Shkodra), 42°21'19" and 19°01'28" (near Rijeka Crnojevica).

Most of the hypotheses on the origin of Shkodra Lake state its tectonic – karstic origin, during Tertiary or Quaternary. According to this theory tectonic depressive movements created a large flooded area. The current lake area is surrounded by limestone and dolomite formations of Palaeozoic, Mesozoic and Tertiary periods. The geomorphology of Shkodra Lake basin is mostly determined by limestone and associated karstic processes. This basin is a depression located south of the Dinaric Alps and orientated northwest-southeast, parallel to the current shore of the Adriatic coast.

The geology of the Lake and its watershed is very interesting. Most areas of the watershed are composed of small calcerous structures, Paleozoic conglomerates and carbonic rocks from Mesozoic periods. In addition, eruptive rocks from Mesozoic, glacial, glacial-lacustrine, fluvio-glacial and alluvial sediments

complete the view of the Lake and its watershed. Moreover, the Lake itself is composed by lacustrine, estuarine and deltaic sediments.

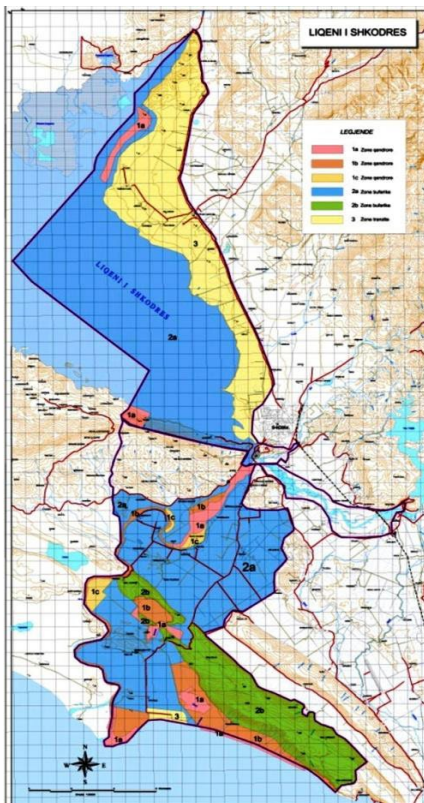


Figure 3.1.1. Map of the Protected Area Shkodra Lake – Buna River – Velipoja

Lake surface oscillates from 350 km² to 500 km², depending on water level fluctuations from min. 4,5 m to max. 9,9 m. In its mean level of 6,5 m, the Lake has a surface of 412 km². During the year water reserves in the Lake change from 1,76 km³ (at the level of 4,71 m above sea level) to more than 4 km³ (at the level of 10 m above sea level). The amount of water during the year changes with more than 2.22 km³ that is more than 50% of water reserve during Lake's maximal level. The catchment area of Shkodra Lake has a surface of 5,179 km², of which 1027 km² are within the Albanian territory. The average altitude of the catchment area is 770 m a.s.l.

Shkodra Lake has an average altitude of 5 m above sea level, maximal depth of 8.3 m, mean depth of 5.01 m, capacity of 1931.62 x 10⁶ m³. The Lake gets deeper in south – west part, on the 7th and 8th isobat, along the middle segment of the national border. 165 km² of the Lake is under sea level. It has an average minimal level of 5,15 m above sea level, mean level of 6,49 m and average maximal level of 8,72 m above sea level. Maximal amplitude of the Lake is 5,33 m (in Albania 5,13 m), mean amplitude is 3,34 m, maximal depth (at Radusha eye) is above 80 m.

The Mediterranean climate predominates in the Shkodra Lake basin. Sun radiation reaches the highest values in June – July (annual potential of sun radiation 2,054 kw/m²) and the lowest values in December – January (annual potential of sun radiation 1,422 kw/m²). Because of the cloudiness, almost 30 % E/year of the sun radiation is not absorbed. The annual average temperature of the air is 14°C – 16°C. The highest average temperature is usually recorded in August (in Shkodra 21,4°C – 27,5°C and Virpazar 20,1°C – 29°C) and the lowest average in January (in Shkodra 0,5°C – 6,5°C and Virpazar 0,6°C – 6,7°C). The highest values of relative air humidity are recorded in November (77%), while the lowest in July (55%). Cloudiness is related to both cyclonic and anticyclonic activity and to local factors. The average annual number of clear days are 116,4 while of cloudy days are 73 – 106. Rainfall is related to both cyclonic and anticyclonic

activity and to local factors. The average of the annual rainfall on the lake is between 1750 mm and 2500 mm. The lowest rainfall values are recorded in July (42 mm in Shkodra and 46 mm in Virpazar) and the highest values in November (274 in Shkodra and 349 in Virpazar).

3.1.2. Legal status and administration

According to the Decision of the Council of Ministers no. 684, dated 2. 11. 2005 "*On declaring Albanian part of Shkodra Lake as a protected area*", Shkodra Lake has been declared protected area of the Category IV: "*Habitat/species management area: protected area managed mainly for conservation through management intervention*". This Decision designates the Shkodra Lake as Managed Natural Reserve.

The total surface of the protected area is 26,535 ha. The Decision lays down the borders of the protected area and its zoning. According to the Law "*on protected areas*" in this category all the territories that represent bio-centres and bio-corridors of local or regional importance, or areas with plants, animals, minerals and paleontological discoveries are included. According to the zoning of this area, the decision defines three different level of protection to be applied: a) the central area; b) habitat management area; and c) traditional development area.

Apart from this decision, another decision of the Council of Ministers, no 683 dated 2. 11. 2005 "*on the declaration of the River Buna and the surrounding wetland territories of Shkodra Lake as special protected areas and its inclusion in the list of wetlands with international importance, especially for the habitats of aquatic birds*", has declared the natural territory of wetland complex of Shkodra Lake as a Specially Protected Area and has included it into the Ramsar Convention. This decision established the boundaries of the two protected areas included in the Ramsar list, in a total surface of 49,562 ha. According to this decision, the activities that shall be realized in this zones, should comply with traditional criteria and it should keep environmental values and needs to be implemented in full compliance with the protection level of the zone and with the objectives of the management plan.

The Management Plan for Shkodra Lake Managed Natural Reserve (APAWA et al., 2012) was developed within the project "*Lake Shkoder Integrated Ecosystem Management Project*" (LSIEMP), supported by the Ministry of Environment, Forests and Water Administration of Albania, GEF and the World Bank. The Management Plan was prepared by the Association for Protection of the Aquatic Wildlife of Albania (APAWA), in collaboration with the Faculty of Natural Sciences, of the University of Shkodra "Luigj Gurakuqi" and the company GR Albania. This Management Plan, under the provisions of the Law "*on Protected Areas*" was approved by the Minister of Environment by Order Nr. 815, dated 21. 11. 2012.

Currently, the administration of Shkodra Lake Protected Area is under the Ministry of Tourism and Environment (MTE) and the National Agency of Protected Areas (NAPA) at central level, as well as the Regional Agency of Protected Areas (RAPA) at the local level.



Figure 3.1.2. Lake shore in Shiroka (left) and at the discharging point of the existing wastewater plant near Shiroka (right) (photo S. Beqiraj, March 2019)

3.1.3 Area of Influence

The Project area is shown in Figure 1.2.1 (see above). The Project area of Influence (AOF) will include the three main Project footprints (Shiroka, Zogaj and Liria community) for improvements to water supply, sewerage collection and wastewater treatment in Zogaj. Improvements to water supply will include the provision of a new water supply system in Shiroka, Zogaj and the Liria community, utilizing the existing water supply sources, and not involving any land take or major new infrastructure. Sewage collection will be extended in Shiroka, connecting the secondary sewage network to the existing main sewage collector and in turn to the Shiroka wastewater treatment plant. In terms of new infrastructure, this will centre on a new sewage and collection network in Zogaj. The likely options are

- Connect a new sewage network in Zogaj to the existing Shiroka Wastewater treatment plant, by a new main collector (approx. 5 km in length) along the route of the Shiroka-Zogaj road or at a slightly elevated level. This option will result in some temporary impacts during construction of the main collector. It is envisaged that there will be no net loss to biodiversity features; and
- Connect a new sewage network to one or two small-scale wastewater treatment plant(s) located on small areas (approx. 100m² each). There will be some land take involved in this option, however, any sites that will be utilized will be outside of the core area and therefore will not result in any net loss of biodiversity features/habitat loss. Any operational impacts - possible leakage of sewerage/wastewater will be avoided due good operational management practices.

Waste management proposals will be centered on improvements to the efficiency of the solid waste management collection system, waste collection equipment (recycling bins) and introduction of recycling measures. No new infrastructure will be proposed.

The AOF lies within the territory of the Protected Area (Category IV: Habitat/Species Management Area). The primary conservation objective in such area is to maintain, conserve and restore species and habitats (after the IUCN) and adopt a mitigation strategy based on no net loss, and preferably a net gain, of priority biodiversity features over the long term. Category IV provides a management approach used in areas that have already undergone substantial modification, necessitating protection of remaining fragments, with or without intervention. As stated by the IUCN, Category IV protected areas cannot be described as “wilderness”. Many of such areas can be subject to management intervention.

The AOF in Zogaj include a “core area”, too (shown as 1/a on the map of the Protected Area). This “core area” includes the forest area above Zogaj village, from an altitude of 494 m a.s.l in Taraboshi Mountain, down to coastal waters, including the waterbody up to 20 m in horizontal distance from the shoreline (as defined in the proclamation decision of the Shkodra Lake protected area in 2005). In such areas the second protection level applies. The primary objective is to protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote leisure, tourism and recreation. Therefore, since the protection level is stronger for this category (II), it would be important to consider reducing environmental impacts related to the project implementation in Zogaj. If the option for one or two small-scale wastewater treatment plants is chosen, a preliminary recommendation would be that the expected discharge of treated wastewater from the wastewater plant(s) in Zogaj is established outside the border of the “core area”. *Chapter 5.3 Suggestions* also addresses this issue.



Figure 3.2.1 Forest in the core area, Zogaj (photo S. Beqiraj, March 2019)

As stated by the IUCN, the Category IV protected areas aim their conservation at particular species or habitats and may in consequence have to pay less attention to other elements of the ecosystem, whereas Category II protected areas aim to conserve fully functional ecosystems. Categories II and IV may in some circumstances closely resemble each other and the distinction is partly a matter of objective – i.e., whether the aim is to protect to the extent possible the entire ecosystem (Category II), or is focused to protect a few key species or habitats (Category IV).



Figure 3.2.2 Shkodra Lake shore in Zogaj project area (photo S. Beqiraj, March 2019)

Whatever the mitigation option is, it would be very important to prepare and implement an environmental monitoring program for the impacted area, considering short-term, mid-term and long-term monitoring. The most convenient might be to involve this environmental monitoring possibly within an integrated Environmental and Social Management and Monitoring Program (ESMMP). Proposed environmental monitoring should include (but not be limited to): benthic invertebrates; macro-vegetation fish; and chemical and microbiological water analyses, according to the WFD (2000/60/EC) standards. Monitoring of birds may not necessarily be included in this program. Birds are a very important group for Shkodra Lake in general, but there is already an ongoing long-term program for annual census of birds in the wetland complex Shkodra Lake – Buna River – Velipoja, in Albania and Montenegro, implemented by international ornithologists. Besides others actors, RAPA Shkoder is involved in this bird census, hence, the needed information related to the bird status in the AOF may be provided in

collaboration with RAPA, as an important stakeholder for this relevant project.

4 Baseline Information

The baseline information and the biodiversity gap assessment in this report is based on screening and analyzing a relatively large existing literature, including books, scientific papers, projects' reports, management plans and other strategic documents about Shkodra Lake and its watershed. The bibliographic references used for this report are listed in the *Chapter 6. References* (at the end of this report).

4.1 Habitats and species diversity

4.1.1 Aquatic and wetland habitats

Shkodra Lake and its watershed represent a complexity of habitats with high diversity of living organisms. These characteristics are related to water regime, which changes according to seasons and fluctuations of water volume. As Shkodra Lake is not a deep lake, water fluctuations happen mainly on surface. This phenomenon, during warm season, creates large marshy surfaces in the north, east and south-east parts of the Lake. Shkodra Lake is known for its diversity in habitats with many plant associations. As the habitats system varies not only in space but also in time, depending on biotic and abiotic factors and on seasons, the real number of Shkodra Lake habitats is higher. Shkodra Lake has three main aquatic habitat systems: the lacustrin habitat system; the palustrin habitat system; and the riverine / fluvial system.

- The *lacustrin habitat* system is divided in two subsystems. *Limnetic subsystem* that includes habitats of the water surface class and bottom plants class that floods constantly. The *littoral subsystem* includes several habitat classes: surface water class with different bottoms that floods constantly or seasonally; the class with no plants and different bottoms that floods constantly or seasonally; the class of different bottom plants that floods constantly or seasonally (this habitat can be found especially in north, east and south – east littoral); the class of emergent plants with very different water regime.
- The *palustrin habitat* system (marshy surfaces formed by the pull back of the lake water during warm season mainly in north, east and south – east part) includes some habitat classes: the class of water surfaces of different bottoms that floods constantly or seasonally; the class with no plants and different bottoms that floods constantly or seasonally; the class of different bottom plants that floods constantly or seasonally; the class of emergent plants (these plants compose the majority of palustrin surfaces) with very different water regime; the shrubby, deciduous class with very different water regime (found in soft and rocky coast but are not very developed); the class of woody plants, deciduous, with very different water regime (found mainly in north, east and south – east parts of the Lake).
- The *riverine / fluvial system* which has two subsystems: the *fragmented subsystem* (habitats of stream flows, like Përroi i Thatë etc.) with no plants, sandy or stony and seasonal flooding. The *continued subsystem* (Buna mouth). This subsystem has four habitat classes: water surface class with different bottoms that floods constantly; the class with no plants and different bottoms that flood constantly; the class of different bottom plants that floods constantly; and the class of emergent plants, not continued, with very different water regime.

4.1.2 Flora and vegetation of the Lake

The aquatic and wetland flora of Shkodra Lake is composed by 256 taxa, including species, subspecies, forms and varieties. From these taxa, 30 are Charophyta, 1 Bryophyte, 8 Pteridophyta (5 from genus *Equisetum*), 3 Nymphaeacea, 103 *Mesangiospermae* (with most dominant families *Apiaceae*, *Asteraceae*,

Brassicaceae, Polygonaceae, Lamiaceae, Plantaginaceae, Salicaceae, Lythraceae and Ranunculaceae), and 111 Monocotyledoneae, with most dominant families Potamogetonaceae (14), Cyperaceae (36), Juncaceae (10), *Phocaea* (21). From the total number of taxa, 80 are aquatic species, of which 36 are hydrophytes with fixed roots in the bottom or floating and others are submerged. The rest are mainly wetland species, living in alternated water conditions.

Aquatic plants associations of Shkodra Lake are divided in three groups: submerged (Potamion), floating (Nympheion) and emergent (Phragmitetalia). As Shkodra Lake has characteristics of the littoral, submerged and emergent macrophytes are dominant. The biomass and productivity are higher for the emergent community. Submerged macrophytes have an important role in Lake's nutrient cycling, in sheltering juvenile fish, macro-zooplankton and benthic invertebrates, carnivore fish, as well as a substrate for microflora and microfauna.

Macrophytes develop from the shore to deep water, starting with emergent associations dominated by *Phragmites australis* and *Schoenoplectus lacustris*. They continue with floating associations that develop in turbulent water, dominated by *Nuphar luteum*, *Nymphaea alba* and *Trapa natans*. Submerged associations are established in deeper waters, with *Myriophyllum spicatum*, *Ceratophyllum demersum*, *Potamogeton lucens*, *Potamogeton perfoliatus*, *Potamogeton crispus* and *Ranunculus aquatilis*. The deepest associations are those of *Vallisneria spiralis*, *Najas marina* and Charophyta. Sometimes in the deepest association an interference of *Myriophyllum* high biomass, prohibits the growth of *Vallisneria*.

These associations are characterized by low number of species and some species are present in few associations. So far 60 associations are known. 6 associations are of Scirpeto – Phragmitetum, the most important association for the biomass production, found between 25 – 70 cm depth. 4 associations are of *Najadetum marina*, found above 3 m depth, *Nymphoidetum peltatae* found mostly in shallow warm waters, *Nymphetum albo – lutea* found between 60 – 65 cm depth, *Sparganio – Glicerietum fluitantis* found between 30 – 40 cm depth. The highest number of species is from the associations of *Potametum perfoliati* found between 1 – 3 m, *Nymphetum albo – lutea*, *Sparganio – Glicerietum fluitantis* and *Scirpeto – Phragmitetum*.

One of the most important submerged algae communities in the Shkodra Lake are the Charophytes or stoneworts (Charales, Characeae). This community is of great importance for the environmental and economic sustainability of the aquatic ecosystem of Shkodra Lake. In the course of many years of research of these algae in the Montenegrin and the Albanian part of Lake, 30 taxa of charophytes have been registered in the rank of species, forms and varieties. These taxa belong to four genera of the Characeae family: *Chara*, *Nitella*, *Tolypella* and *Nitellopsis*. The largest number of taxa belongs to the genus *Chara*, with 12 species, 3 forms and 2 varieties, 10 species belong to the genus *Nitella*, 2 species belong to the genus *Tolypella* and only 1 species belongs to the genus *Nitellopsis*. Due to the high number of Charophytes taxa, their high density and large distribution, Shkodra Lake has been considered as one of the most significant charophyte diversity centers in the Balkan Peninsula.

Vertical zoning of plants in Lake watershed

Macchia - Shbljak zone is situated up to 400 – 500 m above sea level. The most common trees and shrubs in this area are *Quercus ilex*, *Phillyrea latifolia*, *Juniperus oxycedrus*, *Erica arborea* etc. Deciduous trees and shrubs are *Pistacia terebinthus*, *Punica granatum*, *Carpinus orientalis*, *Crataegus monogyna*, *Rubus ulmifolius*, *Periploca graeca*, *Cotinus coggygria*, *Paliurus spina – cristi*, *Quercus robur*, *Acer campestre*, *Cornus sanguinea*, *Celtis australis*, *Ulmus laevis*, *Ulmus minor*, *Amorpha fruticosa*, *Genista hassertiana*, *Fraxinus angustifolius*, *Fraxinus ornus*, *Populus alba*, *Populus nigra*, *Salix alba*, *Salix elaeagnos*, *Salix purpurea*, *Alnus glutinosa*, *Ficus carica* etc.

Oak zone is situated between 300 – 700 m above sea level and is known for the following oak species: *Quercus trojana*, *Quercus cerris*, *Quercus petraea*, *Quercus frainetto*, *Quercus pubescens* etc. Other trees

and shrubs of this area are *Acer platanoides*, *Acer pseudoplatanus*, *Acer obtusatum*, *Castanea sativa*, *Petteria ramentacea*, *Sorbus torminalis*, *Sorbus umbellata*, *Sorbus aria*, *Ostrya carpinifolia*, *Tilia platyphyllos*, *Corylus avellana*, *Crataegus pentagyna*, *Juniperus communis* etc.

Beech zone is situated between 600 – 1,700 m above sea level, which together with conifer subzone reaches 1900 m. The most common in this zone are *Fagus silvatica*, *Acer pseudoplatanus*, *Sorbus graeca* and shrubs *Cotoneaster integerrimus*, *Rubus idaeus*, *Vaccinium myrtillus* etc. The most common from coniferous plants are *Pinus leucodermis* and *Pinus nigra*.

The alpine pastures are situated between 1800 – 1900 m above sea level. Some genera and species of these pastures are *Rosa sp.*, *Juniperus sabina*, *Salix retusa*, *Poa sp.*, *Festuca sp.*, *Sesleria sp.*, *Luzula italica*, *Bromus sp.*, *Koeleria sp.*, *Gentiana verna*, *Gentiana lutea*, *Astragalus purpureus*, *Anthyllis aurea*, *Campanula sp.*, *Silene macrantha*.

4.1.3 Fauna of the Lake and its watershed

4.1.3.1 Invertebrates

Shkodra Lake is characterized by a relatively high diversity of invertebrate species. This is related to the diversity of habitats and microhabitats in the lake, plants and algae, as well as substrata typologies. More than 450 aquatic invertebrate species have been reported from the lake, apart from protozoans and rotifers.

Cnidarians (Cnidaria): they are represented by two species, of which one is autochthonous, the brown hydra *Hydra oligactis* and one alien species, the freshwater jellyfish *Craspedacusta sowerbii*.

Sponges (Spongia): they are represented by one species only, *Spongilla lacustris*.

Flatworms (Platyhelminthes): 31 species are known from which 6 Cestods and 25 Trematods (parasites of fish and water birds).

Nematodes (Nematoda): 11 parasitic species have been reported from the lake.

Rotifers (Rotifera): 51 planktonic and benthic species have been reported, where the families Brachionidae, Gastrotrichidae, Lecanidae, Synchaetidae and Trichocercidae are the predominant ones.

Acanthocephalan (Acanthocephala): 7 parasitic species are known from the lake.

Molluscs (Mollusca): the list of molluscs of Shkodra Lake and the surrounding aquatic bodies (springs, wetlands, underground waters) includes 91 species. 76 species are gastropods (snails) and 15 species are bivalves (mussels). The richest families in species number are Hydrobiidae (26), Planorbidae (19), Lymnaeidae (13), Sphaeriidae (7) and Unionidae (7). 65 species have been found in the lake, in its sublacustrine springs, ponds with direct connection to the lake, lowest part of the lake tributaries and upstream part of Buna River. The other 26 species have been found in springs and underground waters connected to the lake. 28 mollusc species are endemic to the Shkodra Lake and to its related aquatic habitats. However, during the last 12 years the molluscs' lists of Shkodra Lake have been contested time after time by different authors. Therefore, a careful analysis and revision of species composition of molluscs' community of Shkodra Lake would be needed.

Bryozoans (Bryozoa): they are represented by two species in the lake, *Plumatella repens* and *Cristatella mucedo*. They are colonial forms and grow attached to aquatic vegetation, stones, as well as to organic or artificial firm substrata.

Oligochaetes (Oligochaeta) – annelid worms: a total of 35 species of Oligochaeta have been recorded so far in Shkodra Lake. They belong to the families Naididae, Lumbriculidae and Criodrilidae. Among them, three species are endemic to Shkodra Lake: *Spirosperma scodraensis*, *Tubificidarum hrabei*, and *Trichodrilus montenegrinus*. The tubificid worms predominate the Oligochaeta fauna of the Lake. The most abundant species are *Limnodrilus hoffmeisteri*, *Potamothrix hammoniensis*, *Psammoryctides*

barbatus, *Potamotheix prespaensis*, *Aulodrilus plurisetus* and *Limnodrilus udekemianus*.

Leeches (Hirudinea): leeches belong to another group of annelid worms and they are represented by 15 species in the Shkodra Lake. Most of the leech species inhabit the lake, but some species are only reported from the sublacustrine environment (*Glossiphonia paludosa*, *Glossiphonia pulchella*). Two species *Dina dinarica* and *Trocheta dalmatina* inhabit nearby springs.

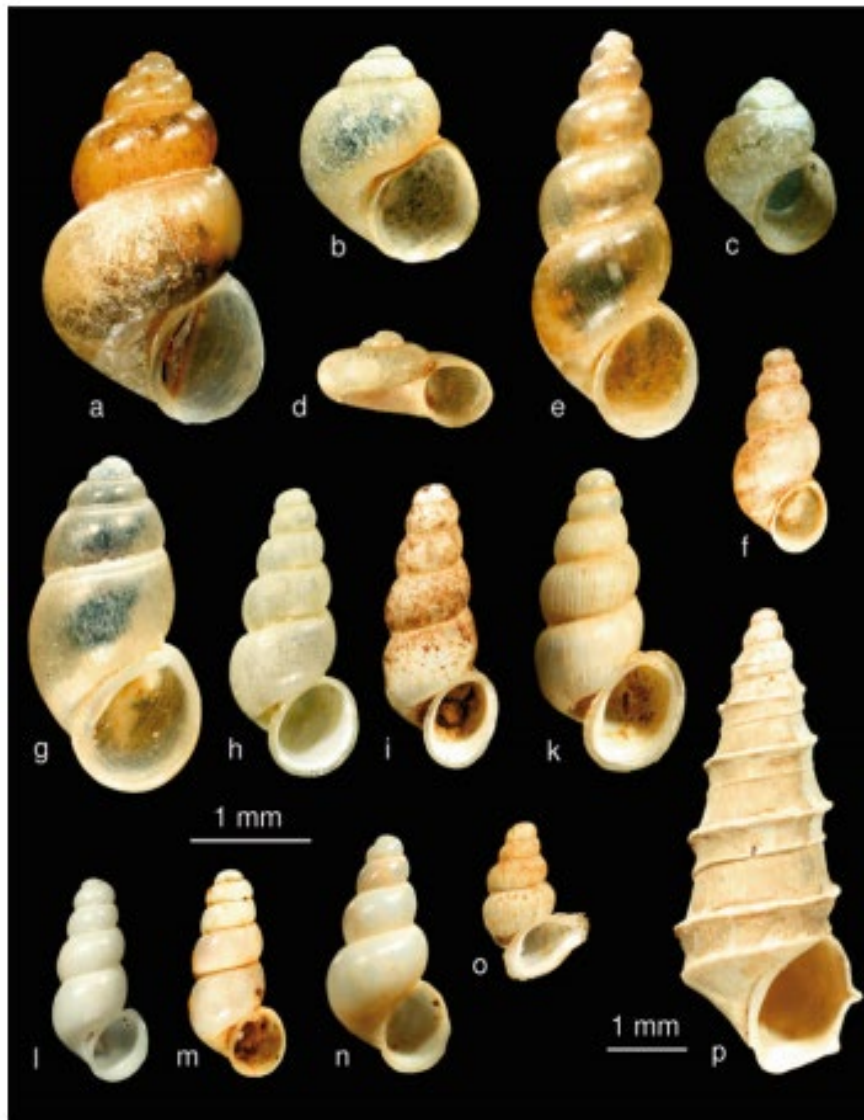


Fig. 2 (a) *Radomaniola curta*, (b) *R. montana*, (c) *Antibaria notata*, (d) *Arganiella tabanensis*, (e) *Vinodolia zetaevalis*, (f) *Bythiospeum demattiai*, (g) *Lithhabitella chilodia*, (h) *Montenegrospeum bogici*, (i) *Iverakia hausdorfi*, (k) *Zeteana ljljanac*, (l) *Paladilhiopsis prekalensis*, (m) *Paladilhiopsis szekeresi*, (n) *Paladilhiopsis wohlberedi*, (o) *Plagigeyeria lukai*, (p) *Pyrgula annulata* (Photos by P. Glöer)

Figure 4.1.1. Gastropod mollusks from Shkodra Lake (Photos: P. Glöer, 2018)

Chelicerates: Spiders and Mites (Chelicerata: Aranea and Acari): the diving bell spider (*Argyroneta aquatica*) is the only spider known to live its entire life under water. In Shkodra Lake this species was recorded in the shallow northern part of the lake. In the various aquatic habitats of the Lake basin, mites (Acari) are represented by two clades, Hydrachnidia (true water mites) and Halacaroidea. The true water mites (Hydrachnidia) include 53 species from Shkodra Lake. Five halacarid mite species (*Lobohalacarus weberi*, *Parasoldanellonyx typhlops*, *Soldanellonyx chappuisi*, *Soldanellonyx monardi* and *Soldanellonyx*

visurgis) were found in the underground waters of Lake catchment area. Some other Acari clades, like acaridid and oribatid mites which include hygrophilous species, can be regularly found in some freshwater habitats such as temporary pools or hyporheic interstitial. In nearby streams, oribatid species (*Trimalacoonthrus major*, *Hydrozetes lemnae*) can regularly be found.

Crustaceans (Crustacea): at least 110 crustacean species have been reported from the lake, of which 34 are Malacostraca. Cladocera, Amphipoda and Copepoda are the groups with the highest number of species. Decapods are represented by 8 species: *Astacus astacus*, *Austropotamobius torrentium*, *Austropotamobius italicus meridionalis*, *Atyaephyra desmaresti*, *Palaemonetes antennarius*, *Potamon fluviatile*, *Troglocaris prasence* and *Troglocaris hercegovinensis*. Branchiopods are the richest group with 36 species, of which 22 are from Euryercidae family. 22 species of Ostracoda are known, of which 11 belong to Candonidae. Copepods are represented by 18 species, of which 11 are from Cyclopedidae family. The problems with taxa synonymies have not been fully resolved and the list of crustaceans' species of Shkodra Lake has not been definitive yet, which makes difficult stating the endemic species. However, it has been clearly stated that 12 species of Malacostraca are endemic to the Lake, one belonging to Mysidacea, one to Isopoda and 10 to Amphipoda, of which 8 species belong to the genus *Niphargus* (*N. asper*, *N. brevicuspis sketi*, *N. inclinatus*, *N. maximus vulgaris*, *N. podgoricensis*, *N. vranjine*, *N. zorae*, *N. kusceri*).

Insects (Insecta): They represent a very interesting group of Shkodra Lake. Till now, no complete study is done for the Shkodra Lake catchment's area insects. Therefore, it's difficult to draw conclusions about this very various and important group of living world. Insects are found from the Lake waters to the alpine pastures of the Lake catchment. From reference studies and comparable studies (with other countries) it is expected that insects' species number in catchment area of the Shkodra Lake is close to 6000. More than 100 species are considered endemic of the catchment area. The orders with the highest number of species are: Coleoptera, Lepidoptera, Hymenoptera, Diptera, Hemiptera and Orthoptera. Their majority is represented by species that have benthic larval phase. Some figures from the most studied insects' groups in Shkodra Lake and its catchment are given in the following. 35 species of Ephemeroptera (Mayflies), 60 species of Plecoptera (stoneflies) and 55 species of Trichoptera have been recorded. 60 species of Odonata (dragonflies), of which 23 in the lake water, and 14 species are threatened at the European and Mediterranean level. From Coleoptera (beetles), 14 species of diving beetles (Dytiscidae), 1 species of burrowing water beetles (Noteridae), and 1 species of whirligig beetle (Gyrinidae) (*Orectochilus villosus*) are known from Shkodra Lake and its associated water bodies. In the surrounding streams, Elmidae and Hydraenidae can be found, some of them, such as *Ochthebius insidiosus* (Hydraenidae) described from Rijeka Crnojevića, being endemic. Hemiptera (water bugs), are represented with 10 species in the lake. True flies (Diptera) are one of the most important and most diverse groups of benthic macroinvertebrate fauna. There are more than 20 families known from Shkodra Lake and its surrounding water bodies. Chironomidae (midges) are represented with 31 species of nonbiting midges from the lake itself and 24 species from springs. The most recent studies speculate that this number is an underestimate and that the taxonomic diversity of nonbiting midges in the Lake basin is much higher. This phenomenon might be caused by the occurrence of cryptic species in some genera or rarely by misidentification among morphologically similar taxa. Culicids (mosquitoes) are represented by several species, of which some are potential vectors of malaria (*Anopheles saccharovi*, *Anopheles maculipennis*), chikungunya virus and dengue virus (*Aedes albopictus*), and West Nile virus and Rift Valley fever virus (*Culex pipiens*). The invasive Asian tiger mosquito (*Aedes albopictus*) has recently been reported from the Shkodra Lake basin.

4.1.3.2 Vertebrates

Fish (Pisces): The ichthyofauna of Shkodra Lake consists of 59 species belonging to 18 families (17 of which are native), including diadromous, euryhaline and introduced species. Of these, 44 are native to the watershed, whereas 15 are introduced. Seven species are endemic: *Ninnigobius montenegrensis*,

Knipowitschia montenegrina, *Barbatula zetensis*, *Rutilus albus*, *Gobio skadarensis*, *Salmo zetensis* and *Chondrostoma scodrense* – extinct (EW). The most diverse family is Cyprinidae with 24 (of which 16 are native) species, followed by Mugilidae (5), and Gobiidae (4). Fish in the Shkodra Lake and its watershed have significant economic potential. The following species are fished for commercial purposes: Bleak (*Alburnus scoranza*), Carp (*Cyprinus carpio*), Goldfish (*Carassius auratus*), Eel (*Anguilla anguilla*), Skadar Rudd (*Scardinius knezevici*), Skadar Chub (*Squalius platyceps*), Ohrid Nase (*Chondrostoma ohridanum*), White Roach (*Rutilus albus*), Spotted Roach (*Pachychilon pictum*), Yellow Roach (*Rutilus prespensis*), all species of Mugilidae, Alosa sp., Sea Bass (*Dicentrarchus labrax*), European Perch (*Perca fluviatilis*) and Flounder (*Pleuronectes flesus*). Regarding their conservation status (after the IUCN categories), the largest number of fish species (30.5%) have the LC status, but one third of the species are in a certain category of threat (33.3%), and those are mainly those species endemic to the Adriatic watershed. Three species (5.1%) are classified as critically endangered (CR), and three others (5.1%) are endangered species (EN), while four (6.8%) are vulnerable (VU). The data necessary for the assessment of threat status are deficient (DD) for nine species (15.2%), whereas the status of a near threatened species (NT) has been stated for two species (3.4%).



**Figure 4.1.2. Bleak *Alburnus scoranza* (left) and white roach *Rutilus albus* (right)
two of the most important commercial fishes from Shkodra Lake (Photos: D. Maric, 2018)**

Amphibians (Amphibia): 15 amphibian species have been reported from Shkodra Lake and its tributaries. 6 of these species are from Ranidae family (*Pelophylax kurtmuelleri*, *Pelophylax ridibunda*, *Pelophylax shqiperica*, *Rana dalmatina*, *Rana graeca*, *Rana temporaria*). 5 species are tailed amphibians of the Family Salamandridae (*Lissotriton vulgaris*, *Mesotriton alpestris*, *Triturus karelini*, *Salamandra salamandra*, *Salamandra atra*). 2 species belong to the Family Bufonidae (*Bufo bufo* and *Bufo viridis*), one species belongs to Family Bombinatoridae (*Bombina variegata*) and one species to Family Hylidae (*Hyla arborea*). From these species, 9 have been found in the Lake, while the other 6 species have been reported from the lake watershed. Concerning their endangered status at European level, 14 species have the LC status, whereas one species (*Pelophylax shqiperica*) has the EN status.

Reptilians (Reptilia): 36 species of reptiles have been reported from Shkodra Lake and its catchment area. 4 species have been found within the lake (*Emys orbicularis*, *Mauremys rivulata*, *Natrix natrix*, *Natrix tessellata*), while the others in the lake catchment. 3 species are turtles (belonging to Chelonia of the families Testudinidae and Emydidae), 18 species belong to Sauria and 15 species belong to Serpentes. The most common species belong to families Gekkonidae, Lacertidae, Anguidae, Typhlopidae, Colubridae and Viperidae. All reptilian species reported from Shkodra Lake have an endangered status after IUCN, although their majority (34 species) have a low status (31 species LC and 3 species NT), and 2 species only have the VU status, namely *Dinarolacerta mosorensis* and *Vipera ursinii*.

Birds (Aves): In Shkodra Lake and its catchment 282 bird species have been reported, which count for 55 % of the total number of bird species in Europe. From this total, 112 are aquatic species (waterfowl). The orders with the highest number of species are Passeriformes (107), especially with the families Sylviidae (20), Turdidae (15), Fringillidae (10) and Motacillidae (9); Charadriiformes (46) with the Family Scolopacidae (19); Anseriformes (29), Accipitriformes (21), Ciconiiformes (14), Gruiformes (10) etc. 178

species (63 %) are wintering species, of which 68 species are waterfowl (24% of the total number of species). Migration is well expressed in aquatic species, especially in ciconiiformes and anseriformes. 189 species (67 %) are nesting species, of which 46 species are aquatic (16,3 % of the total number of species). Shkodra Lake is especially important concerning the bird colonies, where the most important are: the colony of Dalmatian Pelican (*Pelecanus crispus*), the colony of Cormorants (*Phalacrocorax carbo* and *Microcarbo pygmaeus*), the colony of Whiskered Tern (*Chlidonias hybrida*) and the colony of Grey Heron (*Ardea cinerea*). Mixed colonies, too, are usual in the lake and its surrounding waters. The predominant species in the mixed colonies are the Pigmy Cormorant (*Microcarbo pygmaeus*), the Squacco Egret (*Ardeola ralloides*), the Little Egret (*Egretta garzetta*), the Night Heron (*Nycticorax nycticorax*), the Grey Heron (*Ardea cinerea*), and the Cormorant (*Phalacrocorax carbo*). In recent years, some new breeding birds appeared on Shkodra Lake, like the Glossy Ibis (*Plegadis falcinellus*) and the Cattle Egret (*Bubulcus ibis*). Many other species nest in Shkodra Lake, but majority of birds nest along the Montenegro shoreline, due to presence of more suitable habitats for bird nesting, as well as a better protection regime. In Shkodra Lake is worthy to note the presence of a globally endangered species, the Dalmatian Pelican *Pelecanus crispus* that is a nesting species in the lake. Due to high species richness and high number of nesting birds, the Shkodra Lake has been proclaimed a Ramsar site (Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat).

Mammals: 57 species of mammals have been reported from Shkodra Lake and its catchment area. The order Chiroptera (bats) is known for the high number of species (20). 10 species belong to Insectivora, 1 species to Lagomorpha, 12 species to Rodentia, 11 species to Carnivora and 3 species belong to Artiodactyla. Only 3 species are semi-aquatic species, from which the Eurasian otter (*Lutra lutra*) is the most important, as a globally endangered species. The two other semi-aquatic mammal species are the Eurasian Water Shrew (*Neomys fodiens*) and the European water vole (*Arvicola terrestris*). In the mountain areas of the Lake watershed it is worthy to note the presence of large carnivores, such the brown bear (*Ursus arctos*), the grey wolf (*Canis lupus*), the Eurasian lynx (*Lynx lynx*) and the wild cat (*Felis silvestris*), as well as the artiodactylans, such as the northern chamois (*Rupicapra rupicapra*) and the European roe deer (*Capreolus capreolus*).

4.2 Species of conservation concern

4.2.1 Endemic, Rare and Threatened Flora

A characteristic element of the vascular flora of the Shkodra Lake basin is the presence of a large number of **endemic species**, some of them being protected at the international and national level. Altogether, **40 species and subspecies endemic to the Balkan Peninsula** have been recorded in the flora of the Shkodra Lake area. An analysis of the biological spectrum of the Balkan endemic flora revealed that hemicryptophytes are most numerous with 18 taxa, followed by chamaephytes with 13 and therophytes with 6 taxa. In the chorological structure of the endemic flora of the Lake Skadar area, the South-European Mountain group dominates with 22 taxa. A large number of Balkan endemic species were found on the slopes of Mount Rumija and are characteristic of the vegetation of rock crevices and screes (*Cymbalaria ebelii*, *Ramonda serbica*, *Moltkia petraea*, *Teucrium ardunii*, *Stachys menthifolia*, *Seseli globiferum*, *Cardamine rupestris*, *Crepis bertiscea*, *Edraianthus tenuifolius* and *Campanula austroadriatica*). Other species like *Onosma stellulata*, *Sideritis romana* subsp. *purpurea*, and *Vincetoxicum huteri* are characteristic of the vegetation of Mediterranean grasslands and herblands, while *Succisella petterii* is characteristic of wet meadows.

From the green macroalgae Characea, the Balkan endemic species *Chara ohridana* has been recently reported from Shkodra Lake as a new finding site (Blazencic et al., 2018).

Moreover, **42 plant taxa are subendemic**; in addition to being found in the Balkan peninsula these taxa are also present in one or two neighbouring countries. Therefore, the total number of taxa of these two categories (**Balkan endemics + Balkan subendemics**) in the vascular flora of the Shkodra Lake area was

counted as 82. Some of the endemic plant taxa were described from the *loci classici* located within the border of the Shkodra Lake Protected Area. *Minuartia mesogitana subsp. velenovskyi* was described (as *Alsine tenuifolia var. velenovskyi*) from Godinje near Virpazar; *Cymbalaria ebelii* was described (as *Linaria microcalyx subsp. ebelii*) from Vranjina island. The *locus classicus* of *Fritillaria messanensis subsp. gracilis*, a taxon originally described as *Lilium gracile*, is Sutorman on Mount Rumija. Of the above-mentioned species, *Minuartia mesogitana subsp. velenovskyi* is endemic to the Balkans, and *Fritillaria messanensis subsp. gracilis* is subendemic to the Balkans (it is also present in Italy), while *Cymbalaria ebelii* is endemic to the area of the Shkodra basin (Montenegro and Albania). On the other hand, some plant species were described from Mount Rumija and their *loci classici* lie outside the border of the Shkodra Lake Protected Area. This group of endemics includes *Edriaianthus wettsteinii*, *Asperula baldaccii* and *Gymnospermium scipetarum*.

Additionally, there are two more plant taxa described as endemic subspecies from the Lake Skadar Protected Area: *Quercus robur subsp. scutariensis* and *Trapa longicarpa subsp. scutariensis*. The latter is cited in 'The Euro + Med PlantBase', but without specifying the subspecies (subsp. *scutariensis*), while 'The Plant List' mentioned '*T. longicarpa*' as an unresolved name. On the other hand, *Q. robur subsp. scutariensis* is not cited in any of the relevant taxonomic plantbases such as 'The Euro + Med PlantBase', 'The Plant List', 'IPNI' and 'Flora Europaea'.

The basin of Shkodra Laker is an important refuge also for several **relict plant species**. The most common among them are *Carpinus orientalis*, *Castanea sativa*, *Laurus nobilis*, *Ostrya carpinifolia*, *Quercus trojana* and *Paliurus spina-christi*.

The national and/or international conservation status of plant species and plant communities in the area of Shkodra Lake has been a subject of several assessments. Table 4.2.1 here below represents a list of plant species of special conservation concern, referring to species with an international threatening status, as included in: **1) the IUCN Red List at global scale; 2) the IUCN Red List at European scale; 3) the EU Habitat Directive; 4) the Bern Convention; and 5) the CITES Convention.**

Regarding the Habitat Directive, there are 6 species in the Annex I of the Bern Convention, and 26 species in the Annex II of the CITEC Convention. 10 of these species have a national threatened status, too, after **the Red List of Flora of Albania 2013** (the other plant species belonging to the national Red List are not included here, as the list in Table 4.2.1 has included only the species with an international threatening status (see below for the plant species of the national Red List).

Most of the threatened species after the IUCN (at global and European level) have a relatively low threatened status (mainly LC, NT, DD), except *Najas flexilis* that is considered as a vulnerable species (VU B2ab) at European scale. Most of the species (9 out of 10) listed in the Red List of Flora of Albania have a high threatened status in national level (CR, EN, VU),

Table 4.2.1 List of plant species of special conservation concern.

Name of taxa	National Red List Albania	IUCN Red List Global	IUCN Red List Europe	Habitat Directive Annex	Bern Annex	CITES Annex
<i>Marsilea quadrifolia</i>	EN A1c			II, IV	I	
<i>Baldellia ranunculoides</i>	CR A1c	NT	NT			
<i>Cyclamen hederifolium</i>						II
<i>Edraianthus dalmaticus</i>				II, IV		
<i>Cyperus michelianus</i>			NT			
<i>Anacamptis coriophora</i>						II
<i>Anacamptis morio caucasica</i>	EN A1b					II
<i>Anacamptis morio morio</i>						II
<i>Anacamptis morio picta</i>						II
<i>Anacamptis palustris</i>						II
<i>Anacamptis papilionacea</i>						II
<i>Anacamptis pyramidalis</i>				II, IV		II
<i>Dactylorhiza incarnata incarnata</i>						II
<i>Gymnadenia conopsea</i>						II
<i>Himantoglossum caprinum</i>				II, IV		II
<i>Limodorum abortivum</i>						II
<i>Neotinea tridentata</i>						II
<i>Ophrys apifera</i>						II
<i>Ophrys bertolonii</i>						II
<i>Ophrys scolopax cornuta</i>						II
<i>Ophrys sphegodes sphegodes</i>						II
<i>Orchis pauciflora</i>						II
<i>Orchis provincialis</i>	LRcd					II
<i>Orchis quadripunctata</i>						II
<i>Orchis simian</i>						II
<i>Platanthera bifolia</i>						II
<i>Serapias lingua</i>						II
<i>Serapias vomeracea vomeracea</i>			LC			II
<i>Spirantes spiralis</i>			LC			II
<i>Caldesia parnassifolia</i>	VU A1b		NT	II, IV	I	
<i>Potamogeton acutifolius</i>			NT			
<i>Galanthus nivalis</i>			NT	V		II
<i>Narcissus poeticus radiiflorus</i>					I	
<i>Najas flexilis</i>			VU B2ab	II, IV	I	
<i>Ramonda serbica</i>	VU A1b		LC	IV	I	
<i>Ruscus aculeatus</i>				V		
<i>Trapa natans</i>	EN A1b		NT		I	
<i>Trapa longicarpa</i>			DD			
<i>Utricularia vulgaris</i>			LC			
<i>Nymphoides peltata</i>	VU A1b	LC	LC			
<i>Nuphar lutea</i>	VU A1b	LC	LC			
<i>Nymphaea alba</i>	VU A 1b		LC			
<i>Vallisneria spiralis</i>		LC	LC			

This list includes 43 plant species, of which 4 species are included in the IUCN Red List at global scale, 16 species in the IUCN Red List at European scale, 9 species in the Annex II, Annex IV and Annex V of the EU

At national level for Albania, too, Shkodra Lake area is also characterized by a considerable number of rare and threatened plant species and associations. The recent Red List of Flora of Albania (2013) includes about 360 threatened and rare species, or 10% of Albanian wild flora, of which 28 plant species grow in the Shkodra Lake and its surrounding wetlands. They are grouped according to the IUCN threatened status in the following:

Critically endangered	CR A1b	1 species	CR A1c	1 species
Endangered	EN A1b	4 species	EN A1c	1 species
Vulnerable	VU A1b	17 species	VU A2b	2 species
Lower risk	LRnt	2 species		

From the plant species endangered in national level, three of them, *Marsilea quadrifolia*, *Salvinia natans* and *Lycium europaeum* would be considered almost extinct in the Albanian part of the Lake, since they have not been found in that area for many years (*M. quadrifolia* has been recently reported from the Montenegrin side only, after many years of absence there, too). The Common Oak (*Quercus robur*) was considered critically risked, due to damage of its habitat as a result of human activity. The marsh pennywort (*Hydrocotyle vulgaris*) was considered a rare species due to the critical reduction of its habitat, which might lead up to its extinction. Three plant species, *Anacamptis pyramidalis*, *Hyacinthella dalmatica* and *Leucojum aestivum* are proposed to include in the Red List of Albanian plants, because of their very limited distribution area in Albania.

In the Albanian part of Shkodra Lake, 16 **rare or threatened plant associations** have been recorded. These associations belong to (1) LEMNETEA (Lemnion), (5) POTAMETEA (Nymphaeion), (3) Potamion, (4) PHRAGMITI – MAGNOCARICETEA (Phragmition australis) and (3) Populion albae.

Among vulnerable plant species and associations, which include the hydrophytes, their survival depends on the conservation of aquatic habitats and wetlands that are often sensitive in ecological point of view. In the Red List were included rare, endemic and threatened plants with scientific values, that are threatened from damage of their habitats as result of erosion, deforestation, changing of water regime, introduction of invasive species, pollution of their habitats by urban and solid residue etc. The impact of human activity particularly in the last decades has caused the damage and the degradation of several habitats and ecosystems, threatening the existence of many plant species. New insight will be valuable in the area, aiming to evaluate in more details the ecological situation of actual list of the rare and threatened plant species.

4.3.2 Endemic, Rare and Threatened Fauna

The Shkodra Lake and its basin, representing the classic karst of the Dinarides with a very complex hydrogeology, are unique areas with high landscape heterogeneity and rich species diversity, including numerous **endemic species** from various taxonomic groups. However, the endemism in lacustrine species (species found within the lake basin only) is low, whereas the rate of endemism is generally higher in the lake catchment area. Referring to the most recent estimation, after Pesic (2018), the adjusted rate of endemism is estimated at 1.8% for all taxa and 2.7% for Animalia. For example, the adjusted rate of endemism of fish at the catchment level is estimated at 13.6%, whereas at the level of Lake basin is estimated at 3.6%. The animal group with the highest endemism is the hydrobiid gastropods: around 82% of the species that inhabit the Shkodra Lake catchment area are known only from the type localities here.

Just for a comparison, in terms of the total number of species, Shkodra Lake is richer than Ohrid Lake, but the adjusted rate of endemism for Ohrid is estimated at 36% for all taxa and 34% for Animalia. The poverty

of endemic lacustrine species in Shkodra Lake is coherent with the very young age of the present waterbody, estimated by Mazzini et al. (2015), leaving no time for adaptive radiation. On the other hand, the presence of even few lacustrine endemics in this lake demands consideration. Yet on the other side, the lake catchment and its hydrological network, with a large system of karst springs are definitely ancient, originated more than 2.5 Ma and isolated for most of its history, with a high number of crenal and fluvial endemics, at both the species and the lineage (possibly cryptic or pseudocryptic species) levels, depending on the studied taxa. A large number of sublacustrine springs in Shkodra Lake play a significant role in the overall biodiversity of the lake. Moreover, recent studies have shown that they have their own endemic species which require special protection measures for sublacustrine springs.

For the reasons mentioned above, the highest rates of endemism, as expected, is found in underground waters and caves. Among them, two important caves, known for their endemic species are the Lipa Cave and the Obod Cave, in the Montenegrin part of the Lake. Lipa Cave is a *locus typicus* for several endemic species of invertebrates e.g., *Bogidiella montenegrina* (Amphipoda), *Neobisium umbratile* (Pseudoscorpiones), *Folkia mrazeki* (Aranea), *Anthroherpon absoloni* and *Hadesia zetae* (Coleoptera). Obod Cave is a *locus typicus* for other endemic species of invertebrates e.g., *Metohia carinata*, *Typhlogammarus mrazeki* (Amphipoda), *Sphaeromides virei montenegrina* (Isopoda), *Chaetonotus antrumus* (Gastrotricha), *Plagigeyeria montenegrina*, *Saxurinator hadzii* and *Spelaeodiscus obodensis* (Gastropoda).

Troglobit groups are important as much more numerous among narrowly endemic species, sometimes with single known localities. Such are numerous copepods and ostracods (i.e. *Ceuthonectes petkovskii*, *Elaphoidella gordani*, *Elaphoidella montenegrina*, *Stygodiaptomus fesus*, *Pseudocypridopsis petkovskii*). However, only seldom their endemism can be considered with certainty, since the knowledge of the local fauna is far too low for drawing conclusions. Narrowly endemic seems to be the ostracod genus *Trajancondona*. Less strictly endemic are the amphipod *Metohia carinata* and the shrimp *Troglocaris (Spelaeocaris) prasence*, both known only from Montenegro and southern Hercegovina.

Molluscs are the group with the highest number of endemism from the animal groups of the Shkodra Lake catchment. Different publications have stated different numbers for the endemic species. The highest number of endemic molluscs has been published by Dhora (2016), mentioning 28 endemic species from the whole lake watershed. Hydrobiid gastropods are the mollusc group with the highest endemism. Around 82% of the hydrobiid species that inhabit the Shkodra Lake catchment area are known only from the type localities in this area. Only two endemics, *Radomaniola (Orientalina) lacustris* and *Vinodolia (Anagastina) scutarica*, are considered as typically lacustrine forms, while the rest of species belong to the waterbodies in the Lake catchment. Pešić and Glöer (2013) stated that taking the surface area into account by using normalized endemic species area index, Shkodra Lake exceeds such famous ancient lakes as Malawi and Titicaca. The largest number of endemic species belongs to the genus *Bithynia*. Glöer et al. (2015) suggest that Shkodra Lake might be a hot spot of evolution of this genus. All 28 species of endemic mollusks of the Lake watershed belong to **the Red List of Fauna of Albania** (2013) and 44 molluscs species have a threatened status after **the IUCN Red List at Global Scale**, as in the Table 4.2.2 here below:

Table 4.2.2 Number of threatened molluscs species from Shkodra Lake watershed for each category of the IUCN Red List at Global Scale.

IUCN category		Nr. of species
Critically endangered	CR	5
Endangered	EN	9
Vulnerable	VU	1
Near threatened	NT	3
Least concerned	LC	23
Data deficient	DD	3
Threatened molluscs in total		44

Oligochaetes, although with a relatively high number of species found in the lake (35 in total) represent a low rate of endemism, with species only: *Spirosperma scodraensis*, *Tubificidarum hrabei*, and *Trichodrilus montenegrinus*.

Malacostraca crustaceans are the second known animal group with respect to the number of local endemics at the morphological species level, after the gastropod molluscs. The definitive majority of this endemic diversity is associated with the subterranean karst habitats and represented by various *Niphargus* species. It is important to mention that recent molecular studies on Balkan malacostracans have revealed substantial cryptic diversity within the conventionally described morphospecies. Thus, the diversity and endemism of the Shkodra Lake malacostracans may be even higher than is currently believed.

Amphipoda is the group with the highest number of endemic species among malacostracans, with 10 species, of which 8 belong to the genus *Niphargus* (*N. asper*, *N. brevicuspis sketi*, *N. inclinatus*, *N. maximus vulgaris*, *N. podgoricensis*, *N. vranjine*, *N. zorae*, *N. kusceri*). The two other endemic amphipods are *Laurogammarus scutarensis* and *Bogidiella montenegrina*.

From the other malacostracans, mysids (Mysidacea) are represented by one endemic species only, *Diamysis lacustris*, and isopods with one endemic species, too, *Sphaeromides virei montenegrina*.

Endemic copepods are represented mainly by harpacticoids that inhabit underground water habitats, such as *Nitocrella longa*, *Moraria jana*, *Ceuthonectes petkovskii*, *Elaphoidella montenegrina*, *Elaphoidella gordani* and *Elaphoidella uva*, as well as the calanoid *Stygodiaptomus ferus* that have been reported from several caves and springs, most of them as stygobiotic species.

Ostracods are represented by several endemic forms, mainly stygobiotic species, too, of which four species are endemic known only from its *locus typicus*: *Pseudocypridopsis petkovskii*, *Trajancondona particular*, *Trajancondona natura* and *Typhlocypris skadari*. Four other endemic species *Pseudocandona regisnikolai*, *Leptocythere pseudoproboscidea*, *Candona forma* and *Candonopsis mareza* have been reported from various habitats around the Shkodra Lake watershed.

From water mites (Acarina: Hydrachnidia), *Trichothyas jadrankae* is endemic to the Shkodra Lake basin, while three other species are endemic to Montenegro: *Torrenticola lukai*, *Atractides longisetus* and *Stygohydracarus karanovici*. The last one is a typical inhabitant of hyporheic interstitial, although the interstitial fauna of the Shkodra Lake catchment does not exhibit marked endemism.

Insects are supposed to include endemic and subendemic forms, encompassing more than 100 species, most of them terrestrial adults, for the whole Shkodra Lake catchment area, whereas aquatic insects represent a very low rate of endemism for the Lake itself. However, several insect groups are poorly studied, especially in the Albanian part of the Lake, and considerations about endemic forms should be treated very carefully. More than half of the stonefly species (Plecoptera) of the Shkodra Lake catchment area are Balkan endemic or subendemic taxa, with the others showing European or Eurosiberian distribution. *Capnioneura balkanica balkanica* is an endemic species that inhabits spring habitats. It seems to be a winter-emerging endemic of the Morača valley and was found in different crenal habitats from karst spring outlets to small forest brooks. *Brachyptera tristis* is a Balkan endemic species, restricted mostly to the Dinaric ranges and found exclusively in huge karst springs at low to moderate elevations. *Leuctra jahorinensis* and *Leuctra malcor* are narrow endemics of the Dinaric Mountains, both restricted to mountain crenal habitats. *Protonemura auberti* and *Protonemura aestiva* belong to a Central European and Balkan species complex of crenal taxa. In the Balkans, they seem to be connected to karst springs. *Nemoura asceta* is a widespread Balkan endemic species, connected to small, temporary spring brooks of low to high elevations. *Isoperla pesici* is a widely distributed crenal species of the Central Balkans, which occurs in both small and large springs at different elevations. Water beetles (Coleoptera) are relatively common in the surrounding streams of the Lake, especially the Elmidae and Hydraenidae families that are

also represented with endemic forms, such as *Ochthebius insidiosus* (Hydraenidae) described from Rijeka Crnojevića. However, the endemic status of some of their species has been considered as questionable.

Among the insects, dragon flies (Odonata) are among the groups, for which the threatened status in international scale has been assessed. The Table 4.2.3 here below represent the list of the dragonfly species from the Shkodra Lake basin that are threatened at **the European and Mediterranean level**, referring to **the EU Habitat Directive, the Red List of the Mediterranean basin, the European Red List and the Bern Convention**.

Table 4.2.3 List of dragonfly species (Odonota) from the Shkodra Lake basin that are threatened at the European and Mediterranean level (after Boudout & Kalkman, 2015)

Species	EU Habitats Directive, Annexes	Red List of the Mediterranean basin	European Red List	Bern Annexes
<i>Lestes macrostigma</i>		NT	VU	
<i>Calopteryx splendens</i>		VU	LC	
<i>Coenagrion ornatum</i>	II	NT	NT	
<i>Coenagrion pulchellum</i>		NT		
<i>Erythromma najas</i>		NT		
<i>Brachytron pratense</i>		NT		
<i>Caliaeschna microstigma</i>		NT	NT	
<i>Gomphus flavipes</i>	IV	NT	LC	II
<i>Gomphus pulchellus</i>		LC	LC	
<i>Gomphus schneiderii</i>		LC	NT	
<i>Lindenia tetraphylla</i>	II, IV	NT	VU	II
<i>Cordulegaster bidentata</i>		NT	NT	
<i>Cordulegaster heros</i>	II, IV	VU	NT	
<i>Sympetrum vulgatum</i>		NT		

As seen from the table, all the listed 14 Odonata species, are threatened at Mediterranean level and 10 of them at European level. 4 species belong to the EU Habitats Directive and 2 species to Bern Convention.

Fish are represented with a relatively high rate of endemism at the catchment level and a low rate of endemism at the level of Lake basin (for lacustrine species). As mentioned earlier in this chapter, the adjusted rate of endemism at the catchment level is estimated at 13.6%, whereas at the level of Lake basin is estimated at 3.6%. Seven fish species are endemic to the Lake catchment: *Ninnigobius montenegrensis*, *Knipowitschia montenegrina*, *Barbatula zetensis*, *Rutilus albus*, *Gobio skadarensis*, *Salmo zetensis* and *Chondrostoma scodrense*. The last one has been considered as an extinct species from the Lake already (Maric, 2018). Although all the endemic species have a conservation status in the Shkodra Lake, they are seriously threatened by most of the impacts occurring in the Lake, including bycatch. From 59 fish species reported from Shkodra Lake catchment, 44 have a threatened status, of which, 14 species are of high conservation concern: 1 has been considered as extinct species (*Chondrostoma scodrense*), 2 species as extinct in the wild (the sturgeons *Acipenser naccarii* and *Acipenser sturio*), 3 species as critically endangered (*Salmo marmoratus*, *Salmo zetensis*, *Pelagus minutus*), 4 species as endangered (*Anguilla anguilla*, *Gobio skadarensis*, *Rutilus albus*, *Cobitis ohridana*) and 4 species as vulnerable (*Alosa fallax*, *Salmo farioides*, *Chondrostoma ohridanum*, *Cyprinus carpio*). The other threatened species are near threatened (2 species), least concerned (19 species), and data deficient (9 species). See the Table 4.2.4 for more details here below:

Table 4.2.4 Number of threatened fish species from Shkodra Lake watershed for each category of the IUCN Red List.

IUCN category	Nr. of species
Extinct EX	1
Extinct in the wild EW	2
Critically endangered CR	3
Endangered EN	4
Vulnerable VU	4
Near threatened NT	2
Least concerned LC	19
Data deficient DD	9
Threatened fish in total	44

The other 15 species are introduced species, of which 8 have been reported earlier from the Shkodra Lake watershed, but currently they are considered as extinct from that area.

Further, 20 fish species that are considered endemic at the level of Mediterranean basin are threatened in the Shkodra Lake catchment (Table 4.2.5):

Table 4.2.5. Endemic fish species of the Mediterranean basin that are threatened in the Shkodra Lake catchment (after Dhora, 2016).

Fish species	IUCN status	Fish species	IUCN status
<i>Acipenser naccarii</i>	CR	<i>Rutilus karamani</i>	LC
<i>Alburnus scoranza</i>	VU	<i>Rutilus ohridanus</i>	LC
<i>Alosa agone</i> (non-migratory form)	VU	<i>Salaria fluviatilis</i>	DD
<i>Barbatula zetensis</i>	DD	<i>Salmo marmoratus</i>	LC
<i>Barbus rebeli</i>	DD	<i>Salmo montenegrinus</i>	DD
<i>Chondrostoma scodrense</i>	EX	<i>Salmo obtusirostris</i>	EN
<i>Cobitis ohridana</i>	DD	<i>Salmo taleri</i>	DD
<i>Gobio skadarensis</i>	EN	<i>Scardinius knezevici</i>	DD
<i>Pachychilon pictum</i>	LC	<i>Squalius platyceps</i>	LC
<i>Pomatoschistus montenegrensis</i>	DD	<i>Telestes montenigrinus</i>	DD

Many fish species, including endemic, rare and threatened ones, are endangered in the Shkodra Lake catchment because, besides other impacts, they are fished regularly as catch or bycatch, such as *Alburnus scoranza*, *Alosa agone*, *Salmo* (all species), *Squalius platyceps*, *Scardinius knezevici*, *Pachychilon pictum*, *Cyprinus carpio*, *Alburnoides ohridanus*, *Dicentrarchus labrax*, *Platichthys flesus*, *Chondrostoma nasus*, *Mugil cephalus*, *Liza ramada* etc.

From 15 amphibian species reported from Shkodra Lake catchment, four of them (*Triturus macedonicus*, *Pelophylax kurtmuelleri*, *Pelophylax shqiperica* and *Rana graeca*) are endemic to the entire or southeastern part of the Balkan Peninsula. All reported species are **threatened at European level, after the IUCN Red List** (14 species have the LC status, whereas one species, *Pelophylax shqiperica*, has the EN status). All species are included in **the Bern Convention (Annex II and Annex III)**, and 9 species are included in **the EU Habitat Directive (Annex II, Annex IV and Annex V)** – see Table 4.2.6 for more details.

Table 4.2.6 Number of threatened species of Amphibia, Reptilia and Mammalia from Shkodra Lake catchment at European level (after European conventions and directives)

Animal groups	IUCN Red List	CITES Convention		Bern Convention		EU Habitat Directive		
		Annex I	Annex II	Annex II	Annex III	Annex II	Annex IV	Annex V
Amphibia	15	-	-	6	9	2	7	2
Reptilia	36	1	1	26	10	7	28	-
Mammalia	28	1	2	27	20	12	20	-

Reptilians are represented with 36 species in Shkodra Lake catchment area. The Prokletije rock lizard *Dinarolacerta montenegrina* must be a conservation priority in the region, because of its endemic status (after Crnobrnja-Isailovic, 2018). All species have a threatened status in the Lake catchment area, where 2 species, *Dinarolacerta mosorensis* and *Vipera ursinii*, have been considered as vulnerable. Four species are included in **the IUCN Red List at Global Level**: *Emys orbicularis* (status NT), *Mauremys rivulata*, (status LC), *Natrix natrix* (status LC) and *Natrix tessellata* (status LC). All reported species are **threatened at European level, after the IUCN Red List**. 2 species are included in the **CITES Convention (Annex I and Annex II)**, all species are included in **the Bern Convention (Annex II and Annex III)**, and 28 species are included in **the EU Habitat Directive (Annex II and Annex IV)** – see Table 4.2.6 for more details.

From 57 Mammal species recorded in the Lake watershed, 28 species have been listed in **the Red List of Fauna of Albania** (2013). It is worthy to note the presence of species included in the **the IUCN Red List at Global Level**, such as the brown bear (*Ursus arctos*), the grey wolf (*Canis lupus*), the red fox (*Vulpes vulpes*), the pine marten (*Martes martes*), the beech marten (*Martes foina*), the least weasel (*Mustela nivalis*), the western polecat (*Mustela putorius*), the Eurasian otter (*Lutra lutra*), the Eurasian lynx (*Lynx lynx*), the wild boar (*Sus scrofa*), the European roe deer (*Capreolus capreolus*) and the northern chamois (*Rupicapra rupicapra*). Several species of small bats (Microchiroptera) are also included in the the IUCN Red List at Global Level. Although most of these globally threatened species have a low conservation status (most of them LC), their presence in the Shkodra Lake watershed is important for highlighting the need for conservation of the Lake, its watershed and its mammal fauna in regional, European and global levels. Many reported species of mammals are **threatened at European level**. 3 species are included in the **CITES Convention (Annex I and Annex II)**, 27 species are included in **the Bern Convention (Annex II and Annex III)**, and 20 species are included in **the EU Habitat Directive (Annex II and Annex IV)** – see Table 4.2.6 for more details.

Birds represent one of the groups with the highest number of threatened species in the Shkodra Lake watershed. From 282 bird species reported in this area, 157 species (55% of the total) are included in **the EU Directive on Birds** (2009/147/EC), while 168 species (59% of the total) have a threatened status after **the IUCN Red List at European level**. Number of species for each threatened category is in the following:

Table 4.2.7 Number of threatened bird species from Shkodra Lake watershed for each category of the IUCN Red List at European level 9 (after Dhora, 2016).

IUCN category		Nr. of species
Endangered	EN	5
Vulnerable	VU	5
Near threatened	NT	6
Least concerned	LC	152
Threatened birds in total		168

10 birds species have a high threatened status, of which, 5 are vulnerable (VU): *Anser erythropus*,

Marmaronetta angustirostris, *Aquila clanga*, *Aquila heliaca*, *Pelecanus crispus*; and 5 others are endangered (EN) *Branta ruficollis*, *Melanitta fusca*, *Oxyura leucocephala*, *Neophron percnopterus*, *Falco cherrug*. Historically, Shkodra Lake has been considered as one of the most important wetlands for wintering of aquatic birds (waterfowl) in Europe. Referring to long-term bird census, the maximal number of individuals during winter in Shkodra Lake and its surrounding wetlands (in Albania and Montenegro) has varied from 200.000 to 400.000. However, this number has declined during the two last decades, as well as the species number. During some recent years the species number of wintering birds has declined up to 40. The Common Coot (*Fulica atra*) has usually been the species with the highest population density in the lake, counting more than 50% of the wintering birds in the whole lake. Other species with high population density in the lake are *Phalacrocorax carbo*, *Microcarbo (Phalacrocorax) pygmaeus*, *Aythya ferina*, *Larus ridibundus*, *Anas platyrhynchos*, *Podiceps nigricollis*, *Podiceps cristatus* and *Tachybaptus ruficollis*.

Being a protected area and, furthermore, a Ramsar site (**Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat**), the whole Shkodra Lake and its surrounding wetlands must be treated as a habitat of special conservation concern for ornithofauna.

4.3 Habitats of conservation concern

Shkodra Lake is characterized by a relatively high number of important natural habitats that deserve special conservation measures. The Table 4.3.1 here below refers to the **EU Habitat Directive** (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora). Interpretation of habitat types refers to the **Annex 1 “Natural habitat types of community interest whose conservation requires the designation of special areas of conservation”** and the habitat code corresponds to the **NATURA 2000** code.

**Table 4.3.1 List of Natura 2000 habitat types occurring in Shkodra Lake
(after the EU Habitat Directive, Annex 1)**

Code	Natura 2000 habitat types
3130	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea
3150	Natural eutrophic lakes with Magnopotamion and Hydrocharition type vegetation
3240	Alpine rivers and their ligneous vegetation with <i>Salix elaeagnos</i>
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation
3280	Constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of <i>Salix</i> and <i>Populus alba</i>
3290	Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion
5310	<i>Laurus nobilis</i> thickets
6220	*Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea
62A0	East Sub-Mediterranean dry grasslands (<i>Scorzoneretalia villosae</i>)
6420	Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion
8130	Western Mediterranean and thermophilous scree
8210	Calcareous rocky slopes with chasmophytic vegetation
91F0	Riparian mixed forests of <i>Quercus robur</i> , <i>Ulmus laevis</i> and <i>Ulmus minor</i> , <i>Fraxinus excelsior</i> or <i>Fraxinus angustifolia</i> , along the great rivers (<i>Ulmenion minoris</i>)
91M0	Pannonian-Balkan turkey oak – sessile oak forests
91AA	Eastern white oak woods
9250	<i>Quercus trojana</i> woods
9260	<i>Castanea sativa</i> woods

9280	<i>Quercus frainetto</i> woods
9290	<i>Cupressus</i> forests (Acero-Cupression)
92A0	<i>Salix alba</i> and <i>Populus alba</i> galleries
92C0	<i>Platanus orientalis</i> and <i>Liquidambar orientalis</i> woods (Platanion orientalis)
92D0	Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)
9340	<i>Quercus ilex</i> and <i>Quercus rotundifolia</i> forests

There are many NATURA 2000 habitats in Shkodra Lake that contribute to the special ecological value of this area. Altogether, there are 23 European Natural Habitat Types (after the EU Habitat Directive, Annex 1) that occur in the Shkodra Lake area. As seen in the Table 4.3.1, this list includes also two Priority Habitat Types (in danger of disappearance), namely *the Habitat 6220 “Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea”* and *the Habitat 91AA “Eastern white oak woods”*. However, there are no detailed assessments or descriptions for these two habitats types in the existing literature, neither in the Albanian part, or Montenegrin part of the Lake.

Further, **the Management Plan of Shkodra Lake Protected Area** (APAWA et al., 2012), based on experts' judgment, has proposed the following habitats as threatened, sensitive and most important habitats for the Albanian part of Shkodra Lake:

- Area of floating macrophytes in Gashaj, the most important area of floating macrophytes in the Albanian side, threatened from the navigation in the lake. This area is a nesting habitat of *Chlidonias hybridus*, included in the Ramsar, as well as for *Ardeola ralloides* and *Aythya ferina*.
- 18 springs or “eyes” and the artesian waters along the eastern coast of the lake. They are potentially threatened by the pollution in the lake watershed, having a direct impact to the lake, because they have underground communication with the lake.
- Islands of Buna/Bojana River, especially important for the vegetation and birds;
- Reed beds, forests and marshes in the area Shkodër – Gril.
- Coastal area in Flakë (Buzë Uji), especially important for aquatic forest vegetation and birds.
- Forest area “Fshati i Paqes” in Taraboshi Mountain, interesting in floristic aspect.
- Forest area of Zogaj in Taraboshi, very interesting in floristic aspect.
- Western coast of the lake, where bleak (*Alburnus scoranza*) reproduces in spring season.
- Coastal waters with gravel bottom along the segment Shirokë – Zogaj, as reproduction habitats for *Chondrostoma nasus*.
- The Shiroka coast, important sheltering habitat for the bleak *Alburnus scoranza* during the winter.
- The Zogaj coast, important sheltering habitat for the bleak *Alburnus scoranza* during the winter;
- Shallow waters along almost the whole eastern coast, with hard bottoms, where several species reproduces in spring season, like carp *Cyprinus carpio* and *Carassius gibelio*.
- Waters in the mouths of the creeks in eastern coast, where *Chondrostoma nasus* reproduces.
- Flooded areas of the lake, together with the terminal parts of the drainage collectors that discharge waters in the lake.
- Downstream and delta of Përroi i Thatë.
- Steppe area in Postopjë, with very interesting vegetation, also important for medicinal plants.

These habitats have been considered of a special importance, due to their ecological sensibility, presence of rare and threatened plant and animal species, their suitability for sheltering, nesting or feeding, especially for fish and birds.

4.4 Critical Habitats and Species in the Project Area (Shiroka – Zogaj)

As mentioned earlier in this report, in the Albanian part of Lake Shkodra most of existing data refer to the lake in general and seldom to specific areas with indicated sites. Additionally, the time frame of the collected data in several publications is not clear. The description of the habitats in the Project area between Shiroka and Zogaj, is largely based on a survey carried out in this area in 2013, after the publication of RCRD & Green Home (2013). The objects of this survey were the aquatic plant associations, fish, aquatic birds and terrestrial plant associations. The latter has been assessed in a short distance from the lakeshore, up to 400 m horizontally, reaching an altitude up to 170 m a.s.l. Although limited in time, space and number of studied groups, this survey is among the very few ones that provide data about the Project area (Zogaj) that are relatively recent. Another study to be considered is about fish and fisheries in Shkodra Lake, referring to a fish monitoring in Albanian and Montenegrin parts of the Lake during 2013 – 2015, after the publication of GIZ (2017). Two sites from the Albanian part of the Lake were involved in this monitoring, Shiroka (the relevant project area) and Koplík (eastern shore of the Lake, at the opposite shore of the project area). Yet, the results have been presented and discussed for the Albanian part of the Lake in general and not separately for Shiroka and Koplík. However, some results would be worthy to consider for the relevant project area (Shiroka).

Referring to RCRD & Green Home (2013), 9 macrophyte species (Angiosperms) were found in Zogaj as shown in the Table 4.4.1 below:

Table 4.4.1. List of macrophytes (aquatic plants) sampled in Zogaj during the summer field trip, July 2013 (after RCRD & Green Home 2013)

Nr	Scientific name	Family	Zogaj/distance from Lake side					
			0-20m	100m	200m	300m	400m	500m
1	<i>Valisneria spiralis</i>	Hydrocharitaceae	x	x				
2	<i>Najas minor</i>	Najadaceae	x					
3	<i>Najas marina</i>	Najadaceae	x	x				
4	<i>Potamogeton prealongus</i>	Potamogetonaceae	x					
5	<i>Potamogeton crispus</i>	Potamogetonaceae	x					
6	<i>Potamogeton nodosus</i>	Potamogetonaceae	x					
7	<i>Potamogeton perfoliatus</i>	Potamogetonaceae	x					
8	<i>Myriophyllum spicatum</i>	Haloragaceae	x					
9	<i>Ceratophyllum demersum</i>	Ceratophyllaceae			x			

All the macrophytes found were native species, and from them only *Vallisneria spiralis* is threatened. This species has the status “Least Concern” (LC) in the IUCN Red List at both Global level and European level. However, it has not been included in the Red List of Flora of Albania (2013) and it has a large distribution on both sides of Shkodra Lake, especially on littoral habitats.

Macrophytes in Zogaj belong to 4 different plant associations: Potameto-Valisnerietum, Potameto-Najadetum marinae, Najadetum marinae and Ceratophylletum demersi. The first two associations, namely the Potameto-Valisnerietum and Potameto-Najadetum marinae were found till 3.5m of depth, while the associations of Najadetum marinae and Ceratophylletum demersi arrived till 5.5m deep.



Figure 4.4.1. Submergent macrophytes *Valisneria spiralis* and *Potamogeton spp.* in Zogaj (photo RCRD & Green Home, 2013)

These associations belong to the NATURA 2000 habitat: 3150 *Natural eutrophic lakes with Magnopotamion and Hydrocharition type vegetation*. This habitat type is present in lakes and ponds with gray and greenish water mass, water which is more or less turbid and slightly alkaline (pH reaction more than 7) and with floating plants from Hydrocharition assemblage. This habitat also occurs in deeper and open water mass with rooted assemblages of Magnopotamion.

RCRD & Green Home (2013) has reported 16 fish species from its survey, as in the Table 4.4.2 here below:

Table 4.4.2. Fish species found in Zogaj (modified after RCRD & Green Home, 2013)

Fish species	Abundance (L-low; M-medium; H-high)	Stage A- adult; J-juvenile	*Red List Albania	*Red List Montenegro
<i>Alburnoides ohridanus</i>	M	A & J		LC
<i>Alburnus scoranza</i>	H	A & J	VU	NT
<i>Alosa fallax</i>	L	J	VU	VU
<i>Carassius gibelio</i>	M	J		
<i>Cyprinus carpio</i>	M	A		VU
<i>Gambusia holbrooki</i>	L	A		
<i>Liza ramada</i>	L	A		LC
<i>Mugil cephalus</i>	L	A		LC
<i>Rhodeus amarus</i>	L	J		LC
<i>Rutilus ohridana</i>	M	A & J		
<i>Pachychilon pictum</i>	L	A	LC	LC
<i>Perca fluviatilis</i>	M	A & J		
<i>Pseudorasbora parva</i>	L	A		
<i>Salaria fluviatilis</i>	L	A & J	DD	LC
<i>Scardinius knezevici</i>	L	J	DD	LC
<i>Squalius platyceps</i>	M	A & J	LC	LC

* The two columns with the Red Lists status (for Albania and Montenegro) did not exist in the original list from RCRD & Green Home (2013). They have been inserted by the author for the purpose of this report. The Red List for Albania refers to Dhora, 2016 (see also the Table 4.2.5 in this report). The Red List for Montenegro refers to Maric (2018).

From the fish species found in Zogaj, 6 species have a threatened status for Albania and 11 species have a threatened status for Montenegro. Citing the RCRD & Green Home (2013), the Zogaj area is known for fishery activity especially on bleak (*Alburnus scoranza*), common carp (*Cyprinus carpio*), prusian carp (*Carassius gibelio*), mullets (*Liza ramada*, *Mugil cephalus*) and twaite shad (*Alosa fallax*). Five of the

species that are commonly fished have a threatened status for Albania and / or Montenegro. Among them, it's worthy to note 3 species with a high threatened status, vulnerable (VU), namely the bleak (*Alburnus scoranza*), the common carp (*Cyprinus carpio*), and the twaite shad (*Alosa fallax*).

As shown in the Table 4.4.2 here above, 10 species (62% of the total) have been caught as juvenile stage (J and A & J). This may lead to a possible consideration that Zogaj area may be an important area for fish nursery. A regular and long-term fish monitoring would be needed to come with a conclusion about this. However, that consideration corresponds to the statement done in the Management Plan of Shkodra Lake Protected Area (APAWA et al., 2012), based on experts' judgment, about the important habitats of shallow waters with gravel bottom along the segment Shirokë – Zogaj, as reproduction habitats especially for the bleak (*Alburnus scoranza*) and for the nase (*Chondrostoma nasus*). A more detailed comment about these habitats will be done later here below.

Concerning the aquatic birds (waterfowl) recorded in Zogaj, citing the RCRD & Green Home (2013), the area isn't known for a high diversity of waterfowl species. The birds use the area for feeding and roosting. The most common recorded species in this area are presented in the following table.

Table 4.4.3. Waterfowl species recorded in Zogaj (modified after RCRD & Green Home, 2013)

Bird species	Abundance (L-low; M-medium; H-high)	Stage A- adult; J-juvenile	*Red List Albania	*Red List Global
<i>Egretta alba</i>	L	A	EN	LC
<i>Egretta garzetta</i>	L	A	VU	LC
<i>Ardea cinerea</i>	L	A	VU	LC
<i>Chlidonias hybrida</i>	L	A		LC
<i>Fulica atra</i>	M	A		LC
<i>Larus cachinnans</i>	M	A & J	EN	LC
<i>Larus ridibundus</i>	M	A & J		LC
<i>Phalacrocorax carbo</i>	M	A & J		LC
<i>Podiceps cristatus</i>	M	A & J		LC
<i>Tachybaptus ruficollis</i>	M	A		LC
<i>Sterna hirundo</i>	L	A	EN	LC

* The two columns with the Red Lists status (for Albania and Global) did not exist in the original list from RCRD & Green Home (2013). They have been inserted by the author for the purpose of this report. For Albania it refers to the Red List of Fauna of Albania (2013).

Despite the low species richness, it is worthy to highlight that all bird species recorded in Zogaj (Table 4.4.3) have a threatened status (although "Least Concern" – LC) in global level after the IUCN Red List, and 5 species have a high threatened status (EN or VU) in national level for Albania. The low species richness, the low – to medium (L/M) abundance and relatively low presence of juveniles (J) (as for the Table 4.4.3) might be related to the lack of submerged vegetation belts in Zogaj that are needed habitats for waterfowl nesting and / or sheltering. Another reason might be related to the high rate of human disturbance, because Zogaj has been traditionally used as an important fishing area from the local community during the whole year.

Terrestrial plant species and vegetation has also been subject of investigation in Zogaj from the RCRD & Green Home (2013), as mentioned earlier here. During that investigation 76 terrestrial plant species were found. Six species were not native in Zogaj, including three archeophytes (*Morus alba*, *Ficus carica*, *Punica granatum*) and three neophytes (*Robinia pseudoacacia*, *Ailanthus altissima*, *Lunaria annua*). Two threatened plant species were recorded in Zogaj, the St. John's wort *Hypericum perforatum* and the wild almond *Prunus webbii*. The first one has the Endangered (EN) status in national level and Least Concern

(LC) in European level, whereas the second one has the Vulnerable (VU) status in national level and Data Deficient (DD) status in global level, after the IUCN Red List.

Forest vegetation was represented with dense and hardly accessible forests, but due to forest degradation, the stony slopes often become barren land without any trees. Along the investigated area in Zogaj up to 170 m of altitude in calcareous and dolomite terrain, the most commune and well developed plants were *Fraxinus orientalis*, *Pistacia terebinthus* and *Punica granatum*. Four terrestrial plant associations were determined along Zogaj slope: Orno-Quercetum illicis, Pistacio terebinthi-Paliuretum spinosae, Carpinetum orientalis punicosum, Paliuro-Carpinetum orientalis (Table 4.5.4). *Paliurus spinachristi* and *Punica granatum* dominate the bushes floor. This association is thriving in heterogeneous areas, where huge calcareous blocks are toggled with smaller surface covered with pebble and red-soil, hence, different plants were found in a very small area, as forest plants, plants of open areas, plants of stones and rocks.



Figure 4.4.2. Terrestrial vegetation in Zogaj lakeshore (photo RCRD & Green Home, 2013)

In the herbaceous plants floor, the most common were: *Galanthus nivalis*, *Primula vulgaris*, *Vicia grandiflora*, *Anemone apenina*, *Viola odorata* and *Chrysopogon gryllus*, as well as those representing the remains of under-bush floor: *Salvia officinalis*, *Rubus ulmifolius*, *Ruscus aculeatus* etc.

Table 4.4.4. Habitats, associations and threatened terrestrial plant species in Zogaj, (after RCRD & Green Home, 2013)

Sampling Point	Habitats	Plant Associations	Terrestrial plant species	Threatened
Zogaj	Mixed deciduous and evergreen shrubs	<i>Orno-Quercetum illicis</i>	76	<i>Hypericum perforatum</i>
	Mixed deciduous shrubs	<i>Pistacio terebinthi-Paliuretum spinosae</i>		<i>Prunus webii</i>
	Illyrian garrigues	<i>Carpinetum orientalis punicosum</i> <i>Paliuro-Carpinetum orientalis</i>		

A whole series of degradation stages of forest associations was observed. One of the most common degradation was the one characterized by dominance of *Paliurus spina christi* and *Punica granatum*.

Mixed deciduous and evergreen shrubs habitat type was determined on bottom of Taraboshi mountain, parallel to Zogaj village, while mixed deciduous shrubs habitat type was dominant along most of the other area, at a distance of 250 m from the lake shoreline, where the trees and shrubs being scarcely and that habitat was substitute by Illyrian garrigues habitat types.

Regarding the other relevant project site, Shiroke, the analysis here in the following is based on a fish monitoring 2013 – 2015, after GIZ (2017), as mentioned in the beginning of this chapter (4.5). As noted there, the results have been presented and discussed for the Albanian part of the Lake in general and not separately for each of the investigated sites, Shiroke and Koplík. Hence, some considerations presented for Shiroke in the following might be subjective to some extent, however, worthy to consider for the relevant project area.

During the three years of sampling at the Albanian part of the lake, a total of 14 fish species was recorded (Table 4.5.5).

Table 4.4.5. Fishes that were reported from Shiroke and Koplík from GIZ (2017), with the threatened status (where applicable)

Fish species	*Red List Albania	*Red List Montenegro
<i>Alburnoides ohridanus</i>		LC
<i>Alburnus scoranza</i>	VU	NT
<i>Alosa fallax</i>	VU	VU
<i>Carassius gibelio</i>	-	-
<i>Cyprinus carpio</i>		VU
<i>Rhodeus amarus</i>		LC
<i>Rutilus prespensis</i>		LC
<i>Pachychilon pictum</i>	LC	LC
<i>Chondrostoma nasus</i>	LC	
<i>Perca fluviatilis</i>	-	-
<i>Pseudorasbora parva</i>	-	-
<i>Scardinius knezevici</i>	DD	LC
<i>Squalius platycephs</i>	LC	LC
<i>Cobitis ohridana</i>	DD	EN

* The two columns with the Red Lists status (for Albania and Montenegro) did not exist in the original list from GIZ (2017). They have been inserted by the author for the purpose of this report. The Red List for Albania refers to Dhora, 2016. The Red List for Montenegro refers to Maric (2018).

As seen from the Table 4.4.5, 7 fish species are included in the Albanian Red List and 10 fish species in the Montenegrin Red List.

Among the fishes caught were three non-indigenous species, such as *Perca fluviatilis*, *Carassius gibelio* and *Pseudorasbora parva*. The most common species over the three years were *Perca fluviatilis*, *Alburnus scoranza* and *Rutilus prespensis*, while chub *Squalius platycephs* was detected only once (in 2015). Species were evenly distributed at the two sampling sites (Shiroke and Koplík). Regarding vertical distribution, *Alosa fallax*, *Carassius gibelio*, *Scardinius knezevici* and *Alburnoides ohridanus* showed, in tendency, a preference for shallow water, while *Cobitis ohridana* was caught primarily in deeper waters (Figure 4.4.3).

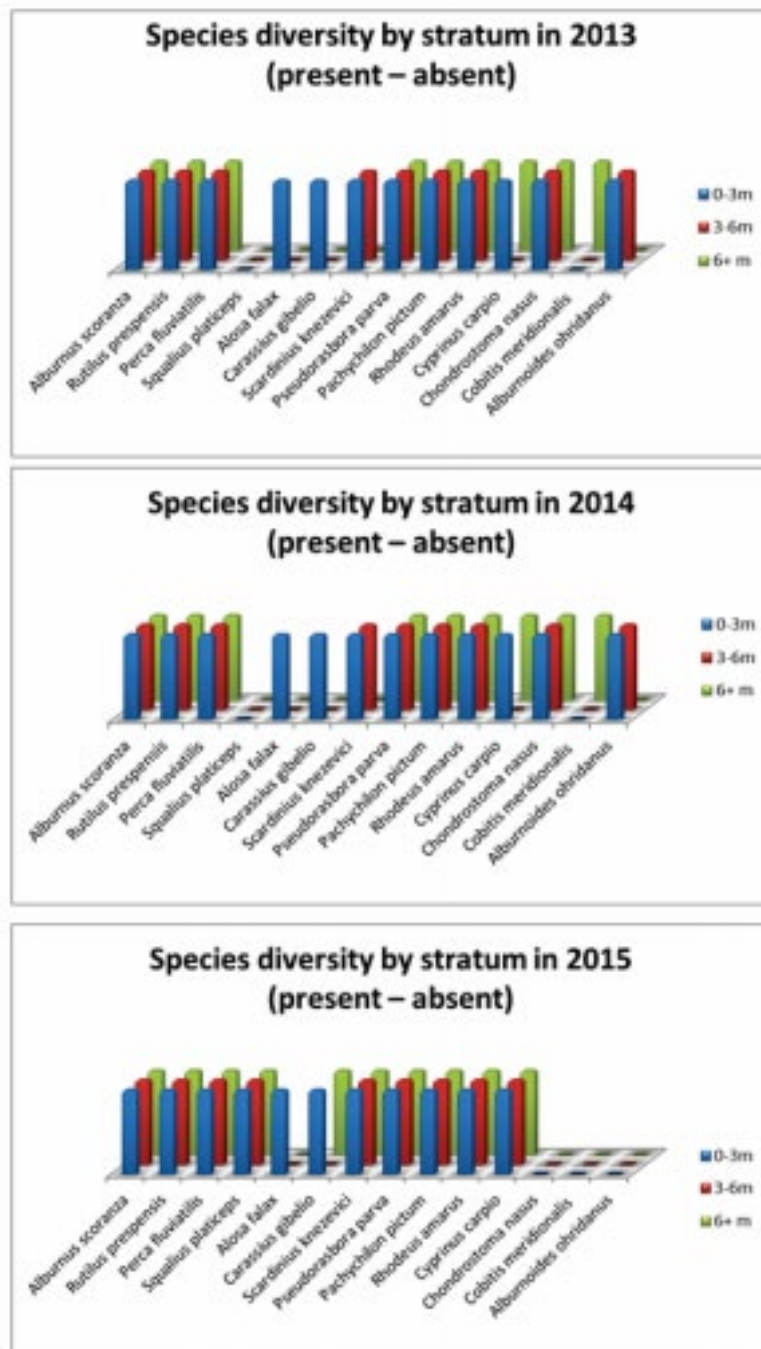


Figure 4.4.3. Occurrence of fish species in various depth strata and years in Shiroke and Zogaj, after GIZ (2017)

Relative species abundance was almost even between years of sampling. Most of the fish caught were roach (*Rutilus prespensis*) and bleak (*Alburnus scoranza*), and also stone moroko (*Pseudorasbora parva*) contributed in significant numbers to the overall catch in any one year and in any depth strata. Nase (*Chondrostoma nasus*) and spotted roach (*Pachychilon pictum*) occurred regularly, but in smaller numbers, while perch (*Perca fluviatilis*) became abundant in the final year of sampling (2015).

Data provided from this fish monitoring (after GIZ, 2017) highlight again the importance of the project area (Shiroke, in this case) as habitat for several fish species, especially bleak (*Alburnus scoranza*), roach (*Rutilus prespensis*) and nase (*Chondrostoma nasus*), as also stated in previous publications. In terms of economic aspects for local community, this area is also important for perch (*Perca fluviatilis*), Prussian

carp (*Carassius gibelio*) and stone moroko (*Pseudorasbora parva*), but these are introduced species, even invasive, and their use for indicating the importance of habitats should be treated in another point of view (which is not a subject for this report).

Concerning the important habitats in the relevant project area, the *Management Plan of Shkodra Lake Protected Area* (APAWA et al., 2012), based on experts' judgment, as mentioned earlier in this report (Chapter 4.3), have stated the following habitats found in Shiroka – Zogaj – Liria:

- The Shiroka coast, important sheltering habitat for the bleak *Alburnus scoranza* during winter;
- The Zogaj coast, important sheltering habitat for the bleak *Alburnus scoranza* during winter;
- Coastal waters with gravel bottom along the segment Shiroka – Zogaj, as reproduction habitats for *Chondrostoma nasus*;
- Western coast of the lake, where bleak (*Alburnus scoranza*) reproduces in spring season;
- Forest area of Zogaj in Taraboshi, very interesting in floristic aspect; and
- Forest area "Fshati i Paqes" in Taraboshi Mountain, interesting in floristic aspect.

In the *Management Plan* (APAWA et al., 2012), the 6 habitats mentioned above have been listed as *threatened, sensitive and most important habitats* (among 16 habitats stated for the whole Albanian part of Shkodra Lake), as habitats of a special importance, due to their ecological sensibility, presence of rare and threatened plant and animal species, suitability for sheltering, nesting or feeding, especially for fish and birds.

5 Main Findings, Gaps and Suggestions

5.1 Main Findings

- The main Project area (Shiroka – Zogaj) is characterized by endemic, rare and threatened species of plants (aquatic and terrestrial), fish, birds and invertebrates. Several species are threatened at global, European, Mediterranean and national levels, referring to the IUCN Red List, Bern Convention, CITES Convention, EU Habitats Directive and EU Birds Directive.
- The Project area is characterized by important aquatic and terrestrial habitats, of special conservation concern, according to *EU Habitats Directive*, including NATURA 2000 habitat, as well as stated in the existing *Shkodra Lake Management Plan* and other scientific and environmental documentation about Shkodra Lake (scientific publications, projects' reports, strategies).
- Shiroka shoreline, Zogaj shoreline and the shallow waters with gravel bottom along the segment Shiroka – Zogaj are important as reproduction and nursery habitats for fish, especially for bleak *Alburnus scoranza* and nase *Chondrostoma nasus*. These species are important in economic aspects for local community.
- The forest area of Zogaj in Taraboshi and the Forest area "Fshati i Paqes" in Taraboshi Mountain between Shiroka and Liria are very interesting in a floristic aspect. Besides the biodiversity and environmental values, these forest areas are also important socio-economic aspect for the local community as touristic and recreational attraction.
- The planned project developments (for water supply, sewerage systems/wastewater treatment and solid waste management) will be carried out within the territory of Shkodra Lake Protected Area and near a core area in Zogaj. Hence, the mitigation measures will be carefully planned, in order to reduce the possible impact to biodiversity and Lake water quality as much as possible, from the possible leakage of sewerage/wastewater, physical impacts during the construction phase (for establishing the pipe systems and the wastewater treatment plant(s), inert residuals and all

other possible impacts related to the operational phase. It is not envisaged that there will be any net loss in biodiversity features/habitats. Furthermore, mitigation measures will be designed to achieve no net loss, and preferably a net gain, of priority biodiversity features over the long term.

5.2 Main Gaps

- Despite the increased intensity of studies, surveys and assessments of Shkodra Lake, its biodiversity, ecological and environmental state during the last 20 years, there is still poor knowledge of some biotic groups.
- Often, it is difficult to reach a full data elaboration and concluding with a full list of species and habitats, as well as assessment of their threatened status and environmental state, because of the following reasons: different studies and publications refer to different study areas, some of them referring separately to: 1) Lake Shkodra only; or 2) Lake Shkodra with the surrounding wetland areas; or 3) Lake Shkodra and its tributaries (rivers), or 4) the whole lake watershed area, up to 1900 m a.s.l. Many surveys and assessments have been done separately for the Albanian part and for the Montenegrin part of the Lake; protection status of the lake is different between the two countries (National Park in Montenegro; Managed Nature Reserve in Albania).
- Several existing publications (especially project reports), even though they have been published recently, mainly refer to old data (as mainly based on desk study only). Hence, they often do not reflect the current or recent situation of Shkodra Lake.
- A lot of data on species presence and ecological state has often been mentioned in general for the Lake, or for its watershed, without referring to a specific site and period, where and when the data have been provided. Additionally, quantitative assessments for some biotic groups are missing, or scarce, or not based on standard methods. This hampers the reliable assessment of environmental state and current impacts on the project area.
- Very limited surveys have been done on benthic macroinvertebrates (macro zoobenthos) in the Albanian part of Lake Shkodra. This animal group is one of the best indicators for the ecological and environmental state of a lake, and it is supposed to be among the most impacted groups (like the whole benthic habitat) from the planned project developments in Shiroka – Zogaj area.

5.3 Suggestions

- Regarding new proposed infrastructure, one of the possible options for the treatment of collected sewage in Zojaj is to provide a separate wastewater treatment plant(s) whereby sewage will be treated to appropriate Albanian and European standards. If this option is chosen, it is recommended that any plant(s) will be established outside the border of the core area, in the south-west of the village (see the map of the Shkodra Lake Protected Area for details and the arguments given in Chapter 3.1 Environmental context of the project area in this report) - already used and altered previously for urban / touristic / or other infrastructure developments, to avoid destruction of additional natural habitats in the Project area.
- If this option is not possible, then it is suggested to establish the treatment plant(s) in a possible barren area from vegetation, or in an area where the vegetation is not well developed and does not imply any important habitat loss.
- To ensure fulfillment of the water quality standards (for chemical and microbiological parameters) at the discharge of wastewater treatment plant, provide monitoring once the facility is fully operating.
- Prepare and implement an environmental monitoring program for the impacted area, considering short-term, mid-term and long-term monitoring, possibly within an integrated Environmental and

Social Management and Monitoring Program (ESMMP). Proposed environmental monitoring should include (but not be limited to): benthic invertebrates, macro-vegetation, fish, water chemical and microbiological analysis, according to the WFD (2000/60/EC) standards. Within this framework, it is recommended an initial rapid assessment (survey) of benthic habitat in Zogaj and Shiroka Project area, in order to have an initial characterization of the impacted sites, before the construction phase, and to use the collected data for comparison with the monitoring surveys in the future, within the proposed ESMMP.

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