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Lake Skadar-Shkoder Integrated Ecosystem Management Project (LSIEMP)

**DEVELOPMENT OF SKADAR-SHKODER LAKE MANAGEMENT STRATEGY AND
NATIONAL FISHERY MANAGEMENT PLANS**

Fishery Management Plan – Montenegro **-Skadar/Shkodra Lake-**

DRAFT FINAL REPORT

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This is the Final Report Draft for the project “Development of Skadar-Shkoder Lake Management Strategy and National Fishery Management Plans (part Fishery Management Plans – Montenegro & Albania)” for the period from October 15 to December 15, 2011.

The implementation of the project implies:

There are two **Joint Visions** for Skadar – Shkodra Lake area at this moment:

1. Joint Vision of Joint / Transboundary Skadar – Shkodra Forum given in the Declaration on Skadar / Shkodra Lake (2nd February 2006) that *fosters **Protection and Management of Lake’s Natural Resources** and Sustainable Development* at local level.
2. Joint Vision Statement given in the Joint Strategic Action Plan (2007) given in the following formulation: *Skadar/Shkodra Lake is a **Trans-boundary equally Protected Area**. The level of protection is in accordance with high environmental **standards**, high **water quality** and rich biological diversity. Skadar/Shkodra Lake is an area for **sustainable activities** and it offers authenticable ecological, historical, cultural, rural and educational experience with a lot of unique places to see and visit. The environment is smartly integrated in regional economy as regards sustainable tourism, fishery, safety food production, medical plants, clean water use, etc. The lake is used in sustainable manner, with cross-border cooperation and management and high ecosystem protection.*

Sustainable development and *Protection* of Skadar – Shkodra Lake Natural Resources and Protected Areas are common key issues in both Joint Visions (from: Lake Skadar-Shkoder Integrated Ecosystem Management Project (LSIEMP) - Skadar-Shkoder Lake Management Strategy, 2012).

- In accordance with the Joint Visions for Skadar – Shkodra Lake key words: trans-boundary protected area, high environmental standards, high water quality, rich biological diversity, sustainable activities as a tourism, fishery, safety food production, medical plants, clean water use, etc., used in sustainable manner, cross-border cooperation and management and high ecosystem protection, the General Objective of this project could be determined as adoption of national FMPs for the Lake Skadar (in Albania and Montenegro), which would back up the integrity of the lake ecosystem and fish resource and also sustainable fishing development, through the implementation activities and recommendations, and which would be accommodated with the possibilities for multipurpose of the fish resources, and harmonized with the relevant national and international legislation and plans.

Deriving from the general objective, it is possible to define some specific objectives

- 1. Pursuing Skadar Lake fish stocks and ecosystem sustainable usage in commercial and ecological terms, to the benefit of the local communities (currently and for the future) in Albania and Montenegro. This usage should be referred to commercial and recreational fishing, and fishing ecotourism as well.
- 2. Setting out and expanding fishery management system, which would include all important stakeholders in Albania and Montenegro, so as to ensure the optimal usage of the fish resources, within commercial and ecological sustainability framework.



- 3. Establishment of the co-management system in both countries, based on the regulations which would assure reliable information on the fishery stock status, fishery characteristics and social and commercial fishery indicators.

Some of the expected outputs could be determined as:

- Raising awareness on the importance and the role of the fish resources sustainable utilization by various beneficiaries on the Lake Skadar, which is considered as natural resource capacity;
- Setting out the fish resources utilization framework, in line with the principles of the Precaution and Protection of the fish diversity and their natural habitat;
- Setting out the monitoring system regarding fish resources of the Lake Skadar by making beneficiaries its integral component.

The freshwater Fishery in the Republic of Montenegro is regulated by the Law on Freshwater Fishery („Official Gazette of the Republic of Montenegro”, No. 11/2007) and therefore, the fishery on the Lake Skadar is subjected to its provisions. This law regulates the manner of use, protection, conservation, breeding and catching fish in the fishing waters. This Act prescribes the content of FMP. It is quoted in Article 13 that: “In terms of the sustainability of the fish stocks, fishing basis for certain fishing waters shall be set out by the Ministry in cooperation with the competent scientific institution. Fishing basis shall be set out for a period of six years.

In particular, fishing basis comprise:

- Freshwater fishing data;
- Basic hydrological, physical, chemical and biological freshwater characteristics;
- Fish fauna varieties, quantity and their health status;
- Fish fauna protection and preservation measures and their implementation;
- Maximum daily and annual quantity of the allowed catch per fish species, determined on the quantity of the fish fauna and annual fish biological productivity;
- Measures for protection and conservation of fish stocks and way of implementation of these measures
- The Fish population growth Programme (in specific time framework, having in mind its quantity and fish species)
- Freshwater capacities marking programme for construction of facilities for aquaculture;
- Protection measures regarding specific habitats;
- Freshwater utilization and protection measures, in accordance with the legislative regulation on water management;
- Organization of the oversight monitoring system
- Economic grounds for freshwater management

In accordance with the national legislation of the Republic of Montenegro, and the Terms of Reference, the five-year FMP is being extended within the project “Development of Skadar-Shkoder Lake Management Strategy and National Fishery Management Plans”.



1. BASIC DATA ON SKADAR LAKE

Skadar Lake is located in the south-eastern part of Montenegro (E 19°15' N 40°10'). Being a flooded limestone field emerged due to tectonic disturbances, its water capacity discharges a great part of the Zeta-Skadar limestone depression, forming a unique geotectonic and geomorphologic complex. The lake has an elliptical shape, approximately 162 km in size, and extends about 50 km towards the north-east; its maximum wideness is about 14 km. The surface of the lake varies in the range from 350 km² to 530 km², depending on precipitation and water flow, while its depth varies from 1 to 5 m in its north-eastern part, and from 3 to 9 m in its south-western part, about 7 m in average. Skadar Lake is charged with water through a great number of subterranean sub-lacustrine wells (so-called "oko"), up to 60 m deep springs, such as "Radusko oko". Skadar Lake is the confluence of various rivers: Moraca Kratun, Rijeka Crnojevica, Plavnica, Crmnica, Zetica, Pjavnik, in Montenegro and Proni Tat, Rijola and Vraka, in Albania. The river that flows out of the Skadar Lake in its south-eastern part is the River Bojana. In terms of climate, the main features of Skadar Lake are aridity, varying precipitation and winds, mostly those blasting from the southwest, that differ in directions and intensities.

Approximately two thirds of the Skadar lake is located in Montenegro, one-third in Albania. Population of smaller and larger settlements on its banks in Montenegro and Albania is mostly engaged in the commercial fishing, which is the main economic activity.

2. ENVIRONMENTAL AND BIOLOGICAL DATA ON SKADAR LAKE

2.1. Water quality and its environmental requirements

The environmental requirements and the living world records are listed in outdated scientific study The Biota and limnology of Lake Skadar, 1981. These are the data published in the Report of the Hydrological and Meteorological Service of Montenegro for 2009.

More recent water quality records refer to the year 2009, and are based on the regular basis on-site monitoring carried out by the Hydrological and Meteorological Service of Montenegro (profiles of Vranjina, Virpazar, Plavnica, Kamenik, Podhum, Starceva gorica, Moracnik, Ckla, very centre of the Lake), including the water quality monitoring on the profile of Fraskanjel, on the Bojana River. The respective measurements are referring to the air temperature, water temperature, its pH value, electro conductivity, dry residue, suspended material, dissolved oxygen quantity, and saturation, BPK₅, HPK, water hardness, concentration of the ions of calcium, magnesium, bicarbonates, calcium/magnesium ratio, sodium, potassium, iron, ammonium ions, nitrite, nitrate, phosphate, sulphate, chloride, phenols, detergents.

Based on the verified data, the water quality of Lake Skadar is estimated as satisfactory (within the limits, or belong to category II, classes A2, C, K2 according to the Ordinance on classification and categorization of surface and underground water, Official Gazette of Montenegro No 2/07) in all investigated locations, despite the significant anthropogenic pressures. From the point of production it has been assessed that in the littoral area dominant process refers to production, while the pelagic area processes of production and decomposition of biomass are being revolved. The main reason for the reasonable value of the water quality is the fact the lake itself represents a hydrologic flow system in which the water changes at least 2 times a year. In addition, the rich developed floating and submerged vegetation in littoral area of the lake has an important role in removing nutrients and other substances from water. The numerous groundwater springs on the bottom of the lake also have a favourable effect on the water quality.



Skadar Lake water temperature depends on the season, so in early spring and late fall it is moving in the range 10-20°C, while in summer this interval is 20-30°C. Varying of the water temperature is more distinguished in the littoral area and near the mouth of confluences. Skadar lake water is characterized by low values of suspended material, which are often below the detection limit.

As expected, the statistical analysis of series of calcium and magnesium ions ratio testing (Ca/Mg) and calcium and sodium ratio (Ca/Na) analysis revealed that the hydro chemical system is much more stable in the pelagic than in littoral area.

Other relevant parameters referring to the amount of fish life are dissolved oxygen amount and its saturation. The dissolved oxygen amount in the Skadar Lake is in range between 6.9 and 9.1 mg/l, or between 66-135%. As the measurements were performed during the period July-November, it can be estimated that the oxygen status, in the water of Lake Skadar, is favourable for normal fish life during the whole year.

Other water quality parameters favourable for fish life are within limits, as in the following table (Table 1.).

Table 1. Review of water quality parameters varying range

Water Quality Parameters	Scope of Variation
pH	8,2 - 8,4
Electro conductivity ($\mu\text{S/cm}$)	191 – 291
Dry residue (mg/l)	119 – 245
Suspended material (mg/l)	0 – 3
O ₂ (mg/l)	6,9 – 9,1
Saturation O ₂ (%)	66 – 135
BPK ₅ (mg/l)	1,2 – 2,8
HPK (mg/l)	1,2 – 3,2
HCO ₃ ⁻ (mg/l)	140 – 198
Hardness (dH°)	5,5 – 8,2
Ca ²⁺ (mg/l)	31,3 - 48,6
Mg ²⁺ (mg/l)	7,0 – 8,0
Na ⁺ (mg/l)	2,1 – 5,6
K ⁺ (mg/l)	0,2 – 0,7
Fe ²⁺ (mg/l)	0,05 – 0,15
NH ₄ ⁺ (mg/l)	0,04 – 0,31
Cl ⁻ (mg/l)	6,0 – 8,4
SO ₄ ⁺ (mg/l)	6,6 – 12,2
PO ₄ ³⁻ (mg/l)	0,04 – 0,21
NO ₃ ⁻ (mg/l)	0,1 – 1,27
NO ₂ ⁻ (mgN/l)	0,000 – 0,011



Phenols (mg/l)	0,000
Detergents (mg/l)	0,001 - 0,052
Reference: Hydrological and Metrological Service of Montenegro	

2.2. *Phytoplankton, zooplankton, macro invertebrates, macrophytes*

Phytoplankton, zooplankton, macro invertebrates, macrophytes carry on an important part in the use of fishing resources as a key component of trophic ecosystem Structure of Lake. Phytoplankton, zooplankton and invertebrates play a direct part as a food resource for all fish species, in different development stages, and macrophytes represent a complex habitat for both fish spawn and for the fish in “older” stages of their development. Unfortunately, only a few scientific studies examine the interrelationship between these communities and fish in Lake Skadar. On the other hand, the overview of species richness and composition of plankton communities, benthic invertebrates and macrophyte vegetation can be found in “old” scientific papers (The Biota and Limnology of Lake Skadar, 1981) and literature on fishery (Fishery-economic basis of the Skadar Lake, I and Part II, 1978), although recent reports (FISHERIES ASSESSMENT IN LAKE SHKODRA - Shkoder, ALBANIA & MONTENEGRO. Progress Report, May 2011) contain more updated scientific references.

Phytoplankton in Skadar Lake comprises rich, diverse and heterogeneous communities β -mezosaprobic type, in general. The composition of phytoplankton particularly includes sea-plants from the category of *Chlorophyta* (308 types and varieties), *Pyrrophyta* (9), *Cyanophyta* (49), *Chrysophyta* (110) and *Euglenophyta* (65), more than 500 types and varieties are being identified in total. Composite seasons' dynamics and various spacing in the pelagic zone of the lake as well as in the macrophytes vegetation zone are most important features of phytoplankton communities (The Biota and Limnology of Lake Skadar, 1981; Fishery-economic basis of the Skadar Lake, I and Part II, 1978)..

Skadar lake zooplankton (with microfauna) is being represented by more than 355 registered types from the category of *Rotatoria*, *Cladocera*, *Copepoda*, *Protozoa*, *Lamellibranchiata*, *Ostracoda*, *Bryozoa*, *Gastrotricha*, *Hydrozoa* and *Spongia*. As phytoplankton, zooplankton communities are also being featured with composite seasons' dynamics and various spacing. The shrimps from the category *Cladocera*, *Copepoda* and *Ostracoda*, being the natural food for the spawn of the most of the fishes in Skadar Lake, are the most important in these terms (The Biota and Limnology of Lake Skadar, 1981; Fishery-economic basis of the Skadar Lake, I and Part II, 1978)..

The Lake Skadar Macroinvertebrates are very heterogeneous (*Gastropoda*, *Bivalvia*, *Oligochaeta*, *Isopoda*, *Amphipoda*, *Decapoda*, *Diptera*, *Ephemeroptera*, *Trichoptera* groups etc.). Species, such as those of *Oligochaeta* and *Chironomidae* group (*Diptera*), are prevailing in the zoobenthos. These are widely spread on the lake bottom surface and have an important role in the fish nourishment. In the shallow coastal zones and in the macrophyte vegetation area, the clamshells from the genera *Dreissena*, *Anodonta* and *Unio* are being predominated in the zoobenthos. A significant quantity of the crabs can also be encountered in those lake areas. In general, macroinvertebrates of the Skadar Lake comprise of the freshwater species, with certain marine and brackish water elements. Being vigorously originated macrophytes vegetation in the Lake Skadar is distinguished by the species of the genera *Phragmites*, *Scirpus* forming the Emerged aquatic vegetation, *Nuphar*, *Nymphaea*, *Trapa* forming the Floatant aquatic vegetation and *Myriophyllum*,



Ceratophyllum, *Potamogeton*, *Ranunculus* forming the submerged aquatic vegetation (The Biota and Limnology of Lake Skadar, 1981; Fishery-economic basis of the Skadar Lake, I and Part II, 1978)..

Macrophytes vegetation is particularly lush in the shallow parts of the lake and it is an important part of the fish community life cycles, since those lake areas represent the environment suitable for spawning, nourishment and hidden habitat for spawn and juvenile fish. The Skadar Lake is the combination of two limnology types: the deeper and more open part is oligotrophic, while the shallow part, overgrown by vegetation is eutrophic, in terms of the trophic status (The Biota and Limnology of Lake Skadar, 1981; Fishery-economic basis of the Skadar Lake, I and Part II, 1978)..

2.3. Basic data on the species of fish in Lake Skadar, (*ichthyofauna, economically significant species, fish stocks and its health status*)

Based on several literature sources (Maric i Milosevic 2009, Maric, 2010, Mrdak 2009, FISHERIES ASSESSMENT IN LAKE SHKODRA - SHKODER, ALBANIA & MONTENEGRO. Draft Final Report, 2011, Talevski *et al.*, 2009) Lake Skadar is being inhabited by 49 species from 17 families, and 3 species of lamprey (*Lampetra planeri*, *Lampetra fluviatilis*, *Petromyzon marinus*), with no fishing importance, and therefore omitted in the Table 2.

Table 2. Fish species in Skadar Lake

Family	Scientific name	Name in English	Albanian name	Montenegrin name
1. Acipenseridae	1. <i>Acipenser sturio</i> Linnaeus, 1758	Sturgeon	Blini	Atlanska jesetra
	2. <i>Acipenser naccarii</i> Bonaparte, 1834 -1841	Adriatic sturgeon	Blini i Adriatikut	Jadranska jesetra
2. Clupeidae	3. <i>Alosa fallax</i> (La Cepède, 1803)	Twaite shad	Kubla	Kubla, Morska fraga
	3a. <i>Alosa sp. (A. agone)</i>	Twaite shad	Kubla e liqenit	Zimska fraga, Kublica
3. Moronidae	4. <i>Dicentrarchus labrax</i> (Linnaeus, 1758)	European sea bass	Levreku	Lubin
4. Mugilidae	5. <i>Mugil cephalus</i> Linnaeus, 1758	Flathead grey mullet	Qefulli i gushtit	Cipal
	6. <i>Lisa ramada</i> Risso, 1826	Thinlip mullet	Qefulli i vjeshhtës	Skocac balavac
5. Anguillidae	7. <i>Anguilla anguilla</i> (Linnaeus, 1758)	European eel	Ngjala	Jegulja
6. Citharidae	8. <i>Citharus linguatus</i> (Linnaeus, 1758)	Spotted flounder		pljosnatica, pataraca
7. Pleuronectidae	9. <i>Pleuronectes flesus</i> Pallas, 1811	European flounder	Shojza	Iverak
8. Cyprinidae	10. <i>Cyprinus carpio</i> Linnaeus, 1758*	Carp	Krapi	Krap, Saran
	11. <i>Squalius platyceps</i> Zupancic, Maric, Naseka & Bogutskaya, 2010	White chub	Klen	Klen
	12. <i>Telestes montenegrinus</i> (Vukovic, 1965)	Montenegrus chub	Skorti me vizë	Moracka jelsovka
	13. <i>Phoxinus lumaireul</i> Schinz, 1840	Minnow	Cigani italian	gaovica, gagica, zelenak,
	14. <i>Rutilus albus</i> Maric, 2010	White roach	Skorti i Shkodrës	Bijeli brcak
	15. <i>Pachychilon pictum</i> (Heckel et Kner, 1858)	Sharadon	Skorti shqiptar Skorti i zi	Saradan
	16. <i>Scardinius knezevici</i> (Bianco & Kottelat, 2005)	Rudd	Gërmuqi Lloska e Shkodrës	Lola
	17. <i>Rutilus prespensis</i> (Karaman, 1924)	Yellow roach	Skorti i Prespës	Sutalj, Brona
	18. <i>Alburnus scoranza</i> (Heckel et Kner, 1858)	Bleak	Gjuca	Ukljeva



	19. <i>Alburnoides ohridanus</i> (Karaman, 1928)	Ohridia schneider	Cironka (Gjuca e Ohrit)	Ohridska ukljevica
	20. <i>Chondrostoma ohridanus</i> Karaman, 1924	Beak carp	Skobuzi Njila Ohrit	Ohridski skobalj
	21. <i>Chondrostoma scodrensis</i> Elvira, 1987	Scadar's beak carp	Njila	Skadarski skobalj
	22. <i>Barbus rebelii</i> Köller, 1925	Rebel barbel	Mrena e Fanit	Jadranska mrena
	27. <i>Pelasgus minutus</i> Karaman, 1924	Montenegrin minnow carp	Gurnec Grunci i Ohrit	Ohridska gaovica
	23. <i>Gobio skadarensis</i> Karaman, 1936	Skadar gudgeon	Mrena njëmustakore e Shkodrës	Skadarska mrenica
	24. <i>Rhodeus amarus</i> (Bloch, 1782)	Bitterling	Idhtaku	Gavcica
9. Balitoridae	25. <i>Barbatula zetensis</i> (Soric, 2000)	Bearded stone loach	Tufëza e Shkodrës Mrena e egër	Zetska brkica
	26. <i>Cobitis ohridana</i> Karaman, 1928	Ohrid Loach	Mrena e egër e Ohrit	Vijun
10. Gasterosteide	27. <i>Gasterosteus gymnurus</i> Cuvier, 1829	Three-spined stickleback	Gjëmbaçi	Bodonja
11. Gobiidae	28. <i>Knipowitschia montenegina</i> Kovacic & Sanda, 2007	Pamzgo goby	Barburiqi malazez	Moracki vodenjak
	29. <i>Pomatoschistus montenegrensis</i> Miler & Sanda, 2008	Montenegrin sand goby	Burdullaku i Shkodrës	Moracki vodenjak
	30. <i>Pomatoschisticus marmoratus</i>	Tubenose goby	Burdullaku i mermertë	Mramorasti glavoc
12. Salmonidae	31. <i>Salmo farioides</i> Karaman, 1937		Trofta e Drinit	Primorska potocna pastrmka
	32. <i>Salmo marmoratus</i> Cuvier, 1817	Bighead trout	Trofta e mermertë Troftë njile	Glavatica
	33. <i>Salmo zetensis</i> Hadzisce, 1962	Adriatic trout	Trofta buzëbutë	Zetska mekousna
13. Bleniidae	34. <i>Salaria fluviatilis</i> Asso, 1801	Sharibrack	Barburiqi	Rijecna slingurica
Allochthonous fish				
Cyprinidae	35. <i>Ctenopharingodon idella</i> (Valenciennes, 1844)	Grass carp	Amuri i bardhë	Bijeli amur
	36. <i>Megalobrama terminalis</i> (Richardson, 1844)	Black amur bream	Pëllëmbëza e zezë	Amurska deverika
	37. <i>Tinca tinca</i> (Linnaeus, 1758)	Tench	Tinka	Linjak
	38. <i>Carassius gibelio</i> (Bloch, 1783)	Prussian carp	Karasi prusian	Srebrni karas
	39. <i>Hypophthalmichthys molitrix</i> (Valenciennes, 1844)	Silver carp	Ballëgjeri i bardhë	Bijeli tostolobik
	40. <i>Hypophthalmichthys nobilis</i> (Richardson, 1844)	Bighead carp	Ballëgjeri laraman	Sivi tostolobik
	41. <i>Mylopharingodon piceus</i> (Richardson, 1845)	Dark carp		crni amur, kineska plotica
	42. <i>Pseudorasbora parva</i> (Schlegel, 1842)	Amurian minnow	Notaku	Amurski cebacok
14. Poeciliidae	43. <i>Gambusia holbrooki</i> (Girard, 1859)	Eastern mosquitofish	Barkaleci pikalosh	Gambuzija
Salmonidae	44. <i>Salvelinus fontinalis</i> (Mitchill, 1815)	Brook trout	Troftë e përrenjve	potocna zlatovcica
	45. <i>Oncorhynchus mykiss</i> (Walbaum, 1792)	Rainbow trout		
15. Percidae	46. <i>Perca fluviatilis</i> Linnaeus, 1758	Perch	Perka	Grgec
	47. <i>Sander lucioperca</i> (Linnaeus, 1758)	Pike-perch	Luçioperkë Sharmaku i egër	Smud
16. Thymalidae	48. <i>Thymalus thymalus</i> (Linnaeus, 1758)	Grayling	Freskori Losa	Lipljen
17. Ictaluridae	49. <i>Ameiurus nebulosus</i> (Lesueur, 1819)	Brown bullhead	Peshk mace kafe	Patuljasti americli somic
* Since it was introduced into the lake during the Roman Empire, carp should not be considered as allochthonous invasive species, as it represents the symbol of the lake and the main fishing species.				



In the above table, species from 1 to 9 are being referred as Adriatic migrants; some of them seasonally occur in Lake Skadar. Species like *Twaite shad* (marked as 3 and 3a) and *Eel* (7), also being referred as migratory fish species, have great economic importance in terms of commercial fishing. Native cyprinid species, carp and bleak, have great importance in commercial fisheries and they represent the main fishermen catch in Lake Skadar. Salmonid fish species can be found in Lake Skadar seasonally. They do not have greater importance for commercial fishing, being very scarce in the full-scale fish catch. Nevertheless, there are several endemic forms, among listed species, that might be of interest in terms of biological and conservation aspect.

In terms of commercial fishing, the most interesting types of the allochthonous fish species are those marked as 38 and 46 in the table (primarily because of their high level of the relative representation). However, having in mind certain characteristics, these species do not have high market price, and therefore are mainly used in the diet of the local population.

So, based on the before mentioned, it can be said that referring to the fish fauna of Lake Skadar these are the species with the most important economic significance (Table 3.):

Table 3. Fish species with the most important economic significance.

1. <i>Alosa fallax</i>	Twaite shad
1a. <i>Allosa sp.</i>	Twaite shad
3. <i>Anguilla Anguilla</i>	European eel
4. <i>Cyprinus carpio</i>	Carp
5. <i>Alburnus scoranza</i>	Bleak
6. <i>Carassius gibelio</i>	Prussian carp
7. <i>Perca fluviatilis</i>	Perch
8. <i>Rutilus prespensis</i>	Yellow roach
9. "Scrap fish" (<i>Scardinius and Pachyhilon</i>)*	rudd and spotted roach
*	

In addition to these species, here follows the list of species with minor economic importance:

1. White chub (*Squalius platyceps*),
2. Beak carp and Scadar's beak carp (*Chondrostoma ohridanus* and *Chondrostoma scodrense*),

On the other hand, prussian carp and perch, which were introduced into the Skadar lake, present almost one third of the total fish catch in the lake (Mrdak 2009). As invasive fish types, due to their population explosion, predatory feature (perch), strong competitive characteristics (prussian carp) these fish types significantly suppressed some native species. Apart from the commercial importance acquired in the past 30-40 years, these two fish species should be addressed to in the specific manner in terms of monitoring, because of their impact on the native fish fauna, especially having in mind the high level of endemism among the fishes of Lake Skadar (Mrdak 2009).

Decree on fishing restrictions, limitations and fish stocks protection measures (Official Gazette of Montenegro 19/11), among other things, defines the period for closed



seasons and minimum measures for fishing in terms of the size of the fish (Table 4.), as follows:

- Bleak from 15 March to 31 October;
- all types of trout from 1 November to 1 April;
- Nase from 1 February to 1 June;
- Other *ciprinide* (carp-carp, chub, Lola and others) from 15 March to 1 June;
- Twaite shad and eel from 1 March to 1 June.

Table 4. The minimum measures for fishing in terms of the size of the fish.

Type/Subtype	Length
Bleak	16 cm
Carp	40 cm
Mullet	25 cm
Grayling	30 cm
Trouts (River trout, Rainbow trout, Adriatic trout and Artic Char)	25 cm
Lake trout and <i>Salmo Dentex</i>	30 cm
<i>Salmo marmoratus</i> and <i>Danubian Salmon</i>	50 cm

With this Decree, it is prohibited to perform commercial fishing with devices and fishing apparatus below the minimum size of the eyelets, or diameter, as follows:

- Bleak grib or purse net below 15.5 mm,
- Bleak frost (stagnant) below 15.5 mm,
- Other fishing instruments (carp net, barracudas gillnet, nase net, etc) below 60 mm.

The Decree defines that the sport and recreational fishing in fishing areas may be performed using maximum two sticks with three hooks on each pole.

Pursuant to Article 25 of the Law on National Parks (Official Gazette 47/91) and the Statute of the Public Enterprise of National Parks of Montenegro, in 2005, the Board of the company passed the Decision on requirements for commercial fishing on Lake Skadar, which defines the parts of the Skadar lake where commercial fishing shall be carried out by citizens, during its time duration, fish species allowed to be caught, fishing devices needed to perform commercial fishing, parts of the lake where fishing is prohibited and other issues regarding commercial fishing performance.

It has been stipulated in the respective Decree that commercial fishing shall be carried out in the waters of Lake Skadar, except in designated places, listed as follows:

- Fishing spots within protection zone,
- In the locations called Crni zar, Panciceva oka, Omerova gorica, Manastirski vrbis and Grmozur,
- On the location called Tanki Rt at 500 m on either side of the bridge,
- Downstream the river to the places called Crnojevica Gradina and Lisinj.

Where it is allowed, in terms of designated places, commercial fishing can be carried out, except in the closed seasons, regarding all kinds of fish, excluding trout and nase, while exceptionally commercial eel fishing can be carried out during the closed season.

Commercial fishing can only be carried out with registered fishing boat, motor power up to 10 HP and visibly marked fishing equipment. Carp and other fish species may be hunted with a maximum of 20 net whose diameter is below the eyelets 60 mm, bleak with a maximum of 10 bleak net whose diameter is below the eyelets 15.5 mm, eel and carp of up



to 10, drum whose diameter is below 25mm eyelets, or the carp below 70mm, and with longlines with a maximum of 500 hooks.

Starting from 15 pm in summer time and 14 pm during winter, fishing equipment may be placed. It also means, their removal should be done on the following day until 9/10 hours (depending on the year season). Commercial fishing on Skadar Lake can be carried out only with the permit issued by the Public Enterprise competent for National Parks of Montenegro Management.

According to the FMP, it is of the utmost importance to assess the daily and annual maximum allowed catch, of each fish species in the lake, determined on the fish stock quantity and annual fish increment. Since there is no record on fish stock characteristics, nor the relevant data and/or evaluations of the current fishing activities, granted or illicit, on the Skadar Lake, it is therefore implied that daily and annual catch share by fish species are likely impossible to be determined.

The protection of the indigenous populations should be introduced in the provisions of the FMP within the spawning programme, determined by the time framework, fish species and their quantity in the lake. As one of the fishery management measures, spawning has been enforced quite often, regardless on the enormous risks that might come along (introduced species, disease spreading, interfering with the genetic structure of the natural fish population, etc). When it comes to the artificial lakes, of the recent date, or the reconstruction of the fish stock after the accidental pollutions accompanied by the massive fish pest, spawning could make more sense. In our opinion, for the next 5 to 6 years, there is no need for spawning in the Skadar Lake. Nesting 5 to 6 tons of carp spawn practically has no impact on the fish resources, since the lake represents the huge fishing water, spreading on more than 350 km², with all the risks remaining. That was exactly how the majority of the introduced species has been introduced into the lake. Nevertheless, the protection of the spawning areas, and the spawn itself, juvenile fish and parent stem is far more effective in terms of the protection of the natural species, including those economically significant, without unnecessary risks.

Fishing water capacity determination programme for the purpose of the **aquaculture facility construction** is another issue that needs further attention. In terms of the Skadar Lake, the necessity of such facility and its justification cannot be left out. The aquaculture would mean farming fish in the cages made for that purpose, which is quite obvious. Since the Skadar Lake is not deep enough for the construction of the facility of that kind, while fish farming corresponds with the significant environmental burdening with the nutrients such as nitrogen and phosphorus, it is our opinion, development of the aquaculture systems should not be considered at the moment.

The special habitats protection measures should refer to the spawning area of the economically most significant fish species (carp, bleak, shad), as well as to the areas important to the migratory species. The main spawning and commercial fishing areas for carp, bleak and shad are being designated in the document "Fisheries Assessment in Lake Shkodra – Skadar - Albania & Montenegro (Progress Report May 2011)" in chapter "Mapping of spawning areas and other essential habitats". In addition to this, the basic pattern of the seasonal distribution of main species of fishes is also being provided. While the mentioned document from May 2011 was being in progress, Final Report Draft of the same document, from December 2011, presented the overview of the spawning and commercial fishing areas by analyzing the status of the four commercially most important fish species population: bleak, carp, shad and prussian carp.

Comparative review of the spawning and commercial fishing areas for bleak (1, 2), carp (3, 4) and twaite shad (5, 6) is illustrated in fig. 1, and it is based on "Fisheries Assessment in Lake Shkodra - Scutari - Albania & Montenegro (Progress report, May 2011



and Final Report Draft, December, 2011)". It is clearly noticeable that the spawning and the commercial fishing areas almost entirely overlap. Having in mind that the spawning fishing prohibitions for the certain fish species differ, previously mentioned overlapping may lead in enhancement of the fishing pressure and interference of spawning on the locations where it occurs, during the spawning periods. The main consequence may be reduced natural spawning effectiveness, and on the long term basis, the decline of fishing stocks. To avoid this situation, it is necessary to:

- harmonize the periods, in spring, of the spawning fishing prohibitions;
- determine the areas with permanent fishing prohibition (one in Montenegro, and one in Albania).

Such measures are proposed in the "Fisheries Assessment in Lake Shkodra - Scutari - Albania & Montenegro (Final Report Draft, December, 2011)."



1 - Spawning areas of bleak



2 - Areas of commercial fishery for bleak



3 - Spawning areas of carp



4 - Areas of commercial fishery for carp



5 - Spawning areas of *Alosa*: red - *A. fallax nilotica*, green - *A. agone*, and yellow -



6 - Areas of commercial fishery on anadromous species



wintering area	
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Fig.1. Comparative review of the spawning and commercial fishing areas for bleak (1, 2), carp (3, 4) and twaite shad (*A. fallax nilotica*, *A. agone*, 5, 6; Reference: "Fisheries Assessment In Lake Shkodra – Skadar - Albania & Montenegro, Progress report, May 2011 and Final Report Draft, December, 2011)".

In order to incorporate the provisions of the respective document into the FMP in Montenegro and in Albania, it is necessary to finalize it, since this is the document in progress.

The available records on **the usage of fishing water in accordance with the respective legislation, structure and the organizational chart of the office for the enforcement of the protection measures and the economic grounds for the usage of fishing waters** were not sufficient for further elaboration in terms of the respective protection measures..

3. STATISTICAL DATA

3.1. Statistical data on commercial fishing

Unfortunately, the review of the currently available data, referring to the Lake Skadar, can be best described by the quote from the Strategy on Fishery Management of the Republic of Montenegro, as it is stated: "The data on the resources status are very scarce and do not provide the insight whether the fish resources capacities are reducing decreasingly or excessively. Still, the catches are recorded in writing".

Statistical data on the catch of fish in Lake Skadar can be determined according to available data referring to certain periods of time. Records of commercial catches of certain species had been properly maintained for the period from 1947 till 1976. Data on the number of boats and the number and types of fishing gear, are also properly recorded. The lack of direct information on CPUE, could be compensated through satisfactory indirect methods. There is certain variety in commercial catches, referring only to the migratory species (eel, shad, shoes, sturgeon) and lake species (carp, bleak, rudd, trout, chub nase). Data records on the fish catch, at the end of that period until 2002, either do not exist or are very fragmented and difficult to reach. Data on fish catch in Lake Skadar from 1947 to 1976, (Tables in the annexes 2 and 3), are no longer useful for the planning of commercial fishing, as the terms and structure of commercial fishing are being changed. Lately (since 2002, the Table 5.), commercial fishing statistics in Montenegro includes five species of fish and the category of "other", with the lack of data on one species (pike) and the category of "mixed fish". On the other hand, it is obvious that the data related to the production of trout in ponds do not to include the trout catch in the open water.

Table 5. Freshwater fish species catch (in tons)

	2002	2003	2004	2005	2006	2007	2008	2009
TOTAL	296	395	751	792	786	441	841	887
Trout	233	302	211	231	253	200	212	263
Carp	-	2	410	410	410	82	452	350
Mixed fish	-	-	-	-	-	-	-	-
Pike	-	-	-	-	-	-	-	-



Eel	2	2	7	4	6	1	1	6
Bleak	1	5	25	30	30	88	112	100
Other	60	84	98	117	87	70	64	168

Reference: Monstat, Agricultural Statistics Department

So, in the last ten years fish catch data are very scarce and are reduced only to data referring to the catch of carp, eel and bleak, as the main commercial species and the fish catch referring to category of "other" (it is not exactly determined what had been comprised with this term). Specifically, this category of "other" could comprise native species (nase, maple, redstart, shad, etc.) and introduced species (as silver carp, perch, etc.). Widely defined, this category can hardly be used for commercial fishing assessment and planning. Also, the data obtained from Fish Processing Factory "Crnojevica" (Table 6.) are not of much help in commercial fishing planning, but may indicate which part of the total catch is being processed: for example, of the total bleak catch, factory purchased 38 and 53% of it, while of the total carp catch, this percentage ranges from 0.3 to 33%.

Fish catch and its trading at Fish Processing Factory "Rijeka Crnojevica" 2007/2008/2009/2010/2011 (kg) 0.3 to 33%.

Table 6. Fish catch and its trading at Fish Processing Factory "Rijeka Crnojevica" 2007/2011 (in kg)

<i>Fish Type</i>	2007	2008	2009	2010	2011
Bleak	47 380	/	38 430	44 800	34 100
Carp	27 300	/	1 065	10 720	6 500
Silver Carp	4 950	/	2 640	5 560	4 700
Redstart	1800	/	3 840	/	/
Perch	/	/	2 100	/	/
<i>Total:</i>	81 430	0	48 075	61 080	45 300
2008. - factory reconstruction, no catch, no trading					

There are no data on fishing effort and CPUE, crucial for the commercial fishing planning in the last ten years. Currently available data refer only to the number of sold permits for certain forms of commercial fishing, as well as the number of sold permits for recreational fishing (table 7.).

Table 7. – Size of permits sold for certain forms of commercial and recreational fishing

Year	Permits				
	Carp Catch	Eel Catch	Bleak Catch	Longline Catch	recreational fishing
2005	171	29	10	14	273
2006	165	7	11	11	391
2007	134	51	5	6	132
2008	173	50	4	19	230 (518)*
2009	148	70	3	8	188 (46)*
2010	151	83	2	12	195 (99)*



* - the number of daily permits issued for recreational fishing (in brackets)

Preliminary analysis of the total catch and number of sold permits for commercial fishing ratio demonstrates some unusual trends, and even illogical. The annual carp and bleak catch from 2002 to 2010, indicates a clear trend, while the number of sold permits for commercial fishing of these two species has a decreasing trend (Fig 2 and 3)

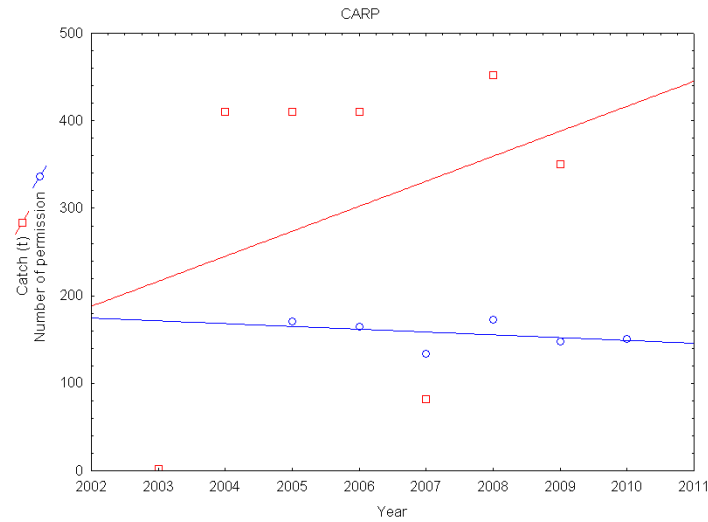


Fig. 2 - Trends on the carp catches and the number of sold permits for commercial fishing of carp in Lake Skadar from 2002 to 2010

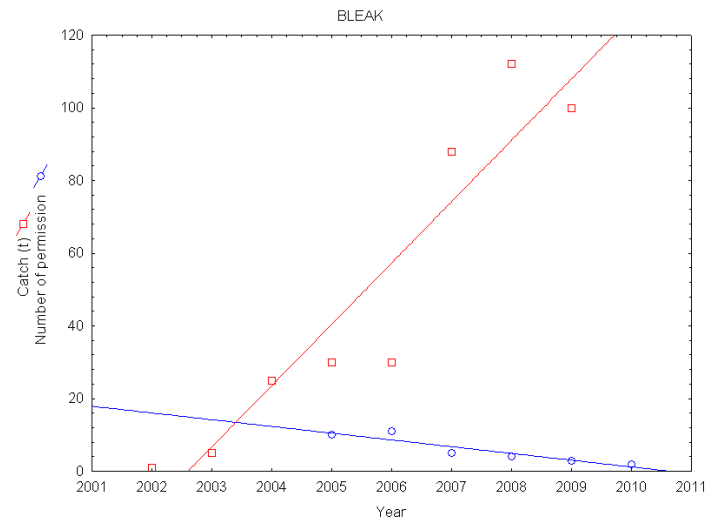


Fig. 3 - Trends on the bleak catches and the number of sold permits for commercial fishing of bleak in Lake Skadar from 2002 to 2010



To the contrary, trends on the number of sold permits for eel increases, while its catch can be estimated as relatively constant for the same time period (Fig 3).

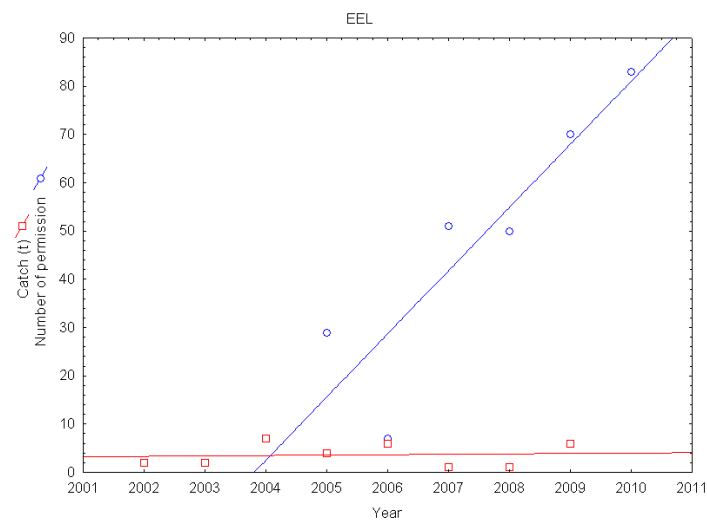


Fig. 4 – Trends on the eel catch and number of sold permits for commercial fishing of eel in Lake Skadar from 2002 to 2010

The rate of trends for carp and bleak could be interpreted that, in the period of ten years, fishing efficiency increased, meaning minor fishing effort increases the catch. When it comes to eel, the increase of fishing effort does not have a significant impact on the annual catch volume. Relevant experience regarding other inland fresh waters, does not respond to both interpretations; as both interpretations are inadequate. It is more likely the summarizing up data on the catch of all 3 types of fish is not adequate, and this is certainly one of the things that will need further consideration.

3.2. **Statistical data on recreational fishing**

The number of daily and annual sales of permits for recreational fishing represents the only reference for the Statistical data on recreational fishing on Lake Skadar, in Montenegro and in Albania.

Having in mind the fact that data on the use of fishing resources of Lake Skadar are scarce, the respective questionnaire (Appendix 3) has been set out. It should allow access to data which are currently unavailable (for example, data on fishing effort and CPUE). The questionnaire was distributed during the interviews with stakeholders in Montenegro and Albania. So far, only 6 questionnaires from Montenegro and 20 from Albania were gathered, which is not sufficient for any major analysis. Nevertheless, although not sufficient, it is possible to notice, based on questionnaires from Montenegro, that:

- commercial fishermen in Montenegro are engaged in fishing less than 200 days of the year,
- mainly steady nets are being used, while fishing,
- commercial fishing gross income is less than 3000 EUR per year (which is 25% of the total fishermen income),
- total annual fish catch, from 2007 to 2010 is in range between 150 to 650 kg.



These are the data published by FMO in Albania, based on benchmarking 20 fishermen in Albania, and only 6 in Montenegro. Therefore, these data can not reflect the actual status, nor can be used for further calculations with the adequate level of certainty. Nevertheless, due to their uniformity, these data could indicate the commercial fishing limits and its main features. Still, the further and precise analysis is certainly needed.

4. PROGRAMME AND LEGISLATIVE DOCUMENTS

The usage of fishing resources in inland fresh waters of Montenegro is regulated by the Law on Freshwater Fisheries (Official Gazette No. 11/2007). This law and deriving by-laws regulate the manner of use, protection, conservation, breeding and catching fish in the fishing waters. This Act prescribes the content of FMP (already mentioned).

Furthermore, this law also determines the fishing areas, requirements for economic and recreational fishing for scientific research purposes, performing activities in the aquaculture, protection of fish stocks and fishing waters biodiversity conservation, record keeping on fishing and aquaculture, inspections and penalties.

The main disadvantage of this legislation is, in our opinion, the insufficient separation of aquaculture as an agricultural activity that uses water resources, from the commercial and recreational fishing, as well as the economic activities which mean the natural fishing resources usage. At the same time, this legislation in a way favours the on-going increase of fishing production in natural water resources management (stocking, introduction of fish species with commercial potential, aquaculture, etc). In long terms, the water ecosystems will be exhausted and degraded in biological terms. Aquaculture, with its features, should be treated like livestock husbandry regulated by specific legislation, while the commercial and recreational fishing should be developed within a long-term sustainability and protection of fishing resources framework.

In any case, it is necessary, to redefine the current legislation in the near future, referring to the protection and sustainable fish resources usage in Lake Skadar. Redefined legislation should be harmonized with one that is applied in Albania, the country Lake Skadar is shared with.

4.1. Other relevant legislation

The Law on National Parks Management (Official Gazette. 47/91, 17/92, 27/94). The purpose and functions of national parks, the boundaries of some NP in Montenegro, national parks protection and improvement measures, spatial plans content and protection and development of national parks programs, national parks property exploitation, NP management, are being determined by this law.

The Law on Nature Protection (Official Gazette of the Republic of Montenegro, No. 51/08) prescribes the protection and preservation of nature, the implementation of nature protection, nature conservation principles, planning, sustainable use, protection of biodiversity and ecosystems, protection of natural resources and species, management and use of protected areas.

The Law on the Environmental Protection (Official Gazette. 51/08). The scope of his Law refers to the principles of environmental protection and sustainable development, the subjects and instruments of environmental protection, public participation on environmental issues and other issues of importance for the environment.



4.2. Planning Documents

There are 4 planning documents, listed as follows, two of which refer to the National Park "Skadar Lake" management and the other two refer to the development of the fishery sector in Montenegro, making reference of the potential capacities for the development of freshwater fisheries in inland waters of Montenegro, but also indicating relevant data lack on current situation.

1. MANAGEMENT PLAN - NATIONAL PARK "SKADAR LAKE" 2011-2015;
2. SPATIAL PLAN FOR SPECIAL PURPOSE NATIONAL PARK "SKADAR LAKE" (Official Gazette. 46/01);
3. DEVELOPMENT OF THE FISHERY SECTOR IN MONTENEGRO 2009 – 2013 (Draft of the National Strategic Plan), 2008
4. STRATEGY ON DEVELOPMENT OF THE FISHERY SECTOR IN MONTENEGRO AND CAPACITY BUILDING FOR THE IMPLEMENTATION OF THE EUROPEAN UNION COMMON FISHERIES POLICY, 2006

4.2.1. RECENT PROGRAMME DOCUMENTS

There are two important documents set out during the 2011. Those documents refer to the future sustainable use of the Skadar Lake, and the protection of the fishery stocks in both countries.

1. FISHERIES ASSESSMENT IN LAKE SHKODRA - SKADAR, ALBANIA & MONTENEGRO, Final Report Draft, December 2011

While outputting FMP, the setting out of another document very important for the fishery management was brought to an end. Some data from the above document were being used for the preparation of the FMP. The document comprises five chapters and annexes. The Chapter ***Aquatic Habitat Conditions*** provides an overview of the basic characteristics of Lake Skadar, which includes information on geology, climate, water characteristics (physical-chemical conditions), phytoplankton, zooplankton, macrophytes, endangered plant associations and species, benthic invertebrates, amphibians and reptiles, mammals, birds and endangered animal species. The Chapter ***Fish and Fisheries Parameters*** provides an overview of the fish fauna of Lake Skadar (Species check-list) and an overview of the parameters for the four fisheries target species (bleak, carp, shad, prussian carp). The analysis of existing data on heavy metals in fish tissue was also presented in the mentioned chapter. The Fishery Management was mapped out in the Chapter ***Monitoring Program***. It refers to the issues such as: the purpose and the legal framework, the past and the current status, the monitoring plan and its alterations, parameters/indicators, location, sampling (multimesh gillnet, fyke net, commercial beach seine, electro-fishing, fish sampling weir, beach seine, logbooks, measurement), timetable, the fishery community involvement (compiling data on the fish catch, involvement in the monitoring program), budgetary framework (initial investment, running cost) and its implementation. The Monitoring Programme was deployed in details.

The Chapter ***Census of the Fishermen*** brings out currently available statistics on the fish catch (in Albania, only). Certain aspects of the Fishery Management were elaborated throughout the document, taking into account: management measures (in Montenegro and in Albania, separately considered), indigenous fish species protection method(s), essential habitats protection measures, restocking programme assessment necessity.



2. SKADAR-SHKODER LAKE MONITORING PROGRAM DEVELOPMENT, September 2011

In this very extensive and detailed document, the chapter "Current status of the Skadar/Shkoder ecosystem and its surrounding area" introduces the analysis of trends based on recent monitoring data which includes all elements of biodiversity, including fishes. In the chapter "Recommendation for joint monitoring program of Lake Skadar/Shkoder" after analyzing characteristics of the 19 species of fishes, 11 of them are being designated as indicator species: three of them are significant in terms of economic importance - eel, perch and prussian carp. The other eight species are migratory, endemic or sub-endemic species. The sampling locations are mapped out in the same chapter: two sites for salmonid fish species, two sites for migratory sturgeon species, five locations for *Telestes montenegrinus*, *Anguilla anguilla* and *Barbatula zetensis*, four sites for *Scardinius Knezevici* and three for invasive species (perch, prussian carp and *Ameiurus nebulosus*) sampling. It is recommended that sampling should be performed according to the CEN standards:

- Water quality: Guidance on the scope and selections of fish sampling methods (EN 14962),
- Water quality: Sampling of fish with electricity (EN 14011),
- Water quality: Sampling of fish with multi-mesh gill nets (EN 14757).

Nevertheless, in the chapter "Framework prioritised annual monitoring program" designated indicators are:

- Species composition, distribution and abundance of fish,
- *Scardinius knezevici*;
- *Acipenser nacacarii*;
- *Acipenser sturio*;
- *Perca fluviatilis*.

In addition to this, the number of sampling locations, as well as the number of parameters, is being reduced.

5. FISHERY MANAGEMENT ORGANIZATIONS AND MNE FISHERY ASSOCIATIONS FROM SKADAR LAKE AREA

The main fishery management organization (FMO) is the Skadar Lake National Park, competent, according to the national legislation, to set out planning and programme documents. One of these documents is FMP. The National Park is also competent to attend all the activities related to the sustainable fish stock utilization in the Skadar Lake, such as fishing permits issuing, organizing the office for the enforcement of the protection measures, enforcement of the fish stock protection measures, etc.

While interviewing with FMO, MNE Fishery Associations from NP Skadar Lake area (fishermen association „Vranjina”, fishermen association initiative – Malesija) and Fish processing Plant “Rijeka Crnojevica”, the lack of the basic records, mainly statistical, for planning and management, in terms of fishery, has been identified as the major issue, since these are the data necessary to determine the current status of the lake fish stock utilization:

- fishery data (number of boats, number of fisherman, etc);



- data on fishing effort (legal and illegal);
- data on catch (legal and illegal);
- fish stock economic valorisation issues;
- MSY issue (maximal sustainable yield);
- fish trading (80% of the fish is being sold on illegal-informal market);;
- decrease of fish stock, especially of the migratory species, during 70ies
- fishing of the migratory species in the River Bojana;
- fishing permits being overprized (license for carp fishing costs 400 EUR and there are 15 nets per license) etc.

6. PROPOSED ACTIVITIES FOR FURTHER STRENGTHENING OF FISHERY SECTOR

After reviewing of all available data so far, following activities should be carried out:

6.1. STOCK ASSESSMENT (THE MOST BASIC ELEMENT OF A FISHERIES MANAGEMENT PLAN)

While setting out FISHERIES ASSESSMENT IN LAKE SHKODRA – SKADAR, ALBANIA & MONTENEGRO (Final Report Draft, December 2011), certain fishery parameters for bleak, carp, shad and prussian carp have been gathered. According to the respective data, the bleak populations, in 2011 were attributed with “good status”. The populations are being dominated by reproductively mature individuals 3+ and 4+, present on each marked location and in all the periods of the year. It has been concluded, to limit the number of issued permits for bleak during the winter season in Montenegro and in Albania, as well (FISHERIES ASSESSMENT IN LAKE SHKODRA - SHKODER, ALBANIA & MONTENEGRO. Draft Final Report, 2011).

On the other hand, the carp population status was assessed as poor, but in recovery. Measures for the recovery of populations of carp, which include the enforcement of the closing season, stronger control in IUU fishery (especially the complete eradication of fishing with generators) and some protection of spawning areas, are being proposed. In addition, measure regarding the extensive cultivation of carp in the lake, as well as the harmonization of the closed season for carp between Albania and Montenegro, have also been suggested (FISHERIES ASSESSMENT IN LAKE SHKODRA - SHKODER, ALBANIA & MONTENEGRO. Draft Final Report, 2011).

As for twaite shad population, its status was assessed as critical requiring immediate protection measures. Introducing measures such as prohibition of twaite shad juveniles fishing (during the summer period) is being proposed. The fishing in the River Bojana/Buna, during the migration period in April (even using generators), represents another particular issue that worsens the twaite shad population status. It has been considered to cease the permits issuing for fishing on the River Bojana/Buna, regardless the fish species. Furthermore, the closing season in April should be applied not only to the Skadar Lake but also for the River Bojana. And at last, a moratorium for twaite shad fishing may be taken in consideration, if the results fail (FISHERIES ASSESSMENT IN LAKE SHKODRA - SHKODER, ALBANIA & MONTENEGRO, Draft Final Report, 2011).

The Prussian Carp is still the dominant specie in terms of fish catch. Comparing to the other cyprinidae, the economic importance of the Prussian carp is increasing, while still considered dangerous invasive species. In this regard, "A joint Action Plan" including measures for the control/reduction of this specie is probably needed in the near future. In our



opinion, this also applies for perch (FISHERIES ASSESSMENT IN LAKE SHKODRA - SHKODER, ALBANIA & MONTENEGRO, Draft Final Report, 2011).

Within the next two years, the Stock Assessment Programme should be implemented, setting out the special addressing to the carp, bleak and shad, as natural species and also to some allochthonous species and commercially significant ones, such as perch and prussian carp, as well as endangered fish species. The Stock Assessment Programme objectives are defined as determination of:

- species diversity and abundance;
- size, age structure and biomass of key commercial species;
- occurrence of allochthonous fish species;
- status of the endangered elements of the ichthyofauna.

The data on the length, gender and age are crucial for the respective key commercial species. The Stock Assessment Programme should also include spawning grounds mapping and other important habitats in the life cycle of fishes, and seasonal importance of these habitats.

For further defining and harmonizing of the methodology, it is necessary for the programme to be developed in cooperation with Albanian partners, taking into account CEN standards for electro fishing, multi-mesh gill nets and choosing location for sampling.

Annex 1 comprises Draft proposal for the stock assessment in Skadar - Shkodra Lake, based on Fisheries Management Plan - Lake Shkodra (2004), with significant modifications.

6.2. CAPACITY BUILDING FOR REFFERAL TO THE FISH STATISTICS

Statistic records and familiarity on fish stock characteristics are the most important components for the permanent and sustainable fishery management of Lake Skadar. The period of one year is quite enough for the protocols to be developed and implemented by FMO and Fishery Associations. Basic statistics, obtained on the regular and factual basis, should refer to:

- fishery data (number of boats, number of fisherman, etc);
- data on fishing effort,
- data on the catch.

The Law on Freshwater Fisheries in Montenegro, in Chapter VII RECORDS ON FISHING AND AQUACULTURE (Article 45) stipulates the obligation for the fish stocks user and the entrepreneurs engaged in commercial fishing, to keep catch records on daily basis. The user of the fish stock is required to keep records on the number of permits issued for the sport and recreational fishing and the quantity of the catch. Also, the licensee for the sport and recreational fishing is required to fill of record card regularly, since it is an integral part of fishing licenses. Data from the records of sports and recreational fishermen catch are an integral part of the fish stocks user annual report, which is submitted to the competent Ministry, at the begging of the year. The form, content and record keeping procedure, as well as the content of annual reports are being prescribed by the competent Ministry.

It can be concluded, from the above mentioned, that there is a legal framework defining the obligation of collecting statistical data. Since these data are very scarce, it is clear that this aspect of the fisheries resources usage has not yet been sufficiently elaborated. In our experience, one of the most important reasons is in the fact that fisheries resources beneficiaries (including stakeholders) do not realize the importance of proper



fishing statistics record keeping, so they fail to do it or do it only tentatively to meet legal obligations. On the other hand, commercial and recreational fishermen often dissimulate fish catch data out of fear of the possible consequences such as increase of permits price and taxes and imposition of the new restrictions. In certain cases, the unnecessary excessive questionnaires often imposed to the stakeholders, and even recreational and commercial fishermen, may have the negative impact on fish catch data: fishermen decline to fill in these forms, and even, as in some cases, if these questionnaires are being processed, the responses may be tentative and imprecise, and sometimes even incorrect (this is especially common to recreational and commercial fishermen).

There are two key matters, in our opinion, which may lead to the enhancement of the current status in this field:

- on-going stakeholders' and commercial and recreational fishermen education on the importance of proper record keeping regarding relevant data on the fisheries resources utilization;
- data collecting protocol optimization

6.3. FISHERY MONITORING PROGRAMMES DEVELOPMENT

The elements for the fish species monitoring programmes are being set out in the “Skadar-Shkoder Lake Monitoring Programme Development” document, in terms of biodiversity. This document is applicable in Montenegro and Albania. Suggested number of sampling locations for certain fish species is as follows: 2 locations for sampling salmonid fish species, 2 for sturgeon species, 5 for eel and 2 endemic species (one *Cyprinidae* and one *Cobitidae*), 4 for *Scardinius knezevici*, 4 for invasive species (*Perca*, *Carassius* and *Ameiurus*). In addition to fish species composition and abundance (parameters: composition, abundance, biomass and age structure), these are the species proposed to be indicators: *Scardinius knezevici* (parameters: length/weight ratio, population structure, relative abundance, mortality, maturity, fecundity), *Acipenser sturio* (parameters: length/weight ratio, population structure), *Acipenser naccari* (parameters: length/weight ratio, population structure) and *Perca fluviatilis* (parameters: length/weight ratio, population structure, relative abundance, mortality, maturity, fecundity). The dynamics of monitoring provides an annual sampling in certain seasons and on certain locations. The sampling methodology should be carried out in the line with CEN standards for electro fishing (EN 14 011), multi-mesh gillnets (EN 14757) and location mapping (EN 14962). It is estimated that such monitoring programme could cost € 10,800, per year, in Montenegro, and in Albania.

The elements for the fish species monitoring programmes are being set out in the FISHERIES ASSESSMENT IN LAKE SHKODRA – SKADAR, ALBANIA & MONTENEGRO, in terms of fisheries management. There are 4 sampling locations in Montenegro and in Albania. The review of the proposed indicators, sampling methodology and frequency is presented in the following table (Table 8.).

Table 8. List of indicators for the monitoring of fish and fisheries (From: FISHERIES ASSESSMENT IN LAKE SHKODRA - SHKODER, ALBANIA & MONTENEGRO, Draft Final Report, 2011).

Proposed indicator	Sampling approach	Sampling and frequency
Main endemic or sub-endemic species status	Multimesh-Gillnet + Fyke-Net	With Multimesh Gillnet during the spring season three times per year (mid April, May and June), Fyke-Net used in combination with the Multimesh Gillnet in the same period



Bleak Status	Commercial Beach Seine + Catch Data	With Commercial Beach Seine two samplings during the winter season (one at the end of December and one in Mid-January and if needed on at the beginning of February), Catch Data all year round to have the total quantity of bleak caught in the lake
Status of other commercial species	Multimesh-Gillnet + Catch Data + Electro-Fishing	With Commercial Beach Seine two samplings during the winter season (one at the end of December and one in Mid-January), Catch Data all year round to have the total quantity of bleak caught in the lake, Electro-Fish samplings will be carried out in three campaigns (mid-May, end-May and mid-June)
Status of salmonids in the lake and tributaries	Electro-Fishing	With Electro Fishing it will be carried in the streams entering the lake in one campaign at the beginning of September or in the winter
Status of migrate species	Fish-Weir + Fyke-Net + Catch Data	Fish Weir collection of sampling during their migration toward sea (November) Catch Data all year round to have the total quantity of eel caught in the lake (including the quantity caught in the fish weir), Fyke Nets to see the presence of the eels all year round, Twaite shad & Mullet - Fish Weir collection of sampling during their migration toward the lake (April) and toward the sea (November) Catch Data all year round to have the total quantity of twaite shad caught in the lake (including the quantity caught in the fish weir).
Fishing Effort	Logbook	The collection of data will be year round by distributing the logbooks to the fishermen. Where not applicable, sampling of the effort will be carried out.
Status of juveniles	Beach Seine + Sampling	The sampling with beach seine will be carried out in October once every two years (one year for the Albanian part and one year for the Montenegrin part).

In our opinion, it is possible to develop the monitoring, referring only to the commercially most important fish species (such as carp, bleak, eel, shad, perch and prussian carp), including the smaller number of indicators and sample volume, which would only facilitate its implementation and sustainability within the specified time framework.

The setting out and the implementation of the fishery monitoring programmes should be effective in the next two year period. The respective programmes should refer to the main natural and, in commercial terms, the most important species (carp, bleak, eel, shad), economically significant allochthonous species (perch and prussian carp), as well as habitats and areas significant for the fish population (spawning areas and areas important for the growth of the spawn). Monitoring programmes should be referred to:

- species abundance and biomass of commercial species: carp, bleak, eel, shad, perch and prussian carp;
- age and size structure of commercial species;



- important habitats and status of juveniles of commercial species (spawning and nursery area).

Sampling locations and methodology should be determined on the experiences presented in the document “FISHERIES ASSESSMENT IN LAKE SHKODRA – SKADAR, ALBANIA & MONTENEGRO”. In short, it would be as presented in Tables 9, 10 and 11:

Table 9. Fishery Monitoring Programme - List of indicators for the fisheries monitoring

Proposed indicator	Sampling approach	Sampling and frequency
Bleak Status	Commercial Beach Seine + Catch Data	With Commercial Beach Seine two samplings during the winter season (one at the end of December and one at the beginning of February). Catch Data all year round to have the total quantity of bleak caught in the lake.
Status of carp, perch and prussian carp	Multimesh-Gillnet + Catch Data + Electro-Fishing	With Commercial Beach Seine two samplings during the winter season (one at the end of December and one in mid-January). Catch Data all year round to have the total quantity of bleak caught in the lake. Electro-Fish samplings will be carried out in two campaigns (mid-May and mid-June)
Status of migrate species (shad, eel)	Fish-Weir + Fyke-Net + Catch Data	Eel - Fish Weir collection of sampling during their migration toward sea (November). Catch Data all year round to have the total quantity of eel caught in the lake (including the quantity caught in the fish weir). Fyke Nets to see the presence of the eels all year round. Shad - Fish Weir collection of sampling during their migration toward the lake (April) and toward the sea (November). Catch Data all year round to have the total quantity of shad caught in the lake (including the quantity caught in the fish weir).
Important habitats and status of juveniles	Beach Seine + Sampling	The sampling with beach seine will be carried out in October once every two years (one year for the Albanian part and one year for the Montenegrin part).
From: “FISHERIES ASSESSMENT IN LAKE SHKODRA – SKADAR, ALBANIA & MONTENEGRO - Draft Final Report, 2011” – modified		

Table 10. Fishery Monitoring Programme - Initial investment

Nr.	Item	Nr. of unit	Price per	Total Cost	Replacement
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			Unit	EUR	period
1	Multimesh gillnet (total length 50 m) mesh sizes 33, 38, 45, 55 and 60 mm (10 m each)	2	150	300	Every 3 years
2	Multimesh gillnet (total length 50 m) mesh sizes 10, 14, 18, 23 and 27 mm (10 m each)	2	150	300	Every 3 years
3	Fyke-Net (mesh size 3 or 5 mm)	4	500	2000	Every 6 years
4	Portable balance 3000 gr max.weight (precision 0.1 gr.)	2	500	1000	Every 6 years
5	Waders	4	75	300	Every 6 years
6	Boots	4	50	200	Every 6 years
7	Ruler 50 cm (for fish measurement)	2	50	100	Every 6 years
8	Hand nets (3 mm and 10 mm mesh size)	2 (3mm) + 2 (10 mm)	50	200	Every 6 years
9	Plastic tanks	2	50	100	Every 6 years
10	Plastic buckets	2	25	50	Every 6 years
Total				4550	
From: "FISHERIES ASSESSMENT IN LAKE SHKODRA – SKADAR, ALBANIA & MONTENEGRO - Draft Final Report, 2011"					

Table 11. Fishery Monitoring Programme - Running cost

Nr.	Description	Nr. of unit	Price per Unit EUR	Total Cost EUR
1	Travelling costs for 5 trips Tirana-Shkodër (175 km)	875 km	0.4	350
2	Lodging for 2 nights for 5 trips for 2 persons	20 nights	25	500
3	Diems for 2 days for 5 trips for 2 persons	20 days	40	800
4	Renting boat + fuel + 2 fishermen	20 days	50	1000
5	Miscellaneous (printing, communication costs etc.)	1	350	350
Total				3000
From: "FISHERIES ASSESSMENT IN LAKE SHKODRA – SKADAR, ALBANIA & MONTENEGRO - Draft Final Report, 2011"				

6.4. EDUCATION

The former practice in fishery resources using, simply imposes the need for continuous education of local population in terms of perception of their role in the sustainable use and management of fishery stocks in Lake Skadar. In the next year, it would be necessary to develop educational programs concerning fisheries resource and its use and to start with their implementation.

Educational programs can be developed in several directions depending on whether they are intended for local people, stakeholders, commercial fishermen and recreational anglers. The general objectives of development of educational programs in the first phase should be defined as acquiring:



- basic awareness and understanding of the total ecosystem in which fishes live; the commercial and recreational fisheries supported by that ecosystem; the issues involved in managing these fisheries; and the effects people can and do have on the resource.
- positive attitudes and values toward fishes, fishing, fisheries, and the aquatic ecosystem in general, ensuring their protection, rehabilitation, and responsible management.
- social and technical skills to make decisions and solve problems associated with the management of fisheries and the motivation to personally act on those issues.

In the second phase, educational programs can be implemented through the elaboration of specific topics (subjected to modifications), such as:

- a. Commercial and recreational fisheries conflicts;
- b. Fisheries and biodiversity;
- c. Fisheries and critical habitats;
- d. Fisheries and watersheds;
- e. Global trends and fisheries issues;
- f. Harvest: effects of gear selection, techniques and effort, and bycatch (for commercial and recreational fisheries);
- g. Introduced species: boon and bane;
- h. Sharing the resource: fisheries and inter specific competition;
- i. Stocking: advantages and limits.

6.5. FISH QUALITY MONITORING PROGRAMME DEVELOPMENT

Skadar Lake is the recipient of pollutants from the urban areas and smaller settlements, surrounding industrial plants and agricultural areas. Pollution often means introducing heavy metals, pesticides and other pollutants; elements and compounds which can be detected in the fishes intended for the human nutrition, due to the process of bioaccumulation.

Primarily, the fish meat quality monitoring is not elaborated within the fisheries management. But if being determined, the increased concentrations of hazardous substances in some fish, could lead to a significant impact on the usage of certain fish species, in terms of fishing.

For this reason, it is necessary within the next two years, to develop a programme to monitor the quality of commercial species fish meat in terms of its possible contamination by harmful and hazardous substances, above all heavy metals and organic compounds contamination (PCBs, PAHs, etc.). Developing of such programme would be assumed by the institutions involved within the Lake Management (for example, Public Health Institute), while fishery stakeholders would take an important part in its implementation. Therefore, certain recommendations for the Fish quality monitoring programme development are being elaborated in this document.

While developing the fish quality monitoring program two-tiered approach for monitoring fish tissue contaminant concentrations is often being practiced. This strategy includes:

- initial screening program (primary studies),



- intensive monitoring study to determine the geographic extent and magnitude of contamination in edible tissues in various fish species (secondary studies).

The main objective of the primary study is to identify the fishing waters and areas where chemical pollutants presence may be expected in the fish meat used in human nutrition, in concentrations that may adversely affect human health. Recommended target species for the primary study are:

- 1 bottom-feeding species (carp), and
- 1 predator species (eel and/or perch).

Target species should meet several criteria:

- species are known to accumulate high concentrations of target contaminants in their tissues,
- they normally populate the freshwater systems,
- they are routinely caught and consumed by anglers,
- they are pollutant-tolerant, easily identified, abundant and easy to collect, and of sufficient size to provide adequate tissue samples for analyses of toxicants.

There are several requirements for the pollutants to be found in the list of target contaminants, for example contaminant's prevalence and persistence in the environment, its potential to bio-accumulate, its biochemical fate, toxicity, and availability/cost of analytical methods. These kinds of lists usually comprise 10-15 heavy metals, and about 30 different organic pesticides/PCBs.

One of the primary objectives of the study is to identify areas where fish meat contamination may pose health or environmental risk. The criteria for selecting sampling locations include:

- presence of municipal or industrial discharges and facilities;
- presence of intensive agricultural activities, and intensive urban land development;
- species and numbers of fish present;
- fishing pressure.

It is recommended that the sampling should be performed in the late summer (from the second half of August till mid November). This is the period which does not coincide the spawning season, the concentration of the fishes fatty tissue is high and permanent, and water levels are usually low, facilitating the sampling.

In regards to the type of samples, as a basis for estimating or predicting human health risks, composite samples can be used – flesh fillet of at least five individuals of the same type (skin and/or scales should be removed from the fillet) in the primary study. Composite samples reduce the analysis cost for the primary study. While sampling, it is necessary to take at least three composite samples. Size of fish used in the sample should be in the range typical for one of their prey.

In general, secondary study has the same design as the primary, while the number of analyzed species increases to cover all species of fishes that are consumed. On the other hand, the number of contaminants that are monitored can be less if some of them are absent in all samples and/or their concentrations in the fish flesh are below the level of significance.



6.6. THE RIVER BOJANA AS CO-MANAGEMENT AREA

The River Bojana, being a rout for migratory fish species, is of the great importance and impact on status and the quality of fish resources in Skadar Lake. The impact of construction for the migratory species fishing is very significant. FMO, Fishery Associations and other relevant national and local institutions, together with the corresponding Albanian organizations and institutions should initiate revision of the manner and intensity of fishing in the river Bojana, as well as to initiate the procedure that the River Bojana obtains the co-management area status, taking into account its essential connection to the Lake Skadar water system. Similar recommendations could be found in the document "Fisheries Assessment in Lake Shkodra - Scutari - Albania & Montenegro (Final Report Draft, December, 2011)".

6.7. SOCIO-ECONOMICAL SURVEY OF FISHERMEN HOUSEHOLDS

Socio-economic aspects of fisheries on Lake Skadar have not been the subject of the specific assessment yet. In the next three years, it is necessary to review the socio-economic aspects of fishing households (legal and illegal), in order to determine the actual significance of this activity for the local population. Information of this kind should help in future decision-making process, not only regarding the proper fishery management but reduction of illegal fishing, as well.

The objectives of such a study include:

- description and analysis of the socio-demographic features (age structure, gender, marital status, family member number, level of education);
- description and analysis of the fishermen common problems on the Lake Skadar;
- description and analysis of socio-economic requirements of small-scale fishermen;
- economic and financial performance of small-scale fishing vessels assessment and evaluation of the viability of small-scale fishing as a commercial activity;
- description of the relations between cooperatives and fishermen, which indicate the effectiveness of cooperatives from its members, taking into account the social aspect of these relations;
- outlining the current social and economic status of fisheries and drafting fishery management plans to be implemented by decision makers in Albania and Montenegro.

6.8. MINIMAL SIZES, CLOSING SEASON AND FISHING TOOLS

One of the important priorities of Skadar Lake Commission (SLC), besides its organizational structure and the implementation of the above mentioned objectives, should be national legislation harmonization between Albania and Montenegro regarding protection measures such as: minimal sizes, closing season and spawning areas, and allowed fishing tools (types, nets length, minimal mesh size, etc). The following table (Table 12.) outlines the current spawning prohibitions in Albania and Montenegro: there is a significant difference in spawning prohibitions duration. The spawn characteristics and spawning areas marking for 4 most important species in commercial terms are stated in the document *Fisheries Assessment in Lake Shkodra – Skadar, Albania & Montenegro*. Therefore, there is no argument, as the same fishing area and fishing stock are involved, for the closing season to differ in Albania and Montenegro (7,5 months in Montenegro for bleak, while in Albania it lasts for 4 months, and 75 days for carp in Montenegro, in Albania 30 days).



Table 12. The current closing season in both countries by species (From: "Fisheries Assessment In Lake Shkodra – Skadar - Albania & Montenegro, Final Report Draft, December, 2011").

Time period SPECIES	Montenegrin part		Albanian part	
	from	to	from	to
Carp	15 th March	1 st June	15 th April	15 th May
Chub	15 th March	1 st June	15 th April	15 th May
Nase	15 th March	1 st June	15 th April	15 th June
Roach	15 th March	1 st June	15 th April	15 th June
Bleak	15 th March	31 st October	1 st April	31 st July

Minimally allowed sizes for some fish species in Albania and Montenegro are presented in the following table (Table 13.). As in the closing season, there is significant discrepancy in terms of protection measures: for example, for carp, the minimally allowed size is 40 cm of length in Montenegro, in Albania 30cm, and for bleak, 16 cm in Montenegro and 10 in Albania. Nevertheless, although prussian carp and perch represent commercially important species, their negative impact as invasive species is enormous, so they do not require protection by prescribing minimally allowed size in terms of fishing.

Table 13. Minimal allowed dimensions for some commercial species (from "Fisheries Assessment in Lake Shkodra - Scutari - Albania & Montenegro, Final Report Draft, December, 2011").

Common name	Scientific name	Montenegro	Albania
Carp	<i>Cyprinus carpio</i>	40 cm	30 cm
Chub	<i>Squalius spp</i>	Not specified	15 cm
Gibel	<i>Carassius spp</i>	Not specified	15 cm
Nase (undermouth)	<i>Chondrostoma spp</i>	Not specified	15 cm
Roach	<i>Rutilus prespensis</i>	Not specified	12 cm
Bleak	<i>Alburnus belvica</i>	16 cm	10 cm
Perch	<i>Perca fluviatilis</i>	Not specified	15 cm
Brown trout	<i>Salmo farioides</i>	25 cm	Not Applicable
Mullet	<i>Mugil spp.</i>	25 cm	Not Specified



Marble trout	<i>Salmo marmoratus</i>	50 cm	Not Applicable
Lake trout	<i>Salmo sp.</i>	30 cm	Not Applicable

There is certain discrepancy in the characteristics of fishing tools (the length of the nets, minimal mesh size, etc.) in Albania and in Montenegro.

All the above mentioned examples clearly indicate the necessity of the national legislation harmonization between Albania and Montenegro, as well as its implementation. This should be one of the main operational tasks of the SLC.



REFERENCES

- 1) Cadima E. L. (2003). Fish Stock Assessment Manual. FAO Fisheries Technical Paper, No. 393. Rome, FAO. p 161.
- 2) Fisheries Assessment In Lake Shkodra – Skadar, Albania & Montenegro. (Progress report, May 2011 and Final Report Draft, December, 2011) “HYDRA” N.G.O. Fishery and Aquaculture Research Centre, Tirana, Albania.
- 3) Fisheries Management Plan - Lake Shkodra (2004). Nordenfjeldske Development Services AS and AquaVision Consulting Ltd Group.
- 4) Fisheries Management Plan for the Skadar Lake (*Vol I and II*, 1978). Institute for Biological and Medical Research in the Socialist Republic of Montenegro, *Biological Institute, Titograd, Montenegro*.
- 5) Gayanilo, F. C., Jr.; Pauly, D. (Eds) (1997). FAO-ICLARM Stock Assessment Tools (**FISAT**) Reference Manual. FAO Computerized Information Series (Fisheries). No. 8. Rome, FAO. p 262.
- 6) Hindson J., Hoggarth D. D., Krishna M., Mees C. C., O'Neill C. (2005). How to Manage A Fishery - A simple guide to writing a Fishery Management Plan. Marine Resources Assessment Group (MRAG), London, Centre for Environment Education, Ahmedabad, Scales Consulting Ltd, London. p 82.
- 7) Law No. 7908, date 5.4.1995. “On Fishery and Aquaculture”,
- 8) Law No. 8870 “On amendments to the Law No. 7908 date 5.4.1995 “On fishery and Aquaculture” date 21.3.2002.
- 9) Maric, D. & Milosevic, D. (2010). Katalog slatkovodnih riba Crne Gore. CANU, Odeljenje za prirodne nauke, posebna izdanja, p 130.
- 10) Maric, D. (2010). Bibliografija o ribarsko-ihtioloskim istrazivanjima u slatkim vodama Crne Gore. Prirodnjacki muzej, Podgorica, p 140.
- 11) Mrdak D. (2009). Environmental risk assessment of the Moraca dams: fish fauna of Moraca river canyon and Skadar Lake. Report committed by WWF MedPO and Green Home under the framework of Sharing Water Project - Skadar Lake component. p 76.
- 12) Uredba o klasifikaciji i kategorizaciji površinskih i podzemnih voda, „Sluzbeni list Crne Gore”, br. 2/07
- 13) „RAPORT PER GJENDJEN E MJEDISIT – 2009”. Agjencia e Mjedisit dhe e Pyjeve, Tirana, Albania.
- 14) Regulation No. 1 date 29.3.2005. “For application of the legislation on fishery and aquaculture”.
- 15) Skadar-Shkoder Lake Monitoring Program Development (2011). ERICo Velenje, Ecological Research & Industrial Co-operation Ltd. Velenje, Slovenia.
- 16) Talevski T., Milosevic D., Maric D., Petrovic D., Talevska M., Talevska A. (2009). Biodiversity of ichthyofauna from Lake Prespa, Lake Ohrid and Lake Skadar. XI Anniversary scientific conference - 120 years of academic education in biology and 45 years faculty of biology. *BIOTECHNOL. & BIOTECHNOL. EQ. 23/2009/SE, SPECIAL EDITION/ON-LINE*. p: 400 – 404.
- 17) Stein, R. A., Mecom, J. O. and Ivanovic, B. (1981): Commercial exploitation of fish stocks in lake Skadar, 1947-1976.- *In: Karaman G. S. & Beeton A. M. (Eds.), The biota and limnology of lake Skadar: 343-354, Titograd.*
- 18) The Biota and Limnology of Lake Skadar (1981). Eds S. G. Karaman & M. A. Beeton. Institution for Biological and Medical Research in Montenegro, Titograd & Centre for Great Lakes Studies, Milwaukee.



ANNEX 1:

DRAFT PROPOSAL: STOCK ASSESSMENT, LAKE SKADAR - SHKODRA

From: Fisheries Management Plan - Lake Shkodra, 2004 – significantly modified

BACKGROUND

The most basic element of fisheries management plan for Skadar Lake is the stock assessment (Fisheries Management Plan - Lake Shkodra, 2004). The importance of data obtained through stock assessment necessary for administrating management in terms of respective measures and activities, as well as addressing to the issues due to inadequate data use, present the field of interest elaborated by many authors, such as Hindson *et al.*, 2005, Cadima 2003, Gayanilo and Pauly, 1997.

The fish stocks in Lake Shkodra have never been subjected to the stock assessment (Fisheries Management Plan - Lake Shkodra, 2004). Currently, around 400 licensed fishermen are engaged in fishing in Albanian (with about 200 boats), and 200-250 in Montenegrin part of the lake. It is estimated that the same number of fishermen is involved in illicit fishing (Fisheries Management Plan - Lake Shkodra, 2004). Furthermore, the total (legal and illegal) annual catch in the Albanian part of the lake is approximately 350 t, and 800 t in Montenegro, during the past few years.

As to achieve the ecologically sustainable yield or MSY (Maximum Sustainable Yield), in other words, to process adequate rules and regulations for the fishery and to implement adequate management measures, it is very important to be familiar with the fish stocks status.

The objectives of the stock assessment in Lake Skadar - Shkodra are to:

- obtain a good understanding of the status of the stocks of bleak, carp, prussian carp, perch, eel and shad in terms of abundance, age and length structure, biomass and other population characters,
- map the spawning areas and other habitats of essential significance in the life cycle of the commercial species,
- status of allochthonous fish species,
- status of the endangered elements of the ichthyofauna, especially species with potential commercial importance,
- initiate and establish a programme to monitor fishing effort and size and structure of catches (commercial species),
- provide advice to stakeholders of adequate revisions of the fisheries regulations for the lake.

APPROACH

Stock and catch structure

Material of bleak, carp, prussian carp, perch and shad will be collected by test fishing with bottom-set and pelagic multi-mesh survey nets, and by sampling fishermen gill net and seine catches. Material of eel will be collected by fyke-nets. Test fishing will be performed twice a year, in March and September. Catch per unit effort (CPUE, in numbers and weight) will be recorded, and fish will be weighed and length measured. In a subsample of adequate size, the fish will also be sexed, and maturity stage will be recorded. Scales and otholiths will be collected for ageing of the fish. Compared with age and size structure of catches, this will give a good indication of the level of exploitation, as too high exploitation rate will result in too few sexually mature fish (i.e. spawners) in the population. Data from fishermen catches



will demonstrate the selectivity of fishing, and if revisions of fishing regulations in terms of mesh sizes, total effort, etc., are required.

Spawning sites

Mapping of spawning sites was carried out through FISHERIES ASSESSMENT IN LAKE SHKODRA - SHKODER, ALBANIA & MONTENEGRO. Draft Final Report, 2011. Information of local environmental conditions in spawning sites (depth, substrate, presence of subsurface springs, etc.) will form the basis for identification of possible no-fishing zones.

Monitoring programme

In order to provide biological data as part of the basis for an adaptive management, a routine programme for annual sampling of commercial fish species in fishermen's catches should be established. Measuring and weighing a specified number of fish according to a detailed sampling programme, and collecting scales and otholiths for ageing of a subset of fish will provide data on the development of the portion of the population subject to fishing. This will detect trends in the population structure.

Transboundary issues

If possible, the stock assessment should be developed referring to the whole lake, through collaboration between respective institutions in the two riparian countries.

Budget (in EUR)

Salaries

Activity	Time required	Unit price	Sum (EUR)	Total (EUR)
Field work survey net fishing	60 staff days	25	1500	
Field work mapping of spawning sites	30 staff days	25	750	
Hire of field assistants	90 days	10	900	
Scale reading & analysis of data	100 staff days	25	2500	
Report writing	30 staff days	25	750	
Per diems	90 days	20	1800	
				8200

Equipment etc

Survey gill nets	3000	
Consumables (ropes, buoys, CDs, notebooks, etc.)	500	
Computer	3000	
Hire of boat for field work	1000	
Fuel	500	
Safety equipment	500	
		8500
TOTAL (EUR)		16700



ANNEX 2:

Yearly fish catch (in kg) on Shkoder-Skadar lake from 1947 to 1960 (From: Stein *et al.*, 1981)

Year	Bleak (ukljeva) (Alburnus alburnus alborella)		Carp (saran)		Nase (skobalj) (Chondrostoma nasus)		Tooth trout (kubla) (Salmo dentax)		Eel (jegulja)		Mullet (Cipoli) (Mugilidae)		Scardinius knezevic (Ljolja)		Trout (Pastrmka)		Chub (klen) Leuciscus cephalus		Sturgeon (jesetra) Acipenser sturio		Other fish		Total catch in a year	
	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%	Total	%		
1947	339,474	54	140,467	22	89,041	14	16,536	2	10,478	1	3,500	1										27,717	4	627,213
1948	584,600	65	115,470	12	114,066	12	15,008	1	13,737	2	3,140	1	15,978	2								26,195	3	888,194
1949	431,808	54	138,580	17	63,475	8	34,085	4	23,050	3	4,264	1										91,998	12	787,260
1950	256,507	37	228,336	33	104,077	15	27,845	4	10,815	1	4,925	1										42,699	6	675,204
1951	594,659	58	278,780	27	31,860	3	6,016	1	18,148	2	2,245	1										94,305	9	1,026,033
1952	584,083	60	178,570	18	69,860	7	6,480	1	25,969	2	2,025	1	19,283	2	1,732	1						88,836	9	976,838
1953	811,824	65	249,736	20	41,037	3	7,825	1	8,831	1	698	1	12,620	1	1,730	1	7,745	1				102,290	8	1,244,336
1954	382,301	41	124,533	13	79,418	8	22,055	2	11,859	2	17,974	1	7,684	1	2,509	1						270,610	29	918,963
1955	425,149	47	139,728	15	83,232	9	80,991	9	1,250	2	1,235	1	9,503	1	5,295	1						142,584	15	901,967
1956	612,976	48	264,952	21	226,700	18	38,000	3	8,200	1	1,333	1	17,000	1	2,660	1	12,020	1				80,516	6	1,264,357
1957	745,305	59	197,264	16	122,125	10	38,851	3	11,793	1	13,086	1	15,446	1	3,223	1	6,948	1	1,502	1		9,285	7	1,249,828
1958	637,808	48	322,242	24	120,508	9	54,155	4	17,275	2	3,108	1	24,723	2	9,178	1	5,504	1	3,186	1		132,766	10	1,330,473
1959	644,954	54	206,308	17	61,808	5	59,789	4	10,397	1	9,048	1	15,582	1	5,883	1	12,458	1	883	1		166,934	14	1,194,044
1960	623,992	57	246,313	22	43,938	4	43,417	5	18,871	2	2,228	1	14,589	1	546	1	15,043	1	436	1		88,246	8	1,097,619
TOTAL	7,675,440	54	2,831,299	20	1,251,165	9	451,053	4	203,673	1	68,809	1	152,408	1	32,756	1	59,718	1	6,007	1		1,449,981	10	14,182,329
Average	548,245	54	202,235	20	89,369	9	32,218	3	14,550	1	4,915	1	10,886	1	2,340	1	4,265	1	429	1		103,571	10	1,013,023



ANNEX 3

Yearly fish catch (in tones) on Shkoder-Skadar lake from 1966 do 1976 (From: Stein *et al.*, 1981)

Year	Bleak (ukljeva) (<i>Alburnus alburnus alborella</i>)	Carp (saran)	Nase (skobalj) (<i>Chondrostoma nasus</i>)	Tooth trout (kubla) (<i>Salmo dentax</i>)	Eel (jegulja)	Mullet (Cipoli) (<i>Mugilidae</i>)	Trout (Pastrmka)	Chub (klen) Leuciscus cephalus	Scardinius knezevic (Ljolja)	Sturgion (jesetra) Acipenser sturio	Other fish	Total
1966	246	10	-	6	-	-	-	-	-	-	91	353
1967	609	186	50	12	4	1	<1	4	12	<1	100	979
1968	684	212	28	8	8	1	<1	8	6	<1	93	1049
1969	359	129	10	2	4	2	<1	8	13	<1	49	577
1970	622	126	27	8	1	<1	<1	6	25	<1	83	899
1971	385	110	32	6	1	<1	<1	6	25	-	126	692
1972	311	153	15	2	<1	1	2	8	29	-	374	895
1973	303	69	3	2	2	<1	<1	2	6	-	588	976
1974	311	38	2	<1	1	1	<1	-	75	-	433	662
1975	403	90	3	2	2	<1	<1	-	132	-	468	1101
1976	303	65	3	<1	1	<1	<1	-	87	-	350	810



Average	464	142	16	4	2	1	1	4	12	<1	163	863
%	53.8	16.5	5.6	5.6	0.8	0.3	0.2	0.5	1.4	0.1	18.9	100