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# PROSPECTIVE MONITORING OF FISH COMMUNITIES FROM BUZĂU RIVER'S BASIN

BY

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**Key words:** prospective monitoring, fish communities, stock, biodiversity, index of biological integrity

Prospective monitoring of fish communities from Buzău River's basin aimed at assessment of ichthyocoenoses specific structure by use of certain qualitative and quantitative methods, viewing a comparison with prior situation and assessment of ichthyocoenoses affectation degree consequent to anthropogenic activities. 21 fish species were identified in 17 sampling sites compared to prior 24 species. Ichthyocoenoses affectation degree is low, their self-support capacity being nearly intact.

## Introduction

River Buzău, a right side tributary of River Siret, springs from northern Ciucaş Mountains at 1250 m altitude. River surface is 5264 $km^2$ while length 302 km. Main tributaries of Buzău River: Bîsca, Bălăneasa, Sărăţel, Slănic, and Cîlnău are left side tributaries while Bîsca Chiojdului, Nişcov, and Buzoel are right side tributaries. Bălăneasa, Sărăţel and Slănic bring high quantities of sodium chloride in Buzău River's water.

Ichthyocoenoses prospective monitoring in Buzău River's basin aimed at assessment of ichthyocoenoses specific structure by means of qualitative (species structure assessment) and quantitative (estimation of numeric and gravimetric stock, calculation of IBI and other ecological indices) methods.

## Material and methods

Number of sampling sites was fixed to cover all fish characteristic communities as well as changes in species spatial distribution (spreading areas). Number of sampling sites must be statistically assured for results correctness.

Species identification was realised based on morphological characters of species collected, using identification keys for each systematic unit as well as species description (characterisation) from literature (Bănărescu P., 1964).

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Gravimetric and numeric stock assessment gives correct and comparable information upon population numbers and biomass at sampling sites for each species and for entire ichthyocoenosis. Those indices also have a high value because give information of maximum importance in case of ecological restoration. Gravimetric (g/100 $m^2$ or kg/ha) and numeric (no. ind./100 $m^2$ or no. ind./ha) stock assessment in running waters is relatively simple because of the easy assessment of total surface surveyed by electric fishing. Quantity or numbers of individuals collected is expressed per conventional surface units (100 $m^2$, 1 ha, 100 linear m, etc.).

Ecological indices and fish communities' structure: In order to establish fish communities' structure and composition at sampling sites, analytical indices (absolute abundance, constancy, dominance) and synthetic (index of ecological significance) were calculated. Special attention was granted to index of ecological significance (W) that gives information upon each species status within community. Fish zones (and subzones) specific to respective basin may be established according to characteristic species (Simionescu V., 1984; Varvara M. et al., 2001).

Biodiversity index calculation assessed ichthyocoenoses biodiversity at sampling sites, its value being an important indicator of ecosystem state under anthropogenic impact. Diversity was calculated according to Shannon - Wiener index (Botnariuc N., Vădineanu A., 1982).

Index of biological integrity (IBI) calculation gave information upon ichthyocoenoses affectation degree due to anthropogenic impact; the 15 parameters investigated emphasized ecosystem structural and functional changes. Fish populations' biological integrity was calculated by means of index of biological integrity (IBI). The index was introduced by Karr J.R. and Dudley D.R. (1981) and Miller A. (1985) to study fish populations from north-American rivers and was largely used after 1990 in U.S.A., France, England, etc. The index uses fish as indicators of aquatic ecosystem state and quality.

**Results and discussions**

Fish sampling by electric fishing was run in Buzău River's basin at 17 sampling sites located on main course of the river and main tributaries. 21 de species with 1929 specimens were identified.

Bănărescu P. (1964) quoted for Buzău River's basin 24 fish native species in the river while 3 native species in swamps. Present survey identified 20 native species while 1 acclimatized species - stone moroko (*Pseudorasbora parva*) in the river. Some of the native species Bănărescu P. quoted for the basin were not sampled: roach, baltic vimba, common carp, northern pike, spined loach. On the other hand, ide (*Leuciscus idus*) autochthonous species previously unquoted was identified (Table 1). Zander and European perch are present in mid and lower course of River Siret from where the species swim in River Buzău. Compared to Putna River's basin, River Buzău is larger in surface but similar in ichthyocoenoses specific structure, both basins with relative clean water without major sources of anthropogenic pollution (Ureche D. et al., 2002).

Figure 1 shows fish species distribution in sampling sites from Buzău River's basin. Species distribution was characteristic to existent habitats while species numbers were conditioned by habitat size, and especially by anthropogenic impact recorded. Spieces numbers progressively increased with distance from springs and as habitats became more spacious (Fig. 1).

Quantitative variations of absolute abundance and biomass were high and according to ecological conditions existent and also to anthropogenic impact. Specimens' number per sampling site varied 0.0 (Slănic, upstream of Săpoca) to 376 (Bîsca Chiojdului, upstream of Gura Bîscei). A total number of 1929 specimens were recorded for the 17 sampling sites.

In Buzău River's basin numeric stock varied between 1.67 ex/100 $m^2$ (Bîsca Mică, site Zănoaga) and 138.07 ex/100 $m^2$ in sampling site downstream of Lake Siriu (Table 2).

Gravimetric stock recorded the lowest value on main course of River Buzău, site Buzău (8.7 g/100 $m^2$) while highest value on main course of River Buzău, downstream of Lake Siriu (552.7g/100 $m^2$) (Table 3, Fig. 2).

**Table 1. Fish species found in Buzău River's basin**

| No | Species | Common name | Ecological status | | | |
|---|---|---|---|---|---|---|
| | | | Bănărescu, 1964 | | 2003 (river) | |
| | | | River | Lake | Native species | Acclimatized species |
| 1. | *Salmo trutta fario* L., 1758 | brown trout | * | | * | |
| 2. | *Thymallus thymallus* L., 1758 | grayling | * | | * | |
| 3. | *Esox lucius* L., 1758 | northern pike | * | | | |
| 4. | *Rutilus rutilus carpathorossicus* Vladykov, 1930 | roach | * | | | |
| 5. | *Leuciscus cephalus cephalus* L., 1758 | european chub | * | | * | |
| 6. | *Leuciscus idus idus* L., 1758 | ide | | | * | |
| 7. | *Phoxinus phoxinus phoxinus* L., 1758 | eurasian minnow | * | | * | |
| 8. | *Leucaspius delineatus delineatus* Heckel, 1843 | belica | * | | * | |
| 9. | *Alburnus alburnus alburnus* L., 1758 | bleak | * | | * | |
| 10. | *Alburnoides bipunctatus bipunctatus* Bloch, 1782 | chub | * | | * | |
| 11. | *Vimba vimba carinata* Pallas, 1811 | baltic vimba | * | | | |
| 12. | *Chondrostoma nasus nasus* L., 1758 | sneep | * | | * | |
| 13. | *Gobio gobio obtusirostris* Valenciennes, 1844 | gudgeon | * | | * | |

| No | Species | Common name | Ecological status | | | |
|---|---|---|---|---|---|---|
| | | | Bănărescu, 1964 | | 2003 (river) | |
| | | | River | Lake | Native species | Acclimatized species |
| 14. | *Gobio kessleri kessleri* Dybowski, 1862 | kessler' gudgeon | * | | * | |
| 15. | *Pseudorasbora parva* Schlegel, 1842 | stone moroko | | | | * |
| 16. | *Barbus barbus barbus* L., 1758 | barbel | * | | * | |
| 17. | *Barbus petenyi* Heckel, 1847 | mediterranean barbel | * | | * | |
| 18. | *Cyprinus carpio carpio* L., 1758 | common carp | * | | | |
| 19. | *Carassius carassius* L., 1758 | crucian carp | | * | | |
| 20. | *Carassius auratus gibelio* Bloch, 1782 | prussian carp | * | | * | |
| 21. | *Orthrias barbatulus* L., 1758 | stone loach | * | | * | |
| 22. | *Misgurnus fossilis* L., 1758 | weatherfish | | * | | |
| 23. | *Cobitis taenia taenia* L., 1758 | spined loach | * | | | |
| 24. | *Sabanejewia aurata vallachica* Nalbant, 1957 | golden spined loach | * | | * | |
| 25. | *Silurus glanis* L., 1758 | wels catfish | * | | * | |
| 26. | *Pungitis platygaster platygaster* Kessler, 1859 | southern ninespine stickleback | | * | | |
| 27. | *Perca fluviatilis fluviatilis* L., 1758 | european perch | * | | * | |
| 28. | *Stizostedion lucioperca* L. 1758 | zander | * | | * | |
| 29. | *Cottus gobio gobio* L., 1758 | bullhead | * | | * | |

**Table 2. Fish population numerical stock (ind./100 m$^2$) at sampling sites on the Buzău River**

| Fish species (common names) \ Sampling sites | Buzău – Vama Buzăului | Buzău upstream Zăbrătău | Buzău upstream Siriu lake | Buzău downstream Siriu lake | Bâsca Mică – Nușa | Bâsca Mică – Zănoaga | Bâsca Mică – upstream V. Oii | Bâsca Mică – Varlam | Bâsca downstream Nemertea bridge | Buzău downstream Valea Lupului | Bâsca Chiojdului upstream Gura Bâscei | Buzău - Viperești | Slănic – upstream Săpoca | Buzău - Buzău | Buzău Găvănești | Buzău - Vișani | Buzău upstream Latinu bridge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| brown trout | | | | | | | | | | | | | | | | | |
| grayling | | | | | 0.4 | | | | | | | | | | | | |
| european chub | 3.14 | 1 | 1.4 | | | | | | 0.17 | 0.13 | 11.39 | 1.7 | | 3 | 0.77 | 0.33 | |
| ide | | | | | | | | | | | | | | | | 0.04 | |
| eurasian minnow | 14 | 1.83 | | 38 | 0.2 | | 4.6 | | | | | | | | | | |
| belica | | | | | | | | | | | | | | | | 1.13 | 0.75 |
| bleak | | | | | | | | | | | | | | 1.16 | 0.04 | | |
| chub | 0.86 | 1.67 | 3.4 | 10.7 | | | 4 | 27.9 | 6.5 | 1.6 | | | | | | | |
| sneep | | 0.33 | 0.3 | | | | | | | 0.93 | 5.56 | 1.8 | | 0.14 | 0.12 | | |
| gudgeon | | 0.83 | 1.3 | | | | | | | | 3.06 | 0.1 | | | 10.34 | 2.04 | 2.75 |
| kessler' gudgeon | | | 0.2 | | | | | | | 10.27 | 6.39 | 3.1 | | 1.57 | | | |
| stone moroko | | | | | | | | | | | | | | | | 0.15 | 0.75 |
| barbel | | | | | | | | | | | | 1.9 | | 1.86 | | 0.04 | 0.25 |
| mediterranean barbel | 2.3 | 3.33 | 0.6 | 10 | | | 5.1 | 3.33 | 2 | 1.73 | 23.89 | 1 | | | | | |
| crucian carp | | | | | | | | | | | | | | | 0.3 | 0.07 | 0.5 |
| stone loach | 0.6 | 17.8 | 0.6 | 74.7 | | | 4.57 | | 0.5 | 0.13 | 5.56 | | | | | | |
| golden spined loach | | | 0.2 | 4.67 | | | | | 0.17 | 1.33 | 48.61 | 0.4 | | 2.86 | 0.35 | | |

| Sampling sites / Fish species (common names) | Buzău – Vama Buzăului | Buzău upstream Zăbrătău | Buzău upstream Siriu lake | Buzău downstream Siriu lake | Bâsca Mică – Nușa | Bâsca Mică – Zănoaga | Bâsca Mică – upstream V. Oii | Bâsca Mică – Varlam | Bâsca downstream Nemertea bridge | Buzău downstream Valea Lupului | Bâsca Chiojdului upstream Gura Bâscei | Buzău - Viperești | Slănic – upstream Săpoca | Buzău - Buzău | Buzău Găvănești | Buzău - Vișani | Buzău upstream Latinu bridge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| wels catfish | | | | | | | | | | | | | | | | 0.18 | 1 |
| european perch | | | | | | | | | | | | | | | | | 0.25 |
| zander | | | | | | | | | | | | | | | | | 0.25 |
| bullhead | 0.6 | | 2.1 | | 0.87 | 1.67 | 2.86 | 0.42 | 1.33 | | | | | | | | |
| TOTALS | 34.1 | 27.46 | 10.1 | 138.07 | 2.4 | 1.67 | 22.27 | 31.65 | 10.67 | 16.12 | 104.46 | 10 | 0 | 10.59 | 11.92 | 3.98 | 6.5 |

**Table 3. Fish population weight stock (g/100 m$^2$) at sampling sites on the Buzău River**

| Sampling sites / Fish species (common names) | Buzău – Vama Buzăului | Buzău upstream Zăbrătău | Buzău upstream Siriu lake | Buzău downstream Siriu lake | Bâsca Mică – Nușa | Bâsca Mică – Zănoaga | Bâsca Mică – upstream V. Oii | Bâsca Mică – Varlam | Bâsca downstream Nemertea bridge | Buzău downstream Valea Lupului | Bâsca Chiojdului upstream Gura Bâscei | Buzău - Viperești | Slănic – upstream Sapoca | Buzău - Buzău | Buzău Găvănești | Buzău - Vișani | Buzău upstream Latinu bridge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| brown trout | | | | | | | | | | | | | | | | | |
| grayling | | | | | 12.07 | | | | | | | | | | | | |
| european chub | 15.7 | 41.3 | 21.1 | | | | | | 3.7 | 2.1 | 156.4 | 11.9 | | 2.3 | 0.92 | 4.29 | |
| ide | | | | | | | | | | | | | | | | 0.07 | |
| eurasian minnow | 54.3 | 5.5 | | 80 | 1.33 | | 32 | | | | | | | | | | |

| Sampling sites / Fish species (common names) | Buzău – Vama Buzăului | Buzău upstream Zăbrătău | Buzău upstream Siriu lake | Buzău downstream Siriu lake | Bâsca Mică – Nușa | Bâsca Mică – Zănoaga | Bâsca Mică – upstream V. Oii | Bâsca Mică – Varlam | Bâsca downstream Nemertea bridge | Buzău downstream Valea Lupului | Bâsca Chiojdului upstream Gura Bâscei | Buzău - Vipereşti | Slănic – upstream Sapoca | Buzău - Buzău | Buzău Găvăneşti | Buzău - Vişani | Buzău upstream Latinu bridge |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| belica | | | | | | | | | | | | | | | | 1.09 | 0.25 |
| bleak | | | | | | | | | | | | | | 0.29 | 0.81 | | |
| chub | 7.1 | 23.3 | 18.4 | 37 | | | 36.02 | 124.2 | 28.2 | 7.1 | | | | | | | |
| sneep | | 97.3 | 27.6 | | | | | | | 246.7 | 11.1 | 34.9 | | 0.6 | 0.54 | | |
| gudgeon | | 13.2 | 6.9 | | | | | | | | 16.4 | 0.7 | | | 19.4 | 3.05 | 2.75 |
| kessler' gudgeon | | | 1.2 | | | | | | | 39.3 | 18.06 | 7.9 | | 0.28 | | | |
| stone moroko | | | | | | | | | | | | | | | | 0.14 | 2.5 |
| barbel | | | | | | | | | | | | 46.4 | | 3.86 | | 0.4 | 27.5 |
| mediterranean barbel | 74.8 | 73.3 | 24.7 | 249 | | | 161.7 | 160.8 | 97.3 | 32.5 | 125.8 | 13.6 | | | | | |
| crucian carp | | | | | | | | | | | | | | | 0.42 | 0.18 | 7 |
| stone loach | 6.3 | 64 | 15.9 | 164 | | | 61 | | 3.3 | 0.5 | 18.3 | | | | | | |
| golden spined loach | | | 0.9 | 22.7 | | | | | 1.2 | 4.7 | 100.56 | 1.1 | | 1.4 | 0.31 | | |
| wels catfish | | | | | | | | | | | | | | | | 5.02 | 173 |
| european perch | | | | | | | | | | | | | | | | | 1 |
| zander | | | | | | | | | | | | | | | | | 75 |
| bullhead | 6.3 | | 9.5 | | 9.9 | 16.67 | 22.8 | 4.2 | 15.8 | | | | | | | | |
| TOTALS | 478.8 | 346.9 | 125.7 | 552.7 | 38.8 | 16.67 | 333.5 | 289.2 | 108 | 332.9 | 446.62 | 116.5 | 0 | 8.7 | 22.4 | 14.24 | 289 |

By calculation of ecological indices and especially of ecological significance index (W) values, fish communities living in hydrographic basin of River Buzău were identified.

Number of species in fish communities surveyed decreased from 7-9 in mountain area to 5-6 in the hilly zone and plain, and returned to 8 at river mouth due to ichthyocoenoses influence from River Siret. Formation of Lake Siriu led to a decrease of species number (downstream) to 5.

Fish communities, characteristic for classical zoning, maintained more than in other rivers comparable in size, because anthropogenic influence is much reduced (low pollution and hydrotechnical fitting out only at Lake Siriu). Thus, mountain zone of River Buzău and main tributaries is brown trout zone. Remarkable is grayling presence in Bâsca Mică.

Mediterranean barbel zone is present on the lower course of main tributaries (Bîsca, Bâsca Chiojdului), favoured by Lake Siriu formation (downstream on River Buzău till the confluence with Bâsca).

Sneep zone extended on River Buzău (upstream of Lake Siriu) till Întorsura Buzăului, consequent to Lake Siriu formation; downstream, zone is interrupted by the lake and reappears downstream of Nehoiu till upstream of Viperești, with a gravimetric dominance.

Barbel zone is characteristic for hilly zone and stretches downstream of Viperești till downstream of locality Buzău having a gravimetric dominance.

Gudgeon zone, upstream of locality Săgeata till the river mouth, covers the plain area. Leading species is gudgeon. Remarkable is the relative weak development of european chub which, different to other rivers comparable to Buzău, did not succeed in impose itself as leading species though frequently appears in sneep and barbel zone (Fig. 3).

Index of biodiversity and index of biological integrity (IBI) showed the presence of certain relatively stable ichthyocoenoses with numerous native species. Affectation degree did not exceed class IV in zones affected by hydrotechnical fitting out or with increased impact of pollution, excepting sampling site 4 (downstream of Lake Siriu) where integrity class was V (Fig. 4).

**Conclusions**

Our research identified 21 species (1929 specimens), collected by electric fishing from 17 sites located on the main course of River Buzău and its main tributaries.

Species distribution was characteristic for existent habitats, species number being according to habitat size and anthropogenic impact recorded. It gradually increased with distance from spring and as habitats became more spacious.

Numerical stock varied from 1.67 ind./100 $m^2$ to 138.07 ind./100 $m^2$ while the gravimetric one from 8.7 g/100 $m^2$ to 552.7g/100 $m^2$.

Species number in fish communities decreased from 7-9 in the mountain area to 5-6 in the hilly and plain areas and returned to 8 at river mouth due to influence of Siret

River ichthyocoenoses. Species number decreased to 5 downstream of Lake Siriu due to lake existence.

Commmunities were characteristic for classic fish zoning. Thus, 5 zones occurred: brown trout zone, Mediterranean barbel zone, sneep zone, barbel zone and gudgeon zone.

Biodiversity and biological integrity indices (IBI) showed the presence of certain relatively stable ichthyocoenoses with numerous native species, affectation degree being according to class IV.

## References


1. Bănărescu P., 1964 – *Fauna R.P.R., Pisces-Osteichthyes, XIII*, Ed. Acad., Bucureşti, 959 p
2. Botnariuc N., Vădineanu A., 1982 – *Ecologie*, Ed. Did. şi Ped., Bucureşti, 438 p
3. Froese R., Pauly D. (Eds.), 2003 – FishBase. World Wide Web electronic publication. www.fishbase.org, version 11/2002
4. Karr J.R., 1981 – Fisheries, 6 (6): 21-27
5. Karr J.R., Dudley D.R., 1981 – Environ. Managem., 5: 55-68
6. Miller A., 1985 – Environmental Management, 9: 179-190
7. Simionescu V., 1984 – Lucrări practice de ecologie, Litogr. Univ. „Al. I. Cuza", Iaşi, 193 p
8. Ureche D., Pricope F., Battes K., 2002 – Prospective monitoring of the Putna basin ichthyofauna, An. Şt. INCD Delta Dunării, Tulcea 2002, 205-223
9. Varvara M., Zamfirescu Şt., Neacşu P., 2001 – Lucrări practice de ecologie. Manual, Ed. Univ. „Al. I. Cuza" Iaşi, 152 p

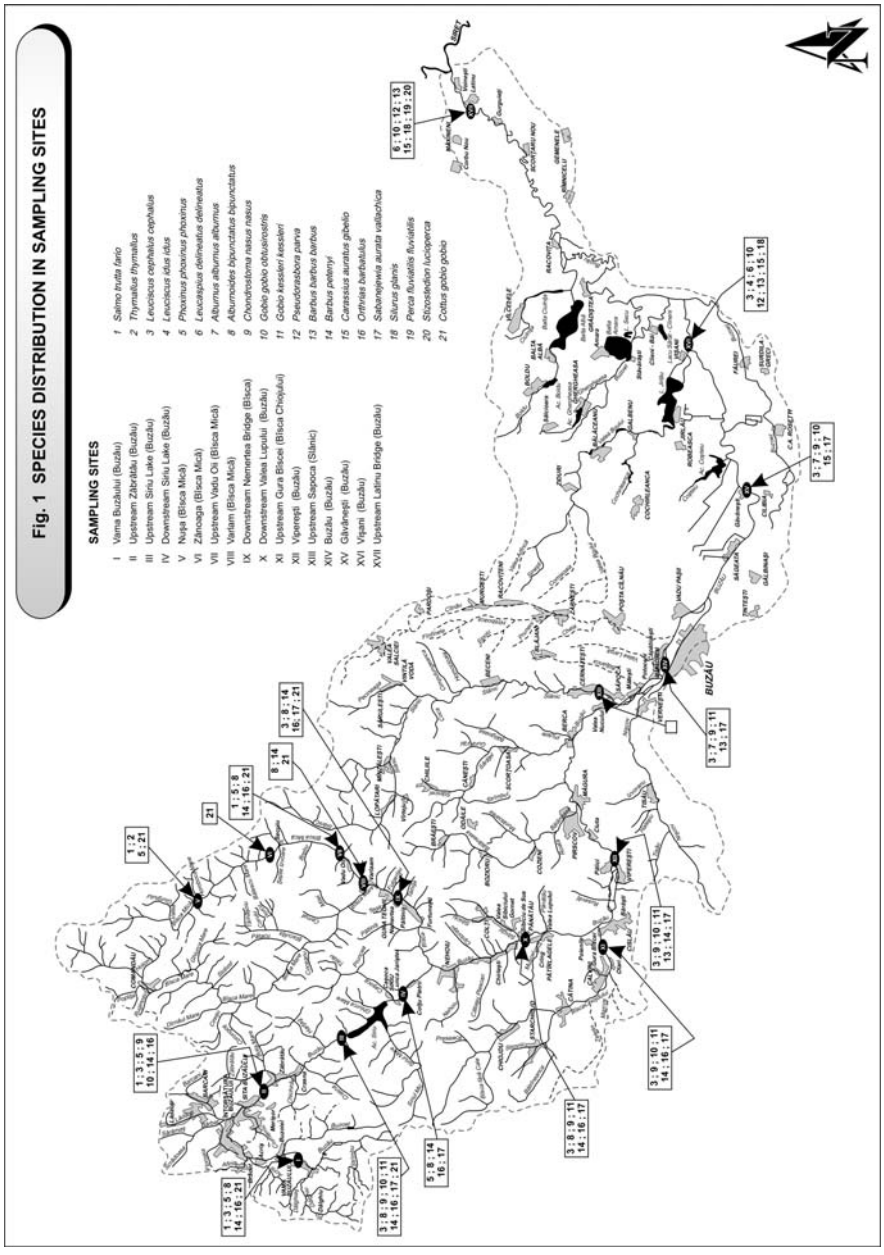
Fig. 1 SPECIES DISTRIBUTION IN SAMPLING SITES
SAMPLING SITES
I Valma Buzăului (Buzău)
II Upstream Zăbrăuţu (Buzău)
III Upstream Siriu Lake (Buzău)
IV Downstream Siriu Lake (Buzău)
V Nuţa (Bâsca Mică)
VI Zănoaga (Bâsca Mică)
VII Upstream Vadu Oii (Bâsca Mică)
VIII Varlam (Bâsca Mică)
IX Downstream Nemertea Bridge (Bâsca)
X Downstream Valea Lupului (Buzău)
XI Upstream Gura Bâscăi (Bâsca Chiojdului)
XII Vipereţi (Buzău)
XIII Upstream Sapoca (Slănic)
XIV Buzău (Buzău)
XV Gâlmeşti (Buzău)
XVI Viţani (Buzău)
XVII Upstream Lăţinu Bridge (Buzău)
1 Salmo trutta fario
2 Thymallus thymallus
3 Leuciscus cephalus cephalus
4 Leuciscus idus idus
5 Phoxinus phoxinus phoxinus
6 Leucaspius delineatus delineatus
7 Alburnus alburnus alburnus
8 Alburnoides bipunctatus bipunctatus
9 Chondrostoma nasus nasus
10 Gobio gobio obtusirostris
11 Gobio kessleri kessleri
12 Pseudorasbora parva
13 Barbus barbus barbus
14 Barbus petenyi
15 Carassius auratus gibelio
16 Orthrias barbatulus
17 Sabanejewia aurata valachica
18 Silurus glanis
19 Perca fluviatilis fluviatilis
20 Stizostedion lucioperca
21 Cottus gobio gobio
BUZĂU
1 : 2
5 : 21
21
1 : 5 : 8
14 : 16 : 21
8 : 14
21
3 : 8 : 14
16 : 17 : 21
1 : 3 : 5 : 8
10 : 14 : 16
1 : 3 : 5 : 8
14 : 16 : 21
3 : 8 : 9 : 10 : 11
14 : 16 : 17 : 21
5 : 8 : 14
16 : 17
3 : 8 : 9 : 11
14 : 16 : 17
3 : 9 : 10 : 11
14 : 16 : 17
3 : 9 : 10 : 11
13 : 14 : 17
3 : 7 : 9 : 11
13 : 17
6 : 10 : 12 : 13
15 : 18 : 19 : 20
3 : 4 : 6 : 10
12 : 13 : 15 : 18
3 : 7 : 9 : 10
15 : 17

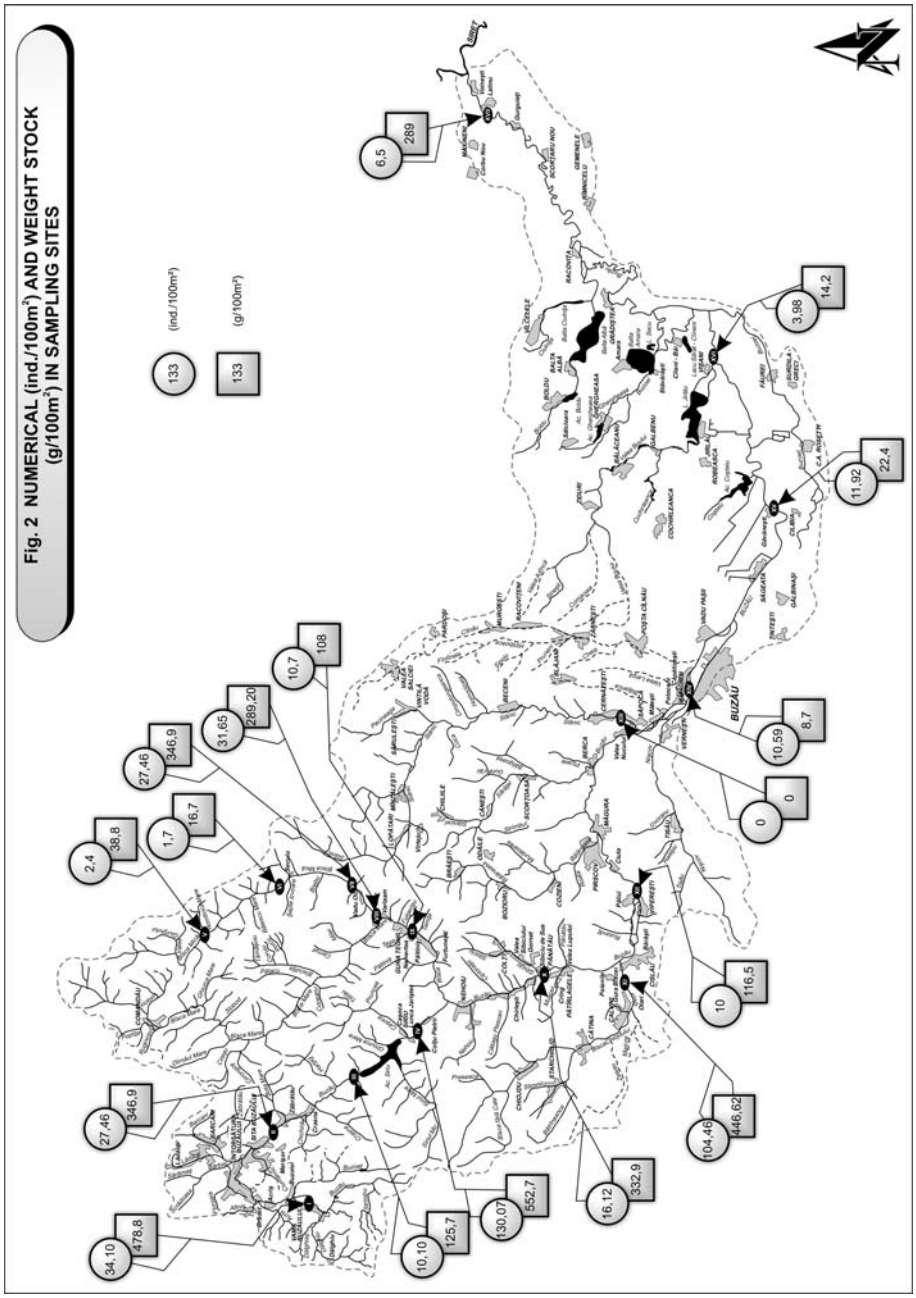
Fig. 2 NUMERICAL (ind./100m²) AND WEIGHT STOCK (g/100m²) IN SAMPLING SITES
(ind./100m²)
(g/100m²)
133
133
BUZĂU
6,5
289
3,98
14,2
11,92
22,4
10,7
108
31,65
289,20
27,46
346,9
1,7
16,7
2,4
38,8
0
0
10,59
8,7
10
116,5
104,46
446,62
16,12
332,9
130,07
552,7
10,10
125,7
34,10
478,8
27,46
346,9

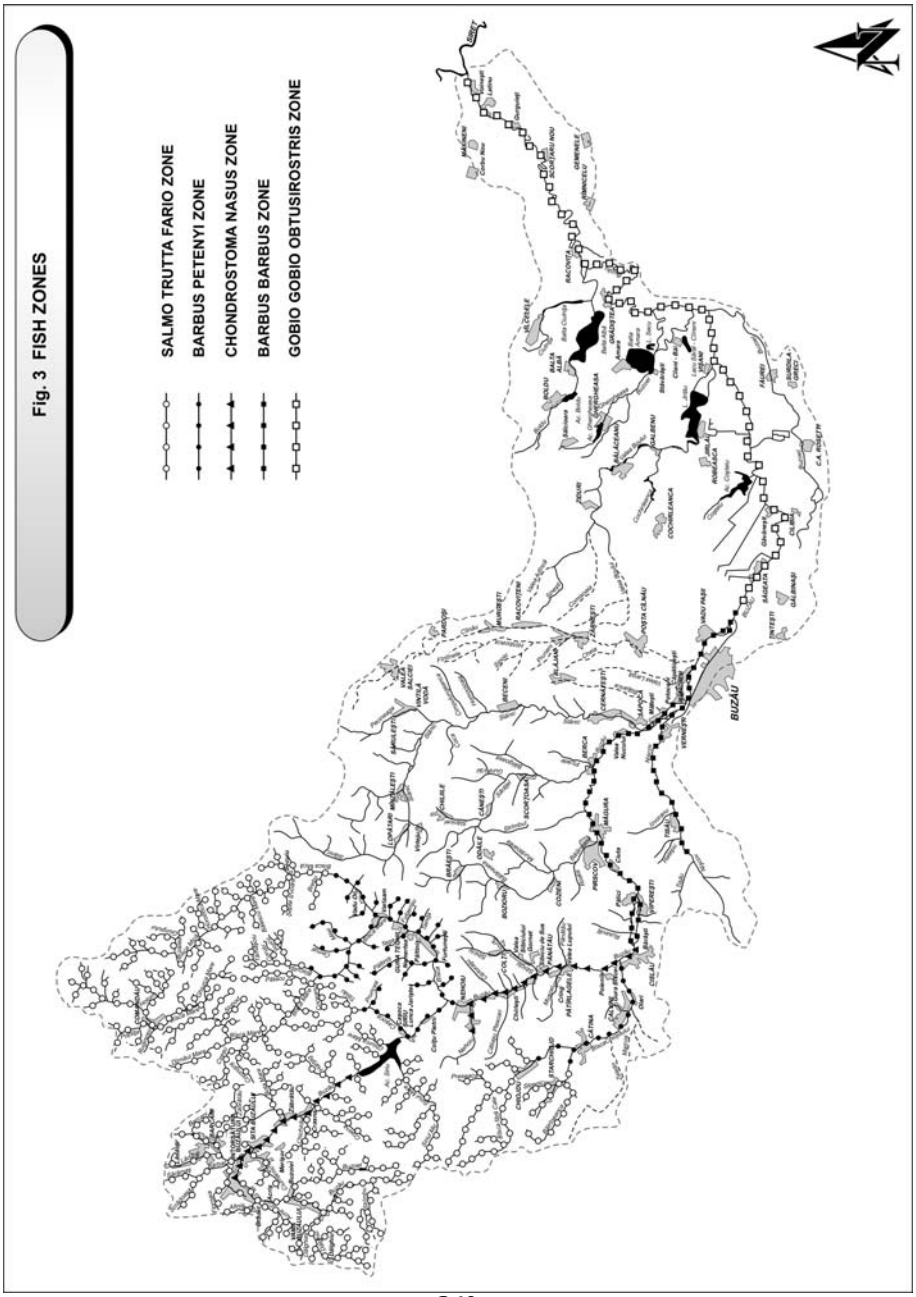
Fig. 3 FISH ZONES
SALMO TRUTTA FARIO ZONE
BARBUS PETENYI ZONE
CHONDROSTOMA NASUS ZONE
BARBUS BARBUS ZONE
GOBIO GOBIO OBTUSIROSTRIS ZONE
BUZĂU

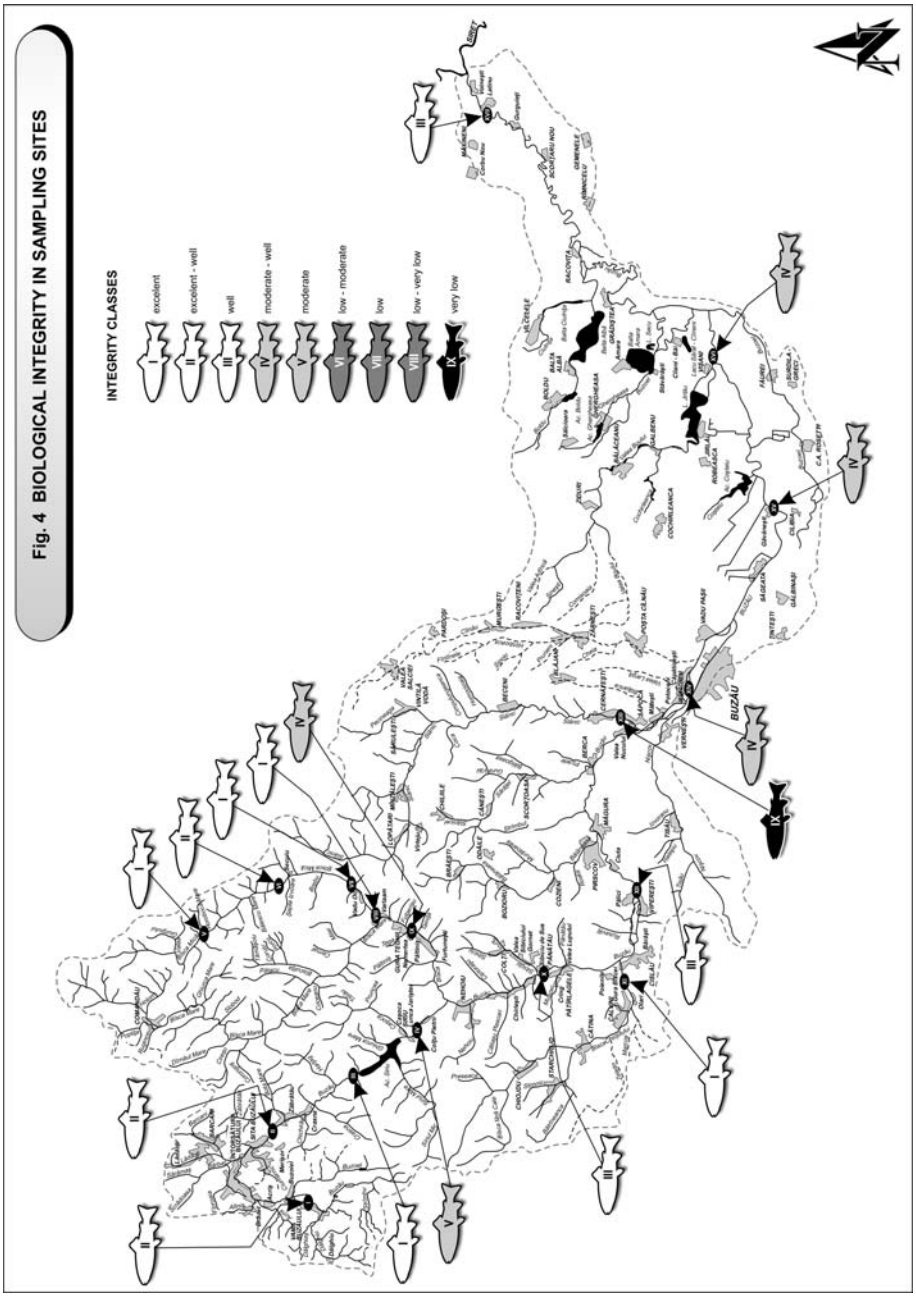
Fig. 4 BIOLOGICAL INTEGRITY IN SAMPLING SITES
INTEGRITY CLASSES
excelent
excelent - well
well
moderate - well
moderate
low - moderate
low
low - very low
very low
BUZĂU