

THE COMPARATIVE ANALYSIS OF FISH RESOURCES IN THE DANUBE NEAR BRĂILA, WITHIN THE PERIODS 1972-1986 AND 2006-2008

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Abstract

The purpose of this paper is to propose a new indicators for assessing the health of fish population in the Danube River, near Brăila. In this way we analyzed the available data sets provided by industrial fishing from this area, for two different periods: present period (2006-2008) and previous period (1972-1986). Between 1972-1986 the environmental conditions in the Danube River were highly affected by direct and indirect anthropogenic activities. In 2006-2008 the human impact on fish populations was diminished because fishing was banned in floodplain areas, economic activities decreased and new legislation on environmental protection came into force. The proposed indicators describing the status of the freshwater fish community from the Danube River, near Brăila are: (1) the total capture (TC, tonnes/year); (2) the total capture per unit area (TCA, tonnes/year x km²); (3) the total number of fish species (TNF, number of species/year); (4) the number of valuable fish species (NVF, number of species/year); (5) the number of ruling fish species (NRF, number of species/year); (6) the abundance of flow preference guilds (AFPG, % / guild). This comparative analysis highlights a highly unbalanced structure of the fish community in both periods, but in 2006-2008 the fish community structure come out to be in a changing process due to increase of rheophilic species.

Key words: Danube, fish, captures, present, past

INTRODUCTION

Freshwater fish capture are an important source of animal protein, at global level that accounted 6.1 % of the total fish global production in 2001 year (the other parts come from marine capture, 59.8 % and from aquaculture, 34.1% [6]. An important guiding principle for freshwater fisheries development should be that of maximizing benefits from all activities for as many stakeholders as possible while maintaining a healthy environment.

There is a long tradition in which fishes have been used as indicators for environment assessment. Various methods were subsequently developed [7, 8, 10]. Due to their complex requirements as specific habitat [3], habitat connectivity conditions [9,14], specific food [15], fishes are sensitive indicators for ecosystem integrity. In Europe, the development of new and the adaptation of existing fish-based methods is still in the

early stage [11]. New EU water policy (Water Framework Directive) specifies fishes as one of the four biotic elements which are decisive for assessing water ecological statute. Future efforts of researchers should aim to standardize fish-based assessment of the ecological integrity of running waters.

MATERIAL AND METHODS

The investigated area is the Danube River between Brăila town (rkm170) and Giurgeni village (rkm 238). In this area the Danube River canal has a total length of 118 km and a total surface of 6160 ha and the floodplain areas has a total terrestrial surface of 14914 ha from which the aquatic surface is 4465 ha.

A suitable way of monitoring and analyzing the trends of the freshwater ecosystems is by comparing the qualitative and quantitative structure of freshwater fish populations of the present with that of the reference situation. In this purpose were

found two suitable data sets that are comprehensive enough to enable ecological analysis of fish community structures. The former fisheries society, SC Vermatta SA, provided the official capture from industrial fishing for 1972-1986 and the actual fisheries authority, National Agency for Fishing and Aquaculture, provided the official capture for 2006-2008. The reference structure of freshwater fish populations is taken over from different bibliographic sources [1,5]. In these analyzed periods the gillnet fishing was used in the running water of Danube River and trapping methods were used in lentic water of floodplain area.

The study highlight the changes of six indicators describing the status of the freshwater fish community by analyzing the captures from industrial fishing, both, in Danube River canal and its floodplain area, in the two different periods. The analyzed indicators are: (1) the total capture; (2) the total capture per unit area; (3) the total number of fish species; (4) the number of

valuable fish species (5) the number of ruling fish species; (6) the abundance of flow preference guilds.

RESULTS AND DISCUSSION

(1) The total annual capture of freshwater fish species - TC (tonnes/year) shows a long-term fluctuation of fish caught in the Lower Danube, near Brăila. It is obvious that the biggest catch was recorded, in all these years, in floodplain areas, the highest catch recorded in 1978 was about 631 tonnes, that means 10.6, respectively 12 times higher than the biggest catch from Danube River canal between 1972-1986, respectively 2006-2008. The average catch calculated for floodplain areas was 8.3, respectively 8.5 times higher than in the Danube River canal between 1972-1986, respectively 2006-2008. The TC (tonnes/year) recorded in the Danube River canal seems to be similar between 1972-1986 and 2006-2008 (figure 1).

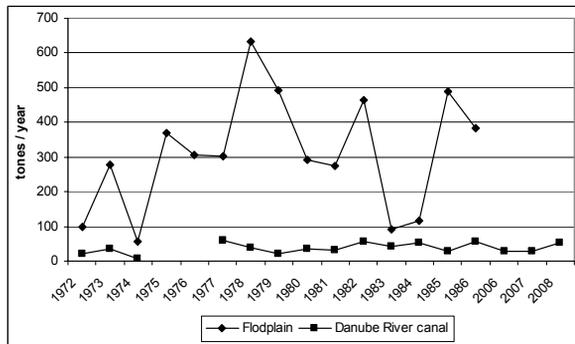


Figure 1. Total annual capture of freshwater fish species (tonnes/year)

During 1972-1986 (15 years) there was 1 year with poor fish catch (1974), 3 years with mediocre fish catch (1972, 1983, 1984), 6 years with good fish catch (1973, 1975, 1976, 1977, 1980, 1982) and 5 years with very good fish catch (1978, 1979, 1982, 1985, 1986) (figure 1). This sequence, 1-3-6-5, is very close to findings of Antipa from reference period, 1880-1910, in the same area, the reference sequence being 1-2-5-7 [1].

(2) The total annual capture of freshwater fish species per unit area - TCA (tonnes/year x km²) is an alternative to the first indicator (1) used to compare the productivity of freshwater ecosystems or the efficiency of inland fisheries all round the world. After FAO statistics, the highest capture in 2001 year was around 4.7 tonnes/km² in Bangladesh, 2.0 tonnes/km² in Cambodia, almost of countries range from 0.5 to 0.2 tonnes/km² [6].

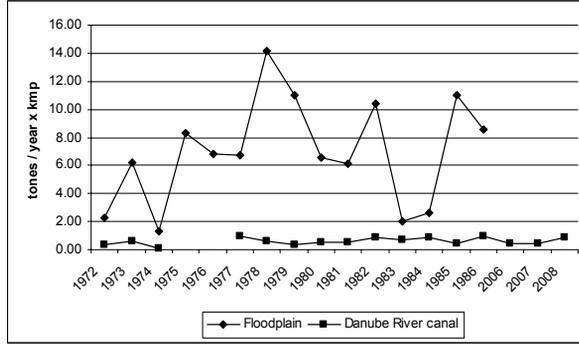


Figure 2. The total annual capture of freshwater fish species per unit area (tonnes/year x km²)

The average catch calculated for Danube River canal of 0.6 tonnes/km² is comparable with the FAO statistic of inland fisheries, instead of it the average catch calculated for floodplain areas of 6.9 tonnes/km² in 1972-1986 period demonstrate that the fishing activity in floodplain areas is total, without chance to escape for fish. The actual legislation forbidden the fishing in floodplain

areas, that being a very good management decision for fish community structure and stock restoration.

(3) The total annual number of freshwater fish species - TNF (number of species/year) is generally an indicator of fish biodiversity, but in this case of industrial fishing in an indicator of fish availability for fishing.

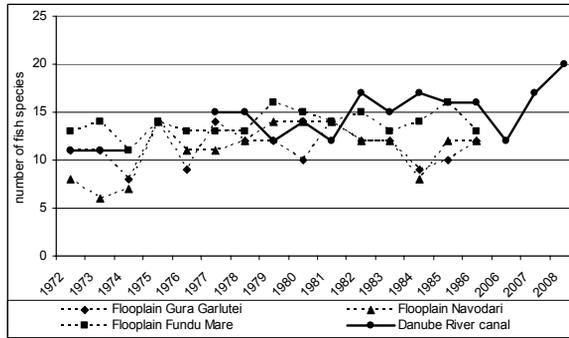


Figure 3. The total annual number of freshwater fish species (TNF)

The figures 3 shows that the diversity of freshwater fish species was higher in the Danube River canal capture, thus in 8 years from all 13 years, when captures was recorded, the TNF in the Danube River canal was higher or equal than the TNF in floodplain area. This situation is due to pointed out in captures of a few strict rheophilic species (*Chondrostoma nasus*, *Abramis sapa*, *Aspro streber*), which live only in running water.

In the present period, the TNF in the Danube River canal has been increased and reach the maximum for all periods as 20 fish species. This situation may be due to a few running water fish species not characteristic for this sector which get down with the high flow happened in the last years.

A similar indicator proposed for ecological purpose is number of river-type-specific species (NRTS) [13], that reflects the indigenous fish fauna naturally occurring in the specific type of a river, excluding

species not native in a given area and not autochthonous in the specific river.

(4) The number of valuable freshwater fish species - NVF (number of species/year). The valuable species are those with relative biomass (RB) bigger than 1%. This is an indicator of fish community structure, the

higher the better. The analyze made in all these three periods highlight that the better fish community structure is between 2006-2008, when the average of this indicator of 11 is 1.4, respectively 1.8 times higher than in the Danube River canal, respectively in floodplain area between 1972-1986 (figure 4).

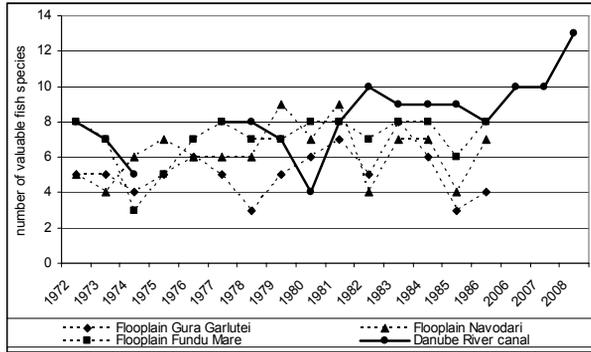


Figure 4. The annual number of valuable freshwater fish species (NVF)

(5) The number of ruling freshwater fish species - NRF (number of species/year). The ruling species are those with relative biomass (RB) bigger than 10%. This is also an indicator of fish community structure, the higher the better. The better fish community structure is between 2006-2008, the average

number of ruling fish species was 4 comparative with 2.3 respectively 1.99 in the previous period in the Danube River canal, respectively in floodplain area (figure 5). The occurrence and number of ruling fish species is a good indicator of diversity of economically important fishes.

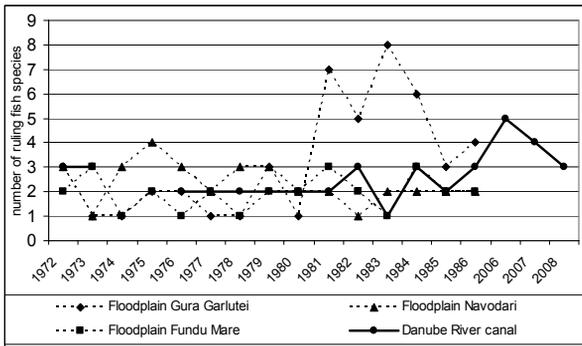


Figure 5. The annual number of ruling freshwater fish species (NRF)

(6) The abundance of flow preference guilds - AFGP (% / guild). Freshwater fish species can be grouped into guilds (functional groups) of species that exploit a resource (food or habitat) in a similar fashion. Guilds are suitable for ecological analysis of fish data sets underlying causes and ecological mechanisms of the depauperate state of the present

ichthyofauna of most large rivers in Europe [4]. Fish species was grouped into feeding guilds [15], reproductive guilds [2], flow preference guilds [12].

Because the fish fauna mainly consists of generalist feeders, the analyses of fish populations structure based on feeding guilds were not very discriminating. Instead, flow

preference and reproduction ecology of river fish are closely linked, therefore in many studies the flow preference guilds are most generally used for assessing the ecological integrity and functioning of large river systems.

The freshwater fish species caught by industrial fishing in the Lower Danube River, near Brăila, are put together according to the flow preference [12] into three guilds: eurytopic species (E), rheophilic species (R) and limnophilic or lentic species (L) (table1).

Table 1. The flow preference guilds of freshwater fish species from the Danube River, Brăila area (¹after [12] and ² after author)

Characteristic of flow preference guilds	Species: scientific name (common name)
Eurytopic species (E): All stages of life history can occur in both lotic and lentic waters	<i>Cyprinus carpio</i> ¹ (common carp); <i>Silurus glanis</i> ¹ (wels catfish); <i>Stizostedion lucioperca</i> ¹ (pike-perch); <i>Abramis brama</i> ¹ (common bream); <i>Blicca bjorkna</i> ¹ (white bream); <i>Alburnus alburnus</i> ¹ (bleak); <i>Aspius aspius</i> ¹ (asp); <i>Carassius auratus</i> ¹ (goldfish); <i>Perca fluviatilis</i> ¹ (european perch); <i>Esox lucius</i> ¹ (northern pike); <i>Rutilus rutilus</i> ¹ (roach)
Rheophilic species (R) A: All freshwater stages of life history are confined to the main river channel. B: Some stages of life history are confined to well connected backwaters or tributaries	<i>Barbus barbus</i> ¹ (barbel); <i>Acipenser ruthenus</i> ¹ (sterlet); <i>Aristichthys nobilis</i> ¹ (bighead carp); <i>Hypophthalmichthys molitrix</i> ¹ (silver carp); <i>Chondrostoma nasus</i> ¹ (sneep); <i>Abramis sapa</i> ² (white-eye bream); <i>Aspro streber</i> ² (Danube streber); <i>Vimba vimba</i> ² (vimba); <i>Pelecus cultratus</i> ² (ziege)
Limnophilic species (L) All stages of life history are confined to lentic waters with macrophytes	<i>Carassius carassiu</i> ¹ (crucian carp); <i>Tinca tinca</i> ¹ (tench); <i>Scardinius erythrophthalmus</i> ¹ (rudd); <i>Acerina cernua</i> ² (ruffe)

The AFPG analyse (figure 6) highlight a high occurrence of eurytopic species, both in the past and present period, and a significant increase for rheophilic species which are well represented in the present period. In Brăila area, the presence of floodplains with stagnant ecosystems and the decrease in

current velocities in the main canal is traditionally reflected in well occurrence of limnophilic and eurytopic species and in poor occurrence of rheophilic species. The increase of rheophilic species abundance in the present period may be a consequence of high flow happend in the last years.

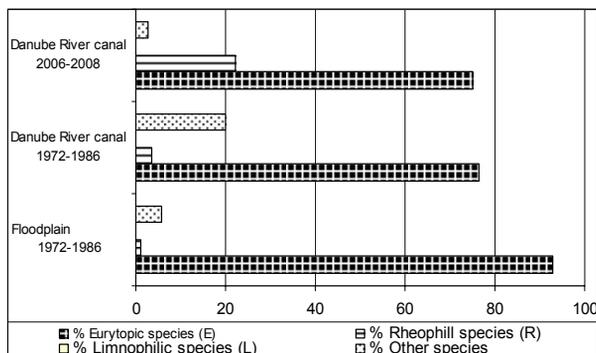


Figure 6. The abundance of flow preference guilds (%) in Danube River, near Brăila

CONCLUSIONS

The data on fish catch recorded in the Danube River canal and its floodplain areas in the previous periods represent an extremely valuable reference to study fish community changes. The informational value of fish catch data can be enhanced by application of fish-based assessment of the ecological integrity of running waters.

The analyses of the six indicators based on fish catch show a highly unbalanced structure of the fish community both for the previous periods and for the present period. The climate changes with its consequence as flow increase may be a cause of actual increase of rheophilic species.

The new legislation on environmental protection for this area (Danube River and its floodplain with a surface of 21074 ha obtained the statute of Natural Park according to Low 5/2000 and HG 230/2003), which forbidden the industrial fishing in floodplain area and permit the industrial fishing only in Danube River canal is just, that offer chances both to fishes and to fisherman.

The proposed indicators of freshwater fish populations can be use both in fisheries management and in environment management. Responsible management should take into account regional research, an adaptive management is considered more suitable than following strict guidelines and regulations.

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