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PRELIMINARY ASSESSMENT OF THE WATER QUALITY AND LENGTH-WEIGHT RELATIONSHIP IN FISHES OF IALOMIȚA RIVER: A NOTE FROM FIERBINȚI-TÂRG

Mala-Maria STAVRESCU-BEDIVAN[1], Gina VASILE SCĂEȚEANU[1], Roxana Maria MADJAR[1], Cristina-Florentina ALISTAR[2], Emilia Brîndușa SĂNDULESCU[1]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, District 1, 011464, Bucharest, Romania
[2]Institute of Biology Bucharest, Romanian Academy, 296 Splaiul Independentei, District 6, 060031, Bucharest, Romania

Corresponding author email: emilia.sandulescu@agro-bucuresti.ro

Abstract

In 2024 and 2025, several specimens of Blicca bjoerkna and Carassius gibelio were captured from the Ialomița River, near the locality of Fierbinți-Târg. The length-weight relationship indicated that the white bream and Prussian carp exhibited positive allometric growth. To complete the habitat assessment, two water samples, collected from the fish capture site (S1) and from another section of the same river (S2), were analyzed for physico-chemical parameters and compared with the limits established by national quality standards and recommended values for fish. Considering all measured quality parameters, water from S2 is of lower quality than that from S1. Microbiological analyses revealed the presence of Gram-positive cocci, bacilli Gram-positive, filamentous micromycetes and yeasts. Correlating the biometric data of the fish with the physico-chemical and microbiological parameters of the water could suggest that both B. bjoerkna, an autochthonous species, and C. gibelio, an invasive species, show positive allometric growth in a less polluted environment, characterized by reduced organic load.

Key words*: fish species, Ialomița river, length weight-relationship, water analysis.*

INTRODUCTION

The Ialomița River, a major tributary of the Danube in southern Romania, flows through an intensively cultivated plain where agricultural runoff and diffuse pollution strongly influence water quality. Long-term monitoring (2007-2018) of the basin documented variable physicochemical conditions, reflecting the influence of land use and anthropogenic pressures on water quality in the lower basin (Dunea et al., 2020). These conditions are typical for lowland rivers receiving agricultural and urban inputs and can favor eutrophic states that affect aquatic biota.

Fish assemblages in the Ialomița River basin are composed of a mixture of native and introduced species.

Surveys reported 32 fish species in the southern part of the basin, including tolerant taxa such as *Carassius gibelio* and other cyprinids dominant in disturbed habitats. Species such as Prussian carp are known to thrive in slow-flowing, nutrient-enriched waters and often dominate where habitat degradation and water-quality stressors are present (Davideanu et al., 2010).

Recent investigations of *Carassius gibelio* from urban lakes in Bucharest have reported pollution-associated alterations in antioxidative defense, gut microbiota, and metabolome, supporting the species' high tolerance and adaptive capacity under contaminant exposure (Alistar et al., 2022; Voinea et al., 2023).

Regarded as an invasive species that impacts ecosystems, Prussian carp *Carassius gibelio* (Bloch, 1782) is the most caught species by fishermen in many lowland rivers in Romania (Drăgan et al., 2024), with a common length of 20 cm (Kottelat & Freyhof, 2007). In Ialomița River, *C. gibelio* was reported before (Năstase & Oțel, 2016; Dunea et al., 2020; Drăgan et al., 2024).

On the other hand, White bream *Blicca bjoerkna* (Linnaeus, 1758), a medium-sized native species, with a typical length of 15-20

cm (Mustea, 2023), has not been reported so far in Ialomița River.

Among other water bodies included in some SCIs Natura 2000 from Romania, Năstase & Oțel (2016) investigated Ialomița River in terms of fish fauna and stated that intense pollution has negative impact on its fish community.

However, little data is available, concerning the physico-chemical parameters and microbiological load of Ialomița River, in relation with fish fauna. Therefore, this study aims to explore the data regarding the ichthyofauna of Ialomița River and its environmental quality, considering the need of information upon this topic.

MATERIALS AND METHODS

Study site and fish measurements

The fish specimens (Figure 1a) were caught with a rod and a trap net in November 2024 and February 2025 from the Ialomița River (Figure 1b), near Fierbinți-Târg, at GPS coordinates 44°41'18.8"N, 26° 23'31.4"E (sampling point S1). The town of Fierbinți-Târg is placed in the south east of the Romania, in the historical province of Muntenia, in the western extremity of Ialomiţa County (https://romaniadategeografice.net/).

In 2024 fishing session, only 14 individuals of *Carassius gibelio* (Prussian carp) were captured, while in 2025 were collected: another 14 individuals of *C. gibelio*, *Blicca bjoerkna* (White bream) (N=48), *Gymnocephalus cernua* (Ruffe) (N=3), *Squalius cephalus* (Chub) (N=3), *Rutilus rutilus* (Roach) (N=2), and one individual of *Cyprinus carpio* (carp). Overall, 85 fish individuals belonging to six species were obtained. However, Prussian carp and White bream constitute the main ichthyological material for the biometric assessment, as these species were best represented numerically.

The scientific name and classification of fish species were given according to FishBase database (Kottelat & Freyhof, 2007; https://www.fishbase.se/). In order to assess the length-weight relationship (LWR), fish individuals were measured for total length (TL, in cm), standard length (SL, in cm) and weighed (TW=total body weight, in grams) to the nearest 1.0 mm and 0.1 g, respectively.

The weight-length relationships were computed as $TW=aTL^b$ and $TW=aSL^b$ where intercept *a* represents the rate of change of weight with length of fish, while slope *b* gives information regarding the type of growth (Froese, 2006). Also, the relationship between the weight and the length of the fish was calculated through linear regression (Log W= Log a + b Log L) (Stavrescu-Bedivan et al., 2023).

According to Karachle & Stergiou (2012), a positive allometric pattern of growth is indicated when $b > 3$ and a negative allometric or hypoallometric growth type when $b < 3$.

Water sampling and analyses

Water samples were collected in 2025 from the fish capture site (S1 from 44°41'18.8"N, 26° 23'31.4"E) and from another section of the Ialomița river (S2 from 44°41'04.7"N, 26° 20'57.9"E).

Water sampling was designed as a preliminary component of the study, aiming to characterize the habitat conditions associated with fish captures. During the 2025 campaign, two sectors of the river (S1 and S2) were analyzed, selected to allow an indicative comparison between the capture site and a sector with potentially different anthropogenic pressures.

The adopted approach provides an initial contextual assessment, while additional long-term investigations are necessary to support more robust conclusions.

In order to ensure accuracy in the water quality assessment, three samples were collected from each sampling point, whereby each one was analyzed in duplicate. Samples were obtained through manual grab sampling, a method widely used in surface water monitoring studies (Kalkhajeh et al., 2019). Water was collected at a depth of 0.5 m using polyethylene bottles that had been rinsed three times beforehand with the sampled water. All samples were properly labeled and transported to the laboratory in a cooler maintained at 4°C. Prior to analysis, the samples were kept in the laboratory until they reached room temperature.

In Table 1 are presented determined parameters, used methods and instrumentation.

Table 1. Determined parameters, analytical methods and instrumentation.

Parameter	Abbreviation	Unit	Analytical methods	Instrumentation
pH	pH	pH units	Potentiometry	inoLab pH 720, WTW, Germany
Electrical conductivity	EC	µS cm^{-1}	Conductometry	SensION7, Hach, USA
Total hardness	TH	mg CaO L^{-1}	Complexometric method	-
Chemical oxygen demand	COD	mg O_2 L^{-1}	Redox titration	-
Nitrite nitrogen	$N\text{-}NO_2^-$	mg N L^{-1}	Spectrophotometry	MetertechSP830 Plus spectrophotometer, Metertech Inc., Taiwan
Nitrate nitrogen	$N\text{-}NO_3^-$	mg N L^{-1}		
Ammonium nitrogen	$N\text{-}NH_4^+$	mg N L^{-1}		
Phosphate phosphorus	$P\text{-}PO_4^{3-}$	mg P L^{-1}		

Microbiological analysis

From each water sample, a specific volume (0.1 mL/100 µL) was plated, under aseptic conditions, on the surface of the agarized medium in the Petri dish (nutrient agar for the detection of bacteria and Sabouraud Dextrose Agar for the isolation of filamentous fungi and yeasts) by the plating method (Manole, 2025).

To assess the general morphological characteristics, the plates were incubated and the developed colonies were observed macroscopically and microscopically by making preparations, the identification being carried out at a presumptive level, without the use of biochemical or molecular tests

RESULTS AND DISCUSSIONS

I. Biometric analysis of Blicca bjoerkna and Carassius gibelio

The biometric data for White bream (*Blicca bjoerkna*) sampled in 2025 (N=48, unsexed) were registered as follows: TL (min. 7.5 - max. 15.5 cm, with an average of 11.78 cm); SL (min. 5.8 – max.12.5 cm, 9.01 cm average); TW (min. 3 – max. 40 g, 16.23 g average).

The weight-length relationships for *B. bjoerkna* were calculated as: Log (TW)=3.3349 Log (TL)-2.4044 (r^2=0.9488, 95% confidence intervals for the intercept and the slope); $TW=0.0039TL^{3.3349}$; Log (TW)=3.089 Log (SL)-1.8075 (r^2= 0.9687, 95% confidence intervals for the intercept and the slope); $TW=0.0156SL^{3.089}$.

Regarding the biometry of Prussian carp (*Carassius gibelio*) sampled in 2024 (N=14, unsexed), the following data were obtained: TL (min. 9 – max. 12.20 cm, average 10.65 cm); SL (min. 7.20 – max. 10 cm, average 8.63 cm); TW (min. 14.7 – max. 33.64 g, 23.80 g average); Log (TW)=3.164 Log (TL)-1.8831 (r^2=0.9299, 95% confidence intervals for the intercept and the slope); $TW=0.0131TL^{3.164}$; Log (TW)=2.6514 Log (SL)-1.1135 (r^2=0.9088, 95% confidence intervals for the intercept and the slope); $TW = 0.0776SL^{2.6514}$.

As for *C. gibelio* collected in 2025 (N=14, unsexed), the registered values are: TL (min. 8.80 – max. 14 cm, average 11.81 cm); SL (min. 7.20 – max. 10 cm, average 8.63 cm); TW (min. 10 – max. 48 g, 27.64 g average); Log (TW)=3.2622 Log (TL)-2.0798 (r^2=0.9541, 95% confidence intervals for the intercept and the slope); $TW=0.0083TL^{3.2622}$; Log (TW)=3.5161 Log (SL)-2.0501 (r^2=0.9652, 95% confidence intervals for the intercept and the slope); $TW = 0.0089SL^{3.5161}$.

In LWR (where TL was considered), it can be noticed that the values for slope *b* were within the expected range of 2.5-3.5 for all analyzed fish individuals. With values of *b* being higher than 3, the growth type for White bream and Prussian carp sampled in Ialomița River was estimated as positive allometric, which means that fishes grow faster in weight than in length (Karachle & Stergiou, 2012). However, the small samples call for caution in interpreting the results and it is estimated that future catches in various sampling points and seasons will be necessary to track the growth patterns of the fish in the studied ecosystem.

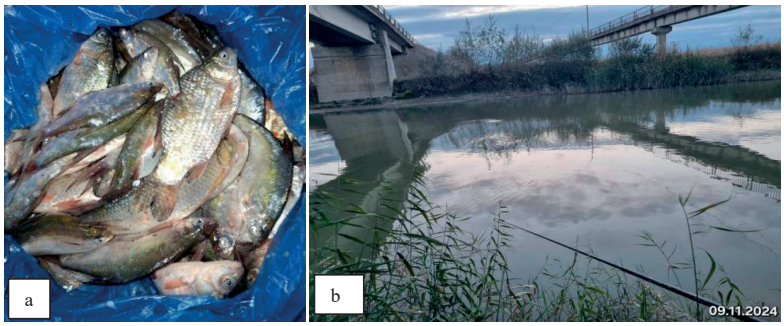

Figure 1. Cyprinid fishes (a) caught in Ialomița River, S1 (b), November 2024

II. Water analysis results and interpretation

Table 2 presents the measured ranges, mean values with standard deviations, and corresponding quality class limits for selected physicochemical parameters in samples S1 and S2. The classification of each parameter is based on established water quality standards (Order 161/2006), allowing comparison of the samples' water quality status.

Table 2. Ranges, means, standard deviations and the assignment of water quality classes for the samples collected from Ialomița river near Fierbinți-Târg locality

Parameter	Unit	S1			S2		
		Min.–Max.	Mean ± SD	Limits/Quality classes *	Min.–Max.	Mean ± SD	Limits/Quality classes *
pH	pH unit	7.52-7.61	7.55±0.052	6.50-8.50	6.29-6.38	6.33±0.047	6.50-8.50
EC	µS cm^{-1}	908-912	909.67±2.082	NA	532-535	533.67±1.528	NA
TH	mg CaO L^{-1}	17.05-17.50	17.28±0.224	NA	10.32-10.77	10.47±0.259	NA
COD	mg O_2 L^{-1}	3.92-4.08	4.02±0.092	I	9.83-9.91	9.86±0.046	II
$N\text{-}NO_2^-$	mg N L^{-1}	0.036-0.038	0.038±0.001	III	0.010-0.012	0.011±0.001	II
$N\text{-}NO_3^-$	mg N L^{-1}	2.125-2.461	2.322±0.176	II	0.128-0.163	0.139±0.020	I
$N\text{-}NH_4^+$	mg N L^{-1}	0.140-0.163	0.147±0.013	I	0.605-0.768	0.682±0.082	II
$P\text{-}PO_4^{3-}$	mg P L^{-1}	0.025-0.037	0.033±0.007	I	0.098-0.160	0.127±0.031	II

Notes: SD = standard deviation; * = according to (Order 161/2006); NA = not available.

a) pH is crucial for aquatic life: high pH increases ammonia toxicity, low pH enhances metal toxicity, and values below 6 promote toxic hydrogen sulfide formation (Sallenave, 2012). Deviations from the optimal pH range also impair fish growth, reproduction, and phytoplankton development (Stone & Thomforde, 2004; Alatorre-Jacome et al., 2011).

The pH values of the analyzed samples ranged between 7.52 and 7.61, with an average value of 7.55±0.052 for sample S1, and between 6.29 and 6.38, with an average value of 6.33±0.047 for sample S2 (Table 2). For sample S1, the pH values fall within the range imposed by legislation (Order no. 161/2006), whereas for sample S2 the pH is slightly lower. The optimal pH for fish generally ranges from 6.50 to 9.00, varying by species (Turlybek et al., 2025). Similar research on water quality in relation to the Prussian carp (*Carassius gibelio*) species indicated pH values ranging between 7.25 and 8.11 (Sandu et al., 2023).

b) Electrical conductivity (EC) reflects dissolved ion concentration; although no official limits exist, surface waters with 60–2000 µS cm^{-1} are generally suitable for most fish (Stone & Thomforde, 2004; Austin et al., 2016). EC values (Table 2) were within the recommended range: 908-912 µS cm^{-1} for S1 (mean 909.67 ± 2.08) and 532-535 µS cm^{-1} for S2 (mean 533.67 ± 1.53).

c) Total hardness (TH), reflecting Ca^{2+} and Mg^{2+} essential for aquatic life (Lall & Kaushik), ranged 17.05–17.50 mg CaO L^{-1} in S1 (mean 17.28 ± 0.224) and 10.32–10.77 mg CaO L^{-1} in S2 (mean 10.47 ± 0.259) (Table 2). Although no regulatory limits exist, 28-84 mg CaO L^{-1} is considered optimal for aquaculture (Stone & Thomforde, 2004).

d) Chemical oxygen demand (COD) measures the oxygen needed to oxidize reducible

substances in water (Lv et al., 2024). Sample S1 falls in water quality class I, while S2 is class II, with a COD more than twice that of S1 (Table 2).

e) Nutrient levels

Phosphorus and nitrogen are essential for algae and aquatic plant growth but can cause eutrophication at high concentrations by lowering dissolved oxygen (Akinnawo, 2023). Phosphate levels of 0.08-0.10 mg L^{-1} may favour algal blooms (Akhter et al., 2021). Nitrogen, mainly as ammonium (NH_4^+), nitrite (NO_2^-), and nitrate (NO_3^-), primarily comes from agriculture (Vasile Scăețeanu & Madjar, 2025) and its oxidation consumes oxygen, exerting additional stress on fish communities. While phosphorus and nitrates contribute to eutrophication, nitrites are directly toxic, converting hemoglobin to methemoglobin, reducing oxygen transport, and causing brown discoloration (Jensen, 2003; Kroupova et al., 2005). Tolerance varies: largemouth and cool-water fish are sensitive even to low levels (Durborow et al., 1997), highlighting the need for continuous monitoring.

Nitrite levels classified S1 as water quality class III and S2 as class II, with S1's mean over three times higher than S2 (Table 2, Figure 2), though both remain below harmful thresholds for fish (0-0.2 mg L^{-1} optimal; >0.5 mg L^{-1} harmful; >1.6 mg L^{-1} lethal) (Akhter et al., 2021). Nitrate ranged from 2.322±0.176 mg N L^{-1} (S1, class II) to 0.139 ± 0.020 mg N L^{-1} (S2, class I), while ammonium remained low (S1, class I; S2, class II). Phosphate averaged 0.033 ± 0.007 mg P L^{-1} in S1 (class I) and 0.127 ± 0.031 mg P L^{-1} in S2 (class II). According to a study (Jeppesen et al., 2000) increased phosphorus concentrations in water lead to higher densities of cyprinid fish, accompanied by a decrease in their average body weight.

Overall, most parameters fell in classes I–II per Romanian legislation (Order no. 161/2006) and the EU Water Framework Directive (Directive 2000/60/EC), except S1, which was class III due to elevated nitrite (Table 2, Figure 2).

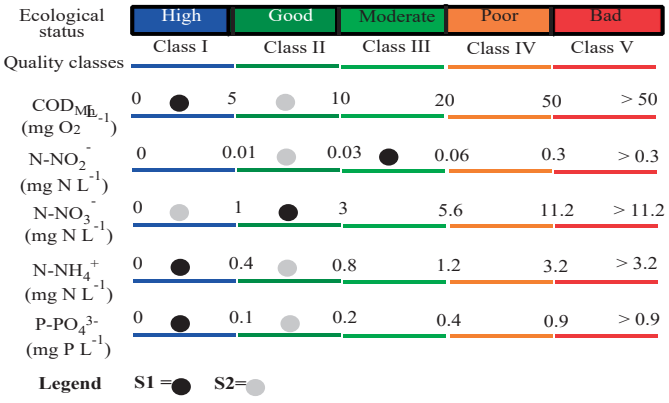

Figure 2. Ecological status and quality classes according to quality parameters' levels for the classification of surface water quality

III. Principal component analysis (PCA) and nutrient correlations

a) PCA analysis

The PCA biplot (Figure 3) reveals a clear separation between fish capture sites S1 and S2, primarily along PC1, which explains 98% of the total variance. This indicates that the major differences between the two sites are driven by the physicochemical characteristics of the water.

Site S1 is positioned on the negative side of PC1 and is closely associated with pH, EC, TH, and nitrogen compounds (NO_2^- + NO_3^-). This suggests that fish captured at S1 are linked to waters with higher mineral content and hardness, reflecting more stable or less nutrient-enriched conditions

In contrast, site S2 is located on the positive side of PC1 and shows a strong association with chemical oxygen demand (COD), ammonium (N–NH_4^+), and phosphate (P–PO_4^3). This indicates that fish capture at S2 occurs in waters with elevated organic matter

and nutrient levels, which may be indicative of anthropogenic inputs or eutrophic conditions. PC2 accounts for only 1.5% of the variance, suggesting that differences along this axis are minimal and that PC1 is the dominant factor structuring the separation between sites.

Overall, the PCA graphic demonstrates that fish capture sites S1 and S2 are characterized by contrasting water quality conditions, which likely influence fish distribution and abundance at the two locations.

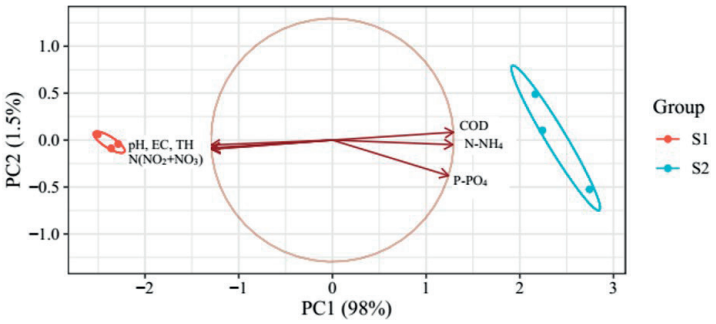

Figure 3. PCA biplot showing the separation of sampling sites based on water quality variables. PC1 explains 98% of the total variance and distinguishes S1 (associated with pH, EC, TH, and NO_2^- + NO_3^-) from S2 (associated with COD, $N–NH_4^+$, and $P–PO_4^{3-}$), while PC2 explains 1.5% of the variance

b) Correlations between TH, EC and pH

A strong positive relationship between TH and both EC and pH has been evidenced (Figure 4). EC increases linearly with TH ($r = 0.9981$, $p < 0.001$), indicating that higher water hardness is associated with increased ionic content. Similarly, pH also rises with increasing TH ($r = 0.9963$, $p < 0.001$), reflecting a shift toward more alkaline conditions as hardness increases. These strong correlations suggest that mineral enrichment of the water significantly influences both conductivity and pH. The strong positive correlations between TH, EC, and pH suggest that mineral content plays a key role in shaping the water chemistry at the study sites.

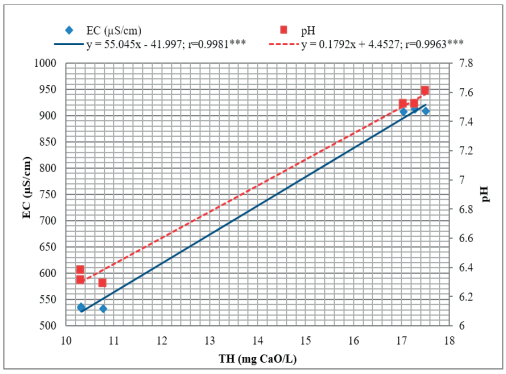

Figure 4. Correlation between TH and EC and pH

As TH increases, the rise in EC indicates a greater concentration of dissolved ions, reflecting enhanced mineralization. Concurrently, the increase in pH with TH suggests a shift toward more alkaline conditions, which could influence the availability of nutrients and the overall aquatic ecosystem health. These relationships highlight how variations in water hardness can impact multiple physicochemical parameters, potentially affecting fish habitats and water quality.

c) Correlations between COD and nutrients

COD was significantly correlated with nutrient concentrations in the water samples. Nitrate ($N–NO_3^-$) and nitrite ($N–NO_2^-$) showed strong negative correlations with COD ($r = –0.9959$ and $–0.9979$, respectively; $p < 0.001$), indicating that their concentrations decreased as COD increased. In contrast, ammonium ($N–NH_4^+$) exhibited a strong positive correlation with COD ($r = 0.9850$, $p < 0.001$), while phosphate ($P–PO_4^{3-}$) showed a moderate positive correlation ($r = 0.9350$, $p < 0.01$). These results suggest that higher organic matter levels, as indicated by COD, are associated with increases in ammonium and phosphate, and decreases in nitrate and nitrite concentrations.The graph (Figure 5) shows how COD, which measures the amount of organic matter

in water (Zhang et al., 2026), relates to different forms of nitrogen and phosphate in the aquatic environment.

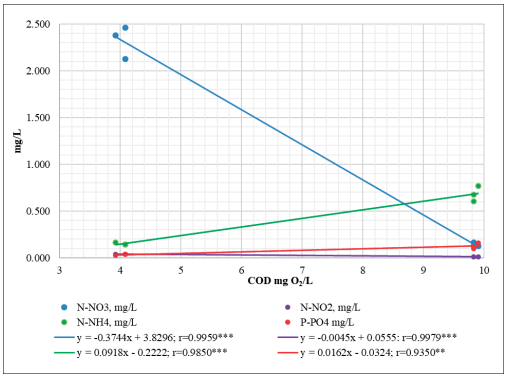

Figure 5. Relationships between chemical oxygen demand (COD) and nutrient concentrations: nitrate ($N–NO_3^-$), ammonium ($N–NH_4^+$), nitrite ($N–NO_2^-$), and phosphate ($P–PO_4^{3-}$)

The observed relationships between COD and nutrient concentrations highlight important shifts in nitrogen and phosphorus dynamics within the aquatic system. The strong negative correlations of nitrate ($N–NO_3^-$) and nitrite ($N–NO_2^-$) with increasing COD suggest that these oxidized nitrogen forms are being depleted, possibly due to enhanced microbial consumption or conversion processes under higher organic load conditions. Meanwhile, the positive correlation between ammonium ($N–NH_4^+$) and COD indicates accumulation of reduced nitrogen species, which may result from increased organic matter decomposition or inhibited nitrification. The moderate increase in phosphate ($P–PO_4^{3-}$) with COD further suggests that organic enrichment may contribute to nutrient release or reduced uptake, potentially exacerbating eutrophication risks. Together, these patterns reflect how elevated organic pollution can alter nutrient cycling, impacting water quality and ecosystem health.

As organic pollution rises (higher COD), oxygen is used up, shifting the nitrogen cycle from nitrate/nitrite forms toward ammonium, and phosphorus is released into the water. This change in nutrient forms can affect water quality and contribute to problems like eutrophication, where excessive nutrients cause algae blooms and harm aquatic life.

Although temporally limited, the water quality analysis allows a clear differentiation between sectors S1 and S2 and provides a plausible interpretative framework for the analysis of the growth patterns observed in fish.

The study thus contributes baseline data for a poorly documented sector of the Ialomița River and supports the design of subsequent ecological monitoring programs.

IV. Microbiological analysis

The microbiological analysis revealed the presence of microorganisms belonging to the main microbial groups: bacteria, yeasts, filamentous fungi (Figures 6 and 7).

In S1, bacterial colonies with morphology corresponding to Gram-positive cocci were observed, suggestive of genera such as *Micrococcus luteus* but also Gram-positive bacilli, possibly belonging to the genus *Bacillus*. Filamentous micromycetes were also identified: *Aspergillus* sp., *Rhizopus* sp., *Trichoderma* spp. as well as yeasts with morphology similar to *Saccharomyces* sp.

In S2, in addition to the previously mentioned bacterial types in S1 (*Micrococcus luteus* and the *Bacillus* spp.), bacterial colonies formed by Gram-positive cocci arranged in short chains were identified, possibly suggesting the presence of enterococci (e.g. *Enterococcus* spp.). Also, in S2, exclusively yeasts were highlighted, without the development of filamentous fungi.

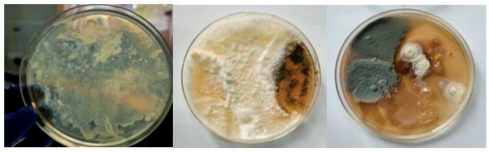

Figure 6. Macroscopic appearance of the colonies developed on nutrient medium (S1 and S2)

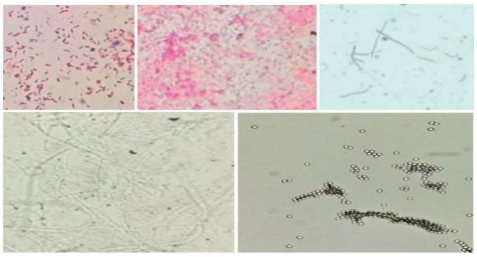

Figure 7. Macroscopic appearance after staining - bacteria and fungal structure

CONCLUSIONS

The microbiological results highlighted in this study are consistent with the physico-chemical ones, indicating a reduced degree of pollution in S1, respectively a higher organic load in S2. This is relevant, as the fish samples come from S1, a section of the Ialomița River where a positive allometric growth pattern was recorded for both species, considering the LWR calculation based on TL.

The analysed water samples exhibited variability in their chemical and physical characteristics, allowing their classification into different water quality classes in accordance with established regulatory standards. Overall, most parameters including pH, EC, TH, and nutrient concentrations fell within ranges considered suitable for freshwater ecosystems and aquaculture. However, nitrite levels in sample S1 were notably elevated, resulting in a lower water quality classification (class III) and highlighting the need for targeted monitoring and management measures. Physicochemical profiling and PCA analysis clearly distinguished S1 from S2, with robust correlations linking TH-EC-pH positively and COD inversely to oxidized nitrogen forms. These findings emphasize the importance of continuous water quality monitoring to protect aquatic life and to maintain the ecological status of water bodies in accordance with national and EU legislation. Furthermore, the results emphasize that maintaining water quality within safe ecological limits is essential for the sustainability of aquatic ecosystems and the protection of fish populations.

As for microbiological analysis, different distribution of microorganisms is observed between samples, indicating variations in microbial load, probably due to local environmental conditions (variations in organic matter input and local ecological conditions), an aspect that requires additional observations for confirmation and correlation with the physico-chemical parameters of the water.

The chemical and microbiological data from the samples indicate an input of biodegradable organic matter (e.g. domestic wastewater, manure, food waste).

S1 was predominantly in class I and presented typical microbiota (*Micrococcus, Bacillus, Aspergillus*), which suggests an area with low anthropogenic impact or well purified at the time of sampling. Therefore, S1 most likely corresponds to a section with better flow and self-purification conditions or located further from urban sources of household contamination.

The limitations of the present study are explained by the fact that catches from a single sampling point do not allow firm conclusions about the growth patterns of fish in relation to the quality of their habitat, but rather indicate potential correlations. For the herein report, LWR is interpreted only as preliminary observations. If in the future approach, White bream and Prussian carp were also sampled from S2, where the water has a higher organic load, it is very likely that *B. bjoerkna* would exhibit isometric or even hypoallometric growth, while *C. gibelio*, a species resistant to chemical and microbiological stress, would maintain its previously observed dynamics, and could benefit from the increase in organic matter, which gives it a competitive advantage in such habitats.

Overall, the results obtained can contribute to the development of local ecological monitoring and fisheries management strategies.

Future investigations should expand both the spatial and temporal coverage of monitoring by including seasonal sampling, assessments under variable hydrological conditions, and fish collections from both analyzed river sectors. Such an approach would enable a more rigorous evaluation of the relationships between organic load, nutrient dynamics, and fish growth parameters, thereby strengthening the ecological interpretation of habitat–biometry interactions.

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