EU4Environment in Eastern Partner Countries:
Water Resources and Environmental Data (ENI/2021/425-550)

AN IMPROVED DELINEATION PROPOSAL FOR GEORGIAN COASTAL AND TRANSITIONAL WATERS AND AN ASSESMENT OF THE ECOLOGICAL STATUS OF COASTAL WATER BODIES FROM KOBULETI TO ANAKLIA FROM 2022 TO 2023

Contract-No: 20940-C1/GE-NEA-2022/2

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ABOUT THIS REPORT

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ABOUT EU4ENVIRONMENT – WATER RESOURCES AND ENVIRONMENTAL DATA

This Programme aims at improving people's wellbeing in EU's Eastern Partner Countries and enabling their green transformation in line with the European Green Deal and the Sustainable Development Goals (SDGs). The programme's activities are clustered around two specific objectives: 1) support a more sustainable use of water resources and 2) improve the use of sound environmental data and their availability for policy-makers and citizens. It ensures continuity of the Shared Environmental Information System Phase II and the EU Water Initiative Plus for Eastern Partnership programmes.

The Programme is implemented by five Partner organisations: Environment Agency Austria (UBA), Austrian Development Agency (ADA), International Office for Water (OiEau) (France), Organisation for Economic Co-operation and Development (OECD), United Nations Economic Commission for Europe (UNECE). The action is co-funded by the European Union, the Austrian Development Cooperation and the French Artois-Picardie Water Agency based on a budget of EUR 12,75 million (EUR 12 million EU contribution). The implementation period is 2021-2024.

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List of abbreviations

BQE .... Biological Quality Elements

CTW .... Coastal and Transitional Waters

CW .... Coastal Waters

DIN .... Dissolved inorganic nitrogen

EU4EnvWD .... EU4Environment in Eastern Partner Countries: Water Resources and Environmental Data

EUWI+ .... European Union Water Initiative Plus

TW .... Transitional Waters

UBA .... Umweltbundesamt GmbH, Environment Agency Austria

PO4 .... Orthophosphates

PTot .... Total dissolved phosphorous

WB .... Water body

WFD .... Water Framework Directive

Country Specific Abbreviations Georgia

NEA .... National Environment Agency

Executive Summary

In August 2022 and May 2023, surveillance monitoring of coastal and transitional waters in Georgia was carried out in accordance with the requirements of the EU Water Framework Directive. Ecological monitoring was carried out at 9 selected coastal water stations from Kobuleti to Anaklia and at 7 transitional water stations at the mouths of the Supsa and Rioni rivers and at Lake Paliastomi.

The thermohaline structure of the water column was determined at 3 additional stations near the coast and river mouths, while sediment samples were taken at 21 sampling sites in this area to determine the substrate type.

Based on the monitoring results for salinity and substrate type (which are delineation factors for coastal and transitional waters in Georgia), an improved delineation proposal for the entire coastal zone from Sarpi (border with Turkey) to Psou (border with Russia) has been proposed. The main features of this proposal are that 6 coastal water types and 19 coastal water bodies occur in Georgia's coastal zone, while only one transitional water type and one transitional water body (Lake Paliastomi) have been identified.

For the status assessment of the supporting physico-chemical quality elements at the investigated stations, threshold values were applied that had been defined as part of the earlier EUWI+ project. The abundance and biomass of phytoplankton were used to assess the status of phytoplankton, while the ecological quality ratio for macrozoobenthos was calculated using the M-AMBI index. Macrophytes have not been identified in the investigated area.

In addition to the mandatory biological quality elements of the WFD, the abundance and biomass of mesozooplankton were investigated at all coastal stations and the trophic status of the stations was assessed.

The ecological status of 3 coastal water bodies was assessed as follows:

- poor for water body CW211_PoHa, which is located in Poti harbour and is designated as a heavily modified water body;

- moderate for the water body CW212_KoRi, which is located between Kobuleti and the river Rioni, and

- good for the water body CW212_RiKo, which is located between the Rioni River and Anaklia.

The critical elements that caused the ecological status to fall below "good" were the physico-chemical quality element “Transparency" and the biological quality element “Macrozoobenthos" in the coastal water body CW211_PoHa and the physico-chemical quality element “Nutrients - orthophosphates” in the coastal water body CW212_KoRi.

The trophic status of these water bodies can be described as eutrophic for CW211_PoHa and as oligo-mesotrophic for the water bodies CW212_KoRi and CW212_RiKo according to the mesozooplankton biomass.

The ecological status of the transitional waters of Lake Paliastomi could not be assessed due to a lack of threshold values for this surface water category.

1. INTRODUCTION AND SCOPE

1.1. Ecological status assessment of Georgian coastal and transitional water bodies from 2019 to 2023

The first ecological status assessment of coastal and transitional water bodies in Georgia was carried out for the coastal area from Sarpi to Kobuleti (EUWI+ Report, 2021). The assessment of the ecological state of water bodies in the area was carried out on the basis of the results of three surveys, carried out in September and November 2019 and July/August 2020, whereby research was carried out in seven water bodies of coastal waters and one water body of transitional waters (Chorokhi river estuary). Based on the results of these three surveys, draft thresholds for supporting physico-chemical and biological quality elements were prepared and the ecological status of water bodies from Sarpi to Kobuleti was assessed. The typology and geographic positions of the water bodies investigated were previously delineation according to the WFD system "B" (EUWI+ Report,2021).

As a follow-up survey, five coastal water bodies and one transitional water body (lake Paliastomi) in the coastal zone from Kobuleti to Anaklia (Figure 1) were surveyed in August 2022 and May 2023 as part of the EU4EnvWD Activity 1.4.1. (Novel approaches to water monitoring are further promoted).The aim of this survey was to collect further data on the relevant CTW quality elements that will be used to revise or correct the draft thresholds for physico-chemical and biological quality elements and assess the ecological status of the surveyed water bodies. In addition, all data collected throughout the coastal zone from Sarpi to Anaklia will serve as a basis for selecting permanent monitoring stations for surveillance monitoring in Georgia.

The typology and geographic locations of water bodies in the coastal area from Kobuleti to Anaklia is also taken from the delineation proposal (EUWI+ Report, 2021).

During all surveys, performed under the EUWI+ and EU4EnvWD programmes, additional sampling and measurements of the substrate composition and salinity distribution (both are delineation factors) have been performed and, based on these results, an improved delineation proposal for the coastal and transitional waters in Georgia is presented (this report, section 2.2).

2. DELINEATION PROPOSALS FOR THE COASTAL AND TRANSITIONAL WATERS IN GEORGIA

2.1. Former delineation proposals

The coastline of Georgia from Sarpi (border to Turkey) in the south to the Psou river (border to Russia) in the north is 315 km long. Until 2018 there was one draft proposal for the delineation of all transitional and coastal waters in this area (EMBLAS/UNDP, 2017) and two draft delineation proposals for a smaller (pilot) area from Sarpi to Kobuleti (EPIRB/MENR, 2016; EUWI+, 2018).

All three draft proposals have been critical analysed during EUWI+ Workshops hold in Batumi (2017; 2019) and during EUWI+ training sessions held at the Department of Fisheries, Aquaculture and Water Biodiversity in Batumi in 2019.

The outcomes of the EUWI+ workshops and training sessions on the delineation are as follows:

- The EPIRB/MENR draft proposal is not in line with the WFD delineation guidelines (WFD Common Implementation Strategy, No5.),
- Both other draft proposals (EMBLAS/UNDP, 2017 and EUWI+,2018) are formally in accordance with the WFD but shows some weaknesses related to the delineation factors.

Considering the identified strengths and weaknesses of the EMBLAS/UNDP (2017) and the EUWI+ (2018) draft proposals, a new delineation proposal was given under the EUWI+ project (EUWI+, 2020). This proposal defined, according to the WFD System “B”, delineation factors and appearing coastal and transitional water types and water bodies for the whole Georgian coastal zone. For water bodies, identified in the coastal zone from Kobuleti to Psou river this delineation proposal stated that they have still a draft status, i.e. there is still a need for checking them with future survey results for substrate composition and salinity distribution.

By processing all data on the state of the delineation factors "substrate" and "salinity", collected in the period from 2019 to 2023 in the coastal area from Sarpi to Anaklia), the delineation proposal (EUWI+, 2020) has been improved and is presented in chapter 2.2.

2.2. An improved EU4EnvWD delineation proposal for Georgian transitional and coastal waters

2.2.1. Definition of transitional and coastal waters

According to the definition of “Transitional and Coastal waters” under the WFD (CIS Guidance document No.5, 2003):

- Transitional waters are bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters but which are substantially influenced by freshwater flows;
- Coastal water means surface water on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, extending where appropriate up to the outer limit of transitional waters.

2.2.2. Appearance of transitional and coastal waters in Georgia

Since the WFD does not specify the minimum size of transitional waters to be designated as separate water bodies, transitional waters in Georgia may occur in all river mouths of the Black Sea region if they can be characterized as a discrete and significant element of surface waters. So far, this characterization has been carried out for the coastal area from Sarpi (border with Turkey) to Anaklia with an identified, discrete and significant transitional water (Lake Paliastomi), while in the coastal area from Anaklia to Psou (border with Russia) the occurrence of transitional waters still needs to be verified by measurements of physico-chemical properties in specific estuaries.

Based on the typology guidelines (CIS Guidance document No. 5, 2003), 12 coastal water bodies were identified in the coastal zone from Sarpi to Anaklia and 7 coastal water bodies were designed for the coastal zone from Anaklia to Psou.

The areas of transitional and coastal waters of Georgia, based on the WFD definition, are shown in Figure 1.

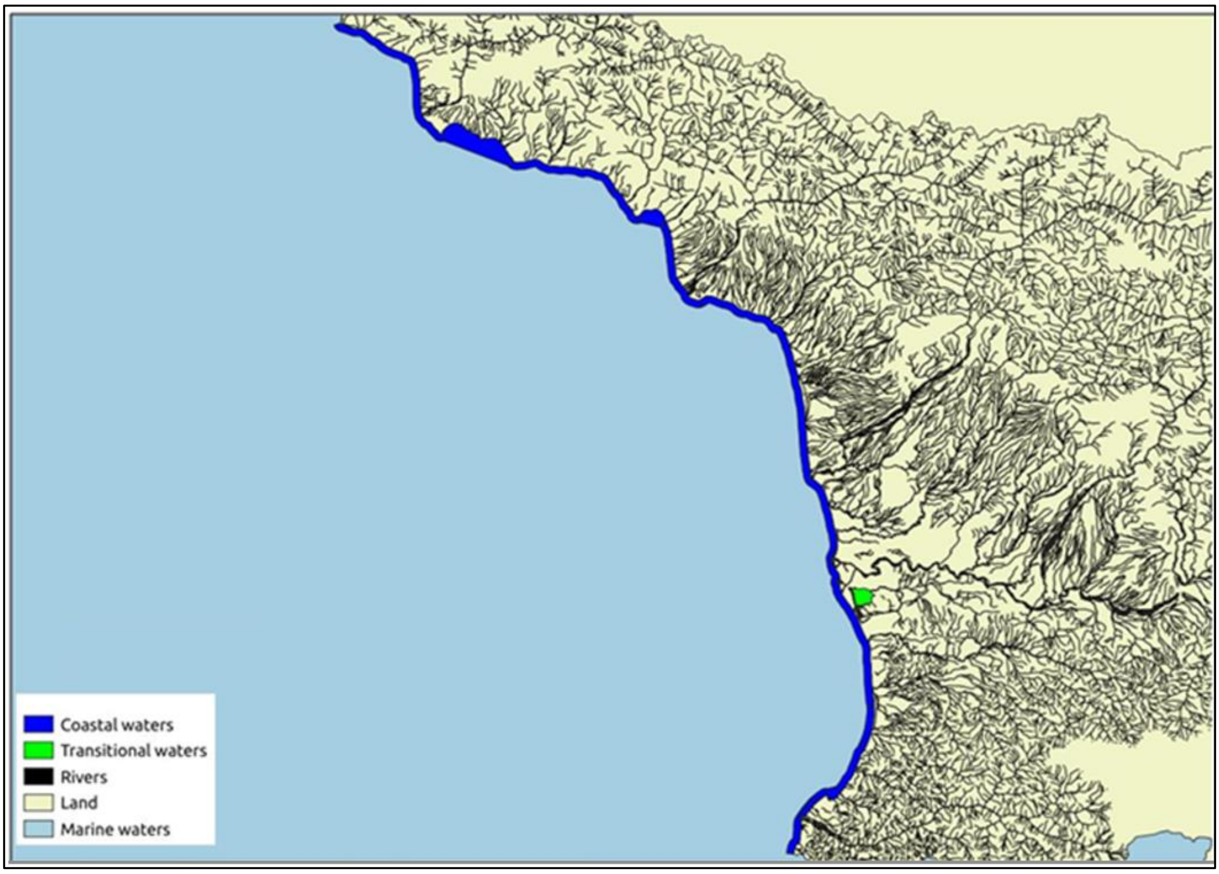


Figure 1: Transitional and coastal waters in Georgia from Sarpi (border to Turkey) to Psou (border to Russia).

2.2.3. Typology system of transitional and coastal waters in Georgia

One of the first stages in the implementation of the WFD in the River Basin district is the characterisation of all naturally occurring water bodies. This process can be referred to as typology. According to the provisions of the WFD, the characterisation of water bodies within each surface water category can be undertaken according to two typology systems: System A (fixed system with obligatory delineation factors) or System B (system with obligatory and optional delineation factors).

SYSTEM B has been applied for the delineation of transitional and coastal waters present in Georgia.

2.2.4. Water types in transitional and coastal waters of Georgia

2.2.4.1. Transitional waters

Obligatory and optional factors for transitional waters appearing in Georgia are given in table 1.

Table 1: Obligatory and proposed optional typology factors for transitional waters in Georgia

TYPOLOGY FACTORS FOR GEORGIAN TRANSITIONAL WATERS		
Transitional waters	**Obligatory**	Latitude, Longitude
		Tidal range
		Average annual salinity range
	Optional	Origin of transitional waters

According to the obligatory factors, all Georgian transitional waters are:

- located in the Ecoregion "Black Sea";
- exposed to a microtidal range (< 1m);
- characterised with fluctuating salinities in the range of 0,5 – 10 (oligo-mesohaline).

In addition to the obligatory factors, the selected optional factor differentiates the transitional waters, originating from marine waters or lakes and limans.

Taking these delineation factors into account, theoretically, 2 transitional water types can be defined in Georgia (Table 2).

Table 2: Possible transitional water types appearing in Georgia

Transitional water type		**Ecoregion**	**Tidal Range**	**Salinity Range (PSU)**	**Origin**
Description	**Code**				
Oligo-mesohaline transitional water type with estuary origin	GE_TW11	Black Sea	Microtidal	0,5 < s < 10	Marine
Oligo-mesohaline transitional water type with lake/liman origin	GE_TW12				Lake/Liman

2.2.4.2. Coastal waters

Obligatory and optional factors for coastal waters appearing in Georgia are given in table 3.

Table 3: Obligatory and proposed optional typology factors for coastal waters in Georgia

TYPOLOGY FACTORS FOR GEORGIAN COASTAL WATERS		
Coastal waters	**Obligatory**	Latitude, Longitude
		Tidal range
		Average annual salinity range
	Optional	Mean depth
		Mean substratum size

According to the obligatory factors, all Georgian coastal waters are:

- located in the Ecoregion "Black Sea";
- exposed to a microtidal range (< 1m);
- characterized by a narrow average annual salinity range (15 < S < 18), except for areas in the vicinity of rivers with significant freshwater discharge, where the annual salinity fluctuations are more strongly expressed (10 < S < 18).

In addition to the obligatory factors, the selected optional factors are:

- depth, which differentiates shallow (< 30m) from deep (> 30m) coastal areas;
- substratum size, which differentiates fine grained substrate (< 45 µm; clay and mud) from coarse grained substrate (> 45 µm; sand – pebble),

Taking these delineation factors into account, theoretically, 8 coastal water types can be defined in Georgia (Table 4).

Table 4: Possible coastal water types appearing in Georgia

Coastal water type		Ecoregion	Tidal Range	Salinity range (PSU)	Mean depth (m)	Mean substratum size (µm)
Description	**Code**					
Mesohaline, shallow coastal water type with fine grained substrate	GE_CW111	Black Sea	Microtidal	10-18	Shallow (< 30m)	Fine grained (< 0,45 µm)
Mesohaline, shallow coastal water type with coarse grained substrate	GE_CW112			10-18	Shallow (< 30m)	Coarse grained (> 0,45 µm)
Mesohaline, deep coastal ater type with fine grained substrate	GE_CW121			10-18	Deep (> 30m)	Fine grained (< 0,45 µm)
Mesohaline, deep coastal water type with coarse grained substrate	GE_CW122			10-18	Deep (>30 m)	Coarse grained (> 0,45 µm)
Narrow mesohaline, shallow coastal water type with fine grained substrate	GE_CW211			15-18	Shallow (< 30m)	Fine grained (< 0,45 µm)
Narrow mesohaline, shallow coastal water type with coarse grained substrate	GE_CW212			15-18	Shallow (< 30m)	Coarse grained (> 0,45 µm)
Narrow mesohaline, deep coastal water type with fine grained substrate	GE_CW221			15-18	Deep (> 30m)	Fine grained (< 0,45 µm)
Narrow mesohaline, deep coastal water type with coarse grained substrate	GE_CW222			15-18	Deep (>30 m)	Coarse grained (> 0,45 µm)

The principle of the applied type-coding of transitional and coastal water types is shown in table 5.

Table 5: Principle of transitional and coastal type coding

Country	Surface water category	Typology factor				Type code
		Salinity	Origin	Depth	Substrate size	
Georgia (GE)	Transitional waters (TW)	Oligo-mesohaline	-	-		GE_TW1 _
		-	Marine			GE_TW1_ 1
		-	Lake/Liman			GE_TW1_ 2
	Coastal waters (CW)	Mesohaline	-	-	-	GE_CW1 _ _
		Narrow mesohaline		-	-	GE_CW2 _ _
		-	-	Shallow	-	GE_CW_ 1 _
		-		Deep	-	GE_CW_ 2 _
		-	-	-	Fine grained	GE_CW_ _ 1-
		-		-	Coarse grained	GE_CW_ _ 2

2.2.4.3. Additional delineation criteria

Besides the basic, significant natural physical features, additional delineation criteria have to be considered as well.

Protected areas: Annex IV of the WFD states that the register of protected areas shall include the following types of protected areas:

- areas designated for the abstraction of water intended for human consumption;
- areas designated for the protection of economically significant aquatic species;
- bodies of water designated as recreational waters, including areas designated as bathing waters;
- nutrient-sensitive areas, including areas designated as vulnerable zones and areas designated as sensitive areas;
- areas designated for the protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection, including relevant Natura 2000 sites.

In regard to the EUWI+ Pilot area (Sarpi to Kobuleti) and the remaining Georgian coastal area from Kobuleti to the Psou river, drinking water protected areas, economically significant aquatic species (freshwater fish and shellfish) protected areas and nutrient-sensitive areas have not been identified, or are yet to be designated.

In Georgia, recreational and bathing waters have been identified as protected areas, but the delineation of associated water bodies is not necessary, and no spatial data reporting is required (Clarification note, 2016). Therefore, water bodies listed in tables 7, 8 and 9 have not been further subdivided according to these criteria.

As Georgia has one National Park (Kolkheti National Park), which partially covers the marine and coastal area of the Black Sea (Figure 2), the designation of the coastal part of the National Park as a WFD protected area, in relation to the *protection of habitats or species where the maintenance or improvement of the status of water is an important factor in their protection,* should be adopted at the national level.

Figure 2: Black Sea part of the Kolkheti National Park.

Status criteria: According to the CIS Guidance document No.2 (2003), a discrete element of surface water (i.e. water body) should not contain significant elements of different status. As the status of a water body is mainly affected by pressures, the pressure – impact analysis and the risk assessment, performed in the Chorokhi-Ajaristskali River Basin Management Plan (EPIRB/MENR, 2016), as well as the EUWI+ and EU4EnvWD survey results, indicate that no further subdivision of proposed water bodies in the Georgian coastal zone from Sarpi to Anaklia is required with respect to this delineation criteria.

Artificial and heavily modified water bodies: The designation of AWB and HMWB is the last step in the delineation process. According to the available data significant artificial water bodies in the area from Sarpi to Anaklia are not present; however, Batumi and Poti harbours can be considered as candidates for heavily modified water bodies.

The designation of both harbours as HMWB's should be undertaken according to the procedure described in the WFD CIS Guidance document No.4 (2003) (Identification and Designation of Heavily Modified and Artificial Water Bodies)

2.2.5. Identified transitional and coastal water types and bodies in the coastal zone from Sarpi to Anaklia

In the coastal zone from Sarpi to Anaklia, one transitional and 6 coastal water types have been identified (Table 6, figure 3).

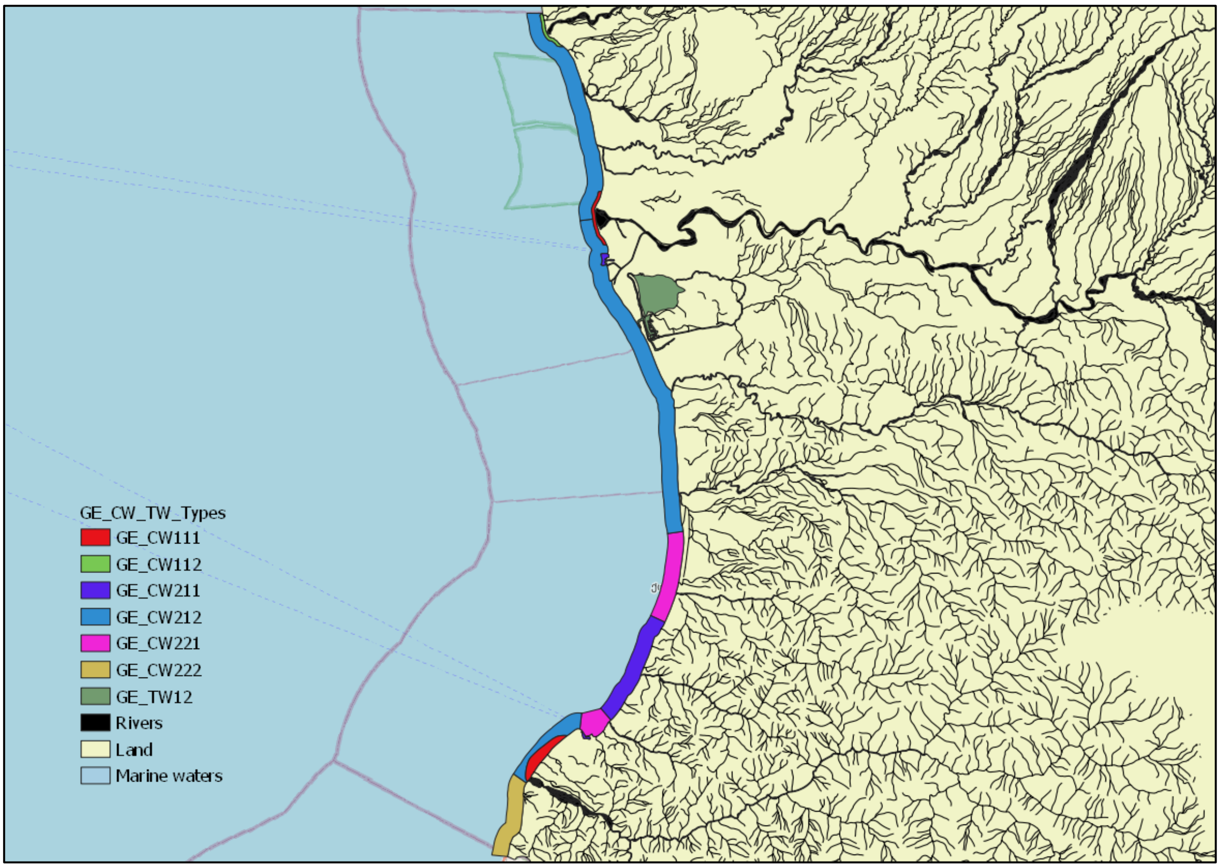


Figure 3: Coastal and transitional water types appearing in the Georgian coastal zone from Sarpi to Anaklia.

Measurements in the estuaries of the Chorokhi, Kintrishi, Supsa, Rioni, and Enguri rivers during the EUWI+ and EU4EnvWD surveys generally showed a sharp transition from river (Sal < 0.5) to coastal waters (Sal > 10) within a few metres. The only exception was the Chorokhi Estuary, where a temporally unstable, small area (< 10,000 m^2) of transitional waters (S = 0.5 - 10) was established. The only stable and significant area of transitional waters in the Georgian coastal zone was found in Lake Paliastomi, which belongs to the transitional water type GE_TW12 (oligo-mesohaline type of lake/liman origin).

Two of the coastal water bodies (Batumi harbour - CW211_BaHa and Poti Harbour - CW211_PoHa) are proposed as candidates for acquiring the status of heavily modified water bodies.

Table 6: Transitional and coastal water types and bodies in the Georgian coastal zone from Sarpi to Anaklia

Coastal zone	Transitional (TW) and coastal water (CW) types		Transitional (TW) and coastal water (CW) bodies		Geographic position (min, max)** (WGS84)	
	Type	Description	Name	Site	Latitude	Longitude
Sarpi to Anaklia	GE_TW12	Oligo-mesohaline transitional water type with lake/liman origin	TW12_Pl	Paliastomi lake	42,059851 42,141249	41,687826 41,770515
	GE_CW111	Mesohaline, shallow coastal water type with fine grained substrate	CW111_ChBa-C	From Chorokhi river to Batumi cape - near coast	41,598800 41,649227	41,571387 41,627758
			CW111_Po-C	Poti- near coast	42,169437 42,226575	41,633209 41,656842
	GE_CW112	Mesohaline, shallow coastal water type with coarse grained substrate	CW112_An-C	Anaklia – near coast	42,377611 42,411827	41,548539 41,583636
	GE_CW211	Narrow mesohaline, shallow coastal water type with fine grained substrate	CW211_BaHa	Batumi harbour	41,646346 41,655154	41,647855 41,660823
			CW211_PoHa	Poti harbour	42,147984 42,160697	41,648871 41,668343
			CW211_KrTs	From Korolistskali river Tsikhidziri cape	41,667299 41,779636	41,673601 41,759632
	GE_CW212	Narrow mesohaline, shallow coastal water type with coarse grained substrate	CW212_ChBa	From Chorokhi river to Batumi cape	41,597429 41,673666	41,554294 41,647106
			CW212_KoRi	From Kobuleti to Rioni	41,866955 42,196615	41,617460 41,780554
			CW212_RiAn	From Rioni to Anaklia	42,194400 42,412060	41,529603 41,648108
	GE_CW221	Narrow mesohaline, deep coastal water type with fine grained substrate	CW221_BaKr	From Batumi cape to Korolistskali river	41,649063 41,679554	41,645445 41,688704
			CW221_TsKo	From Tsikhidziri cape to Kobuleti	41,773139 41,869945	41,739112 41,782162
	GE_CW222	Narrow mesohaline, deep coastal water type with coarse grained substrate	CW222_SaCh	From Sarpi to Chorokhi river	41,518760 41,606517	41,528452 41,572925

*Geographic positions** are extracted from shape files*

Figure 4: Positions and shapes of appearing transitional and coastal water bodies in the Georgian coastal zone from Sarpi to Anaklia.

2.2.6. Coastal water types and bodies in the coastal zone from Anaklia to Psou estuary

In the coastal area from Anaklia to Psou estuary (border with Russia) significant transitional waters have, so far, not been detected, while three coastal water types have been identified (Table 8, figure 5).

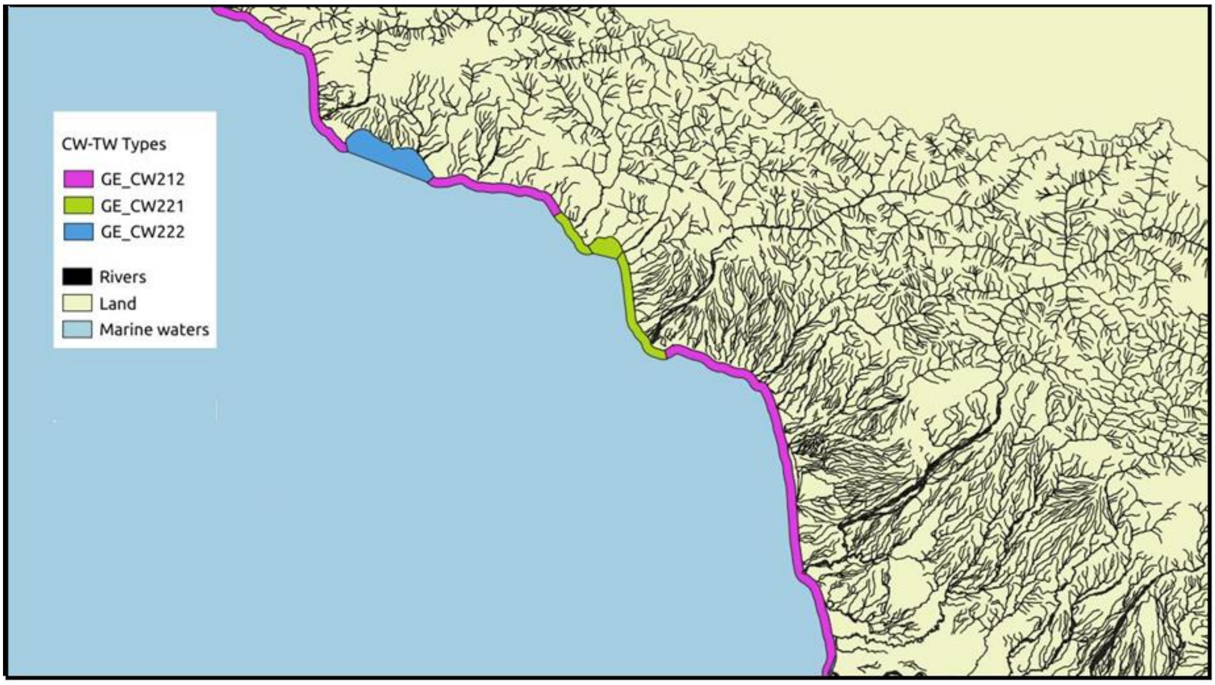


Figure 5: Positions and shapes of transitional and coastal water types appearing in the coastal area from Anaklia to Psou (border with Russia).

According to the applied typology for transitional and coastal waters, seven coastal water bodies are present in this area (Table 7, figure 6). To recent knowledge no coastal water body in this area can be proposed as a candidate for acquiring the status of a heavily modified water body.

Table 7: Transitional and coastal water types and bodies in the coastal zone from Anaklia to Psou estuary

Coastal zone	Transitional (TW) and coastal water (CW) types		Transitional (TW) and coastal water (CW) bodies		Geographic position (min, max)** (WGS84)	
	Type	Description	Name	Site	Latitude	Longitude
Anaklia to Psou estuary	GE_CW212	Narrow mesohaline, shallow coastal water type with coarse grained substrate	CW212_AnKd	From Anaklia to Kodori cape	42,411493 N 42,802293 N	41,185311 E 41,552254 E
			CW212_DzGu	From Dzista estuary to Gudauta	43,029771 N 43,09911 N	40,563613 E 40,90805 E
			CW212_PiPs	FromPitsunda to Psou estuary	43,128305 N 43,389087 N	39,991278 E 40,358023 E
	GE_CW221	Narrow mesohaline, deep coastal water type with fine grained substrate	CW221_KdKe	From Kodori cape to Kelasuri	42,773852 N 42,971396 N	41,053383 E 41,191709 E
			CW221_KeSu	From Kelasuri to Sukhami cape	42,956008 N 42,997384 N	40,978455 E 41,067795 E
			CW221_SuDz	From Sukhami cape to Dzista estuary	42,961828 N 43,038719 N	40,88858 E 40,991622 E
	GE_CW222	Narrow mesohaline, deep coastal water type with coarse grained substrate	CW222_GuPi	From Gudauta to Pitsunda	43,080318 N 43,173225 N	40,351449 E 40,579888 E

Xx	Abbreviations of particular site names. Geographic positions** are extracted from shape files*

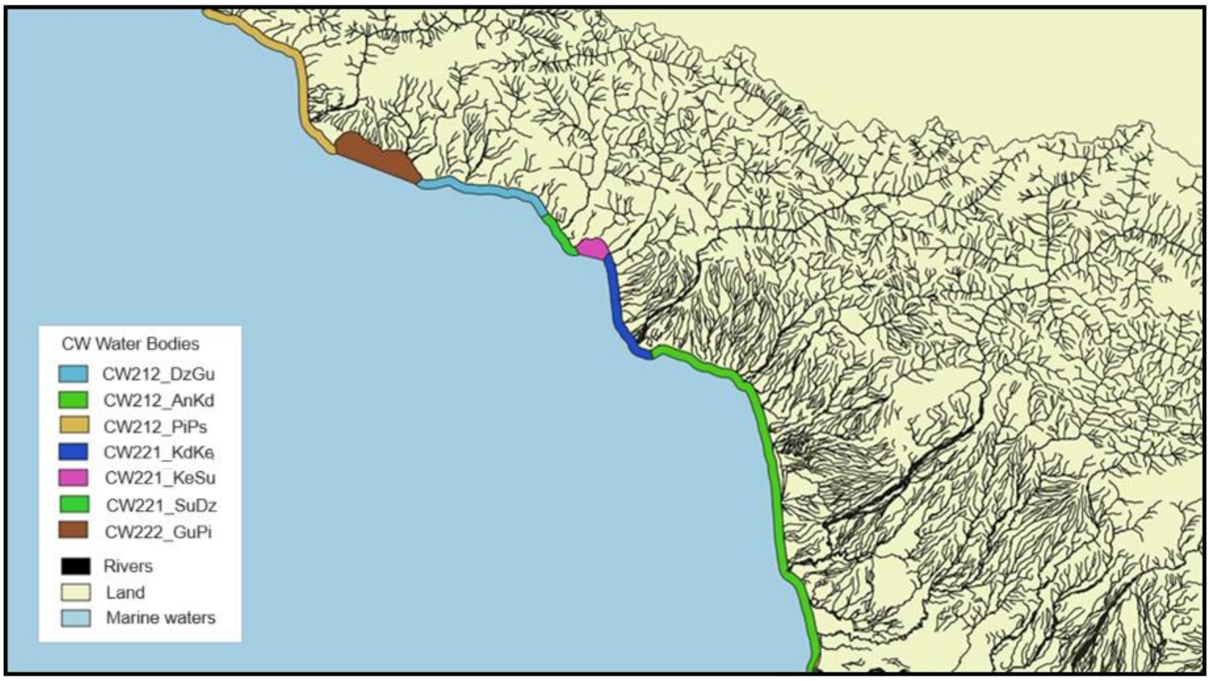


Figure 6: Positions and shapes of coastal water bodies appearing in the coastal zone from Anaklia to Psou estuary.

3. RESULTS OF THE CTW SURVEILLANCE MONITORING PERFORMED FROM KOBULETI TO ANAKLIA IN AUGUST 2022 AND MAY 2023

3.1. Parameters studied

Table 8 contains basic information on the parameters studied during the CTW campaign in August 2022 and May 2023.

Table 8: Parameters analyzed in the field and in the laboratory

Country	Georgia	
Campaign [1)]	Summer 2022	Spring 2023
Objectives	1. Collection of data on supporting physico-chemical and biological quality elements in coastal and transitional waters from Kobuleti to Anaklia for the final establishment of chemical and biological status thresholds. 2. Determination of substrate in particular water bodies. 3. Determination of the influence of the rivers (Supsa, Rioni, Enguri) on the physico-chemical characteristics of the adjacent coastal waters	
Quality elements	Biological quality components: • Phytoplankton • Macrozoobenthos Supporting elements: • General physico-chemical quality elements (temperature, salinity, transparency, nutrients) Eutrophication indicator • Zooplankton	
Preparation of field work	18.August 2022	
Field work	19. - 24. August 2022	4. – 10. May 2023
Chemical analyses	19. August – 30. September 2022	4. May – 15. June 2023
Biological analyses	5. September – 1. December 2022	22. May -1. August 2023
Reporting	1. – 15. December 2022	20. - 28. November 2023
Submission of technical report	April 2023	July 2024

3.2. Methods

3.2.1. Selected sampling sites

Basic data on the selected sampling sites are given in Tables 9 and 10 for ecological monitoring of coastal and transitional waters in October 2022 and May 2023. The position of the sampling sites are also shown on the Figures 7 to 9).

During the surveys measurements and sampling were also performed in the transitional waters of the Supsa estuary (Stations KoRi3 in 2022 and KoRi3a and KoRi3b in 2023) as well as in the transitional waters of the Rioni estuary (station 7a, 2022). Due to the fact that the transitional zone between freshwater and coastal water in both estuaries was very narrow (from a few meters to below 50 m) transitional water bodies in these estuaries have not been delineated. However, the data acquired at these stations are still given in the excel data sheets (Annex 2).

Additional to the ecological monitoring during the survey in 2022 additional sediment sampling for substrate determination have been performed at all stations in (Table 9) as well as at stations between the "ecological" stations (Table 11). All sediment sampling stations are shown on figure 10.

Additional temperature – salinity measurements have also been performed during both surveys. The geographic positions for these measurements are given in table 11.

Table 9: List of sampling sites in coastal and transitional waters and estuaries in 2022

WB	WB definition and location	Site	Nr	HMWB 1)	Risk 2)	Significant Pressure 3)	Latitude 4)	Longitude 4)
CW212_KoRi	Mesohaline, shallow coastal water type with coarse grained substrate north of Kobuleti	CW	KoRi1+	NO	NR	N	41.771833	41.872333
CW212_KoRi	Mesohaline, shallow coastal water type with coarse grained substrate adjacent to Supsa estuary	CW	KoRi2+	NO	NR	N	41.741333	42.018833
Not delineated	Oligo-mesohaline transitional water type with estuary origin in the Supsa estuary	E	KoRi3	NO	NR	N	41.752650	42.020150
CW212_KoRi	Mesohaline, shallow coastal water type with coarse grained substrate between Grigoleti and Maltakva	CW	KoRi4+	NO	NR	U	41.703833	42.064917
TW12_Pl	Oligo-mesohaline transitional water type with lake/liman origin in the Paliastomi lake	TW	KoRi5a+	NO	PR	U	41.711950	42.120833
TW12_Pl	Oligo-mesohaline transitional water type with lake/liman origin in the Paliastomi lakel	TW	KoRi5b+	NO	PR	U	41.743767	42.124917
CW211_PoHa	Narrow mesohaline, shallow coastal water type with fine grained substrate in Poti harbour	CW	KoRi6+	YES	PR	H, U	41.651800	42.150417
CW212_RiAn	Mesohaline, shallow coastal water type with coarse grained substrate north of Poti	CW	RiAn7+	NO	PR	U	41.636417	42.233333
Not delineated	Oligo-mesohaline transitional water type with estuary origin in the Rioni estuary	E	RiAn7a	NO	PR	U	42.182717	41.636417
CW212_RiAn	Mesohaline, shallow coastal water type with coarse grained substrate between Poti and Anaklia	CW	RiAn8+	NO	NR	N	41.447350	42.255500
CW212_RiAn	Mesohaline, shallow coastal water type with coarse grained substrate south of Anaklia	CW	RiAn9+	NO	NR	N	41.578833	42.362800
CW212_RiAn	Mesohaline, shallow coastal water type with coarse grained substrate in front of Anaklia	CW	RiAn10+	NO	PR	U	41.553950	42.386000

1) Assignment as provisional HMWB: yes / no

2) Assignment of the risk status: R = at risk, PR = possibly at risk, NR = not at risk
3) Significant pressure: N = no significant pressure, P = organic pollution, E = eutrophication, T = toxic impact, H = hydro-morphological alterations, M = multistressor, O = other, U = unknown
4) Latitude, Longitude: Format = Degree with six decimals (e.g. as 44.630139, conversion from 44° 37’ 48.5’’ through calculation 44 + 37 / 60 + 48.5 / 3600)
5) Site: CW = Coastal waters, TW = Transitional waters; E – Estuary
+) Sediment sampling performed at station for substrate type determination

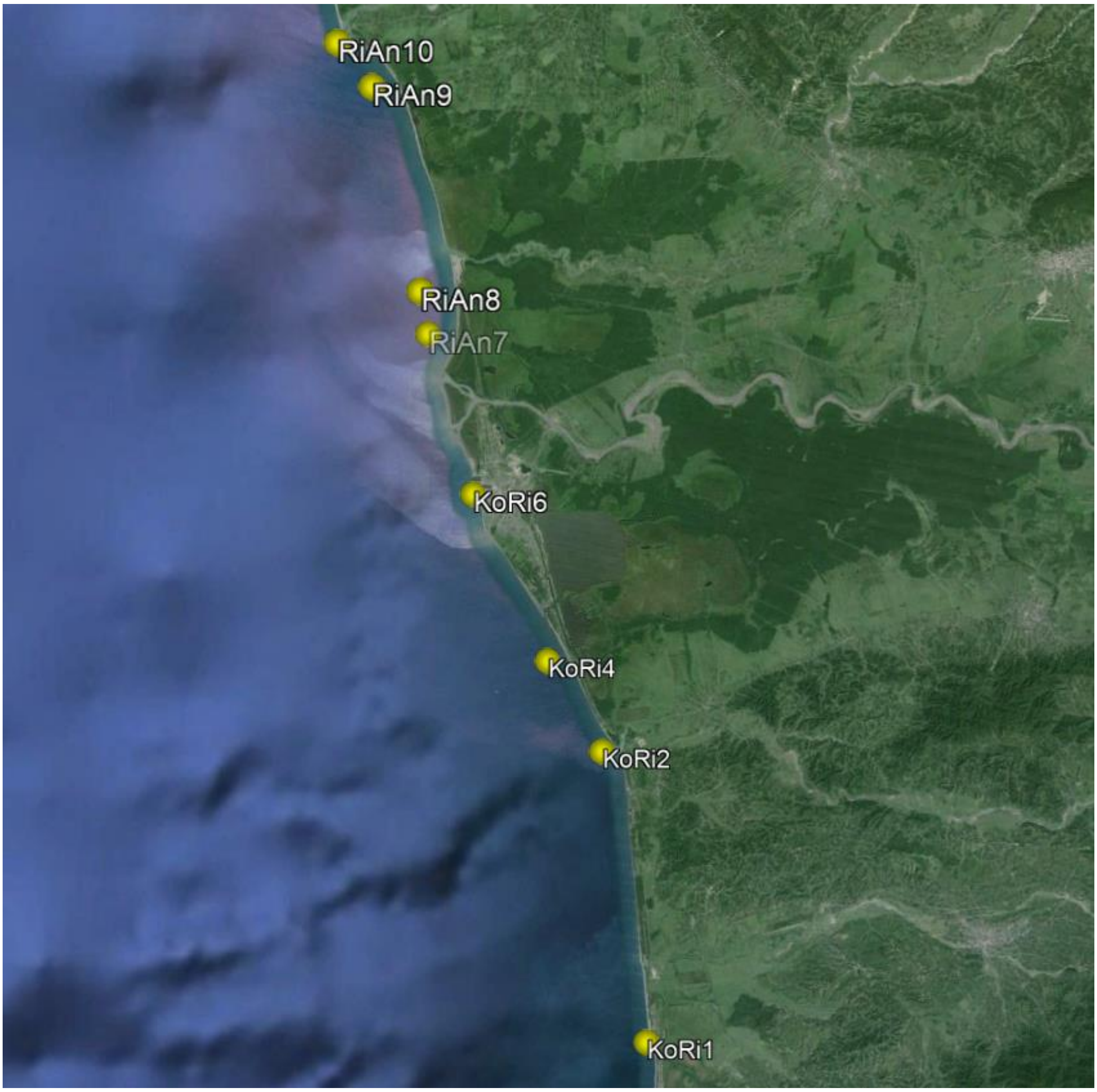


Figure 7: Coastal water sampling sites from Kobuleti to Anaklia in September 2022.

Table 10: List of sampling sites in coastal and transitional waters and estuaries in 2023

WB	WB definition and location	Site	Nr	HMWB 1)	Risk 2)	Significant Pressure 3)	Latitude 4)	Longitude 4)
CW212_KoRi	Mesohaline, shallow coastal water type with coarse grained substrate north of Kobuleti	CW	KoRi1	NO	NR	N	41.872750	41.769583
CW212_KoRi	Mesohaline, shallow coastal water type with coarse grained substrate adjacent to Supsa estuary	CW	KoRi2	NO	NR	N	42.019117	41.741467
Not delineated	Oligo-mesohaline transitional water type with estuary origin in the Supsa estuary	E	KoRi3a	NO	NR	N	42.020167	41.751917
Not delineated	Oligo-mesohaline transitional water type with estuary origin in the Supsa estuary	E	KoRi3b	NO	NR	N	42.020167	41.751417
CW212_KoRi	Mesohaline, shallow coastal water type with coarse grained substrate between Grigoleti and Maltakva	CW	KoRi4	NO	NR	U	42.064917	41.704088
TW12_Pl	Oligo-mesohaline transitional water type with lake/liman origin in the Paliastomi lake	TW	KoRi5a	NO	PR	U	42.129300	41.748360
TW12_Pl	Oligo-mesohaline transitional water type with lake/liman origin in the Paliastomi lakel	TW	KoRi5b	NO	PR	U	42.1116970	41.730370
CW211_PoHa	Narrow mesohaline, shallow coastal water type with fine grained substrate in Poti harbour	CW	KoRi6	YES	PR	H, U	42.150332	41.651673
CW212_KoRi	Oligo-mesohaline transitional water type with estuary origin in the Rioni estuary	E	KoRi7b	NO	PR	U	42.186010	41.637750
CW212_RiAn	Mesohaline, shallow coastal water type with coarse grained substrate north of Poti	CW	RiAn7	NO	PR	U	42.233190	41.620665
CW212_RiAn	Mesohaline, shallow coastal water type with coarse grained substrate between Poti and Anaklia	CW	RiAn8	NO	NR	N	42.255793	41.614017
CW212_RiAn	Mesohaline, shallow coastal water type with coarse grained substrate south of Anaklia	CW	RiAn9	NO	NR	N	42.363000	41.578978
CW212_RiAn	Mesohaline, shallow coastal water type with coarse grained substrate in front of Anaklia	CW	RiAn10	NO	PR	U	42.386277	41.553983
CW112_An-C	Mesohaline, shallow coastal water type with coarse grained substrate near coast and near Anaklia	CW	RiAn11	NO	PR	U	42.388600	41.560950

1) Assignment as provisional HMWB: yes / no
2) Assignment of the risk status: R = at risk, PR = possibly at risk, NR = not at risk
3) Significant pressure: N = no significant pressure, P = organic pollution, E = eutrophication, T = toxic impact, H = hydro-morphological alterations, M = multistressor, O = other, U = unknown
4) Latitude, Longitude: Format = Degree with six decimals (e.g. as 44.630139, conversion from 44° 37’ 48.5’’ through calculation 44 + 37 / 60 + 48.5 / 3600)
5) Site: CW = Coastal waters, TW = Transitional waters; E = Estuary

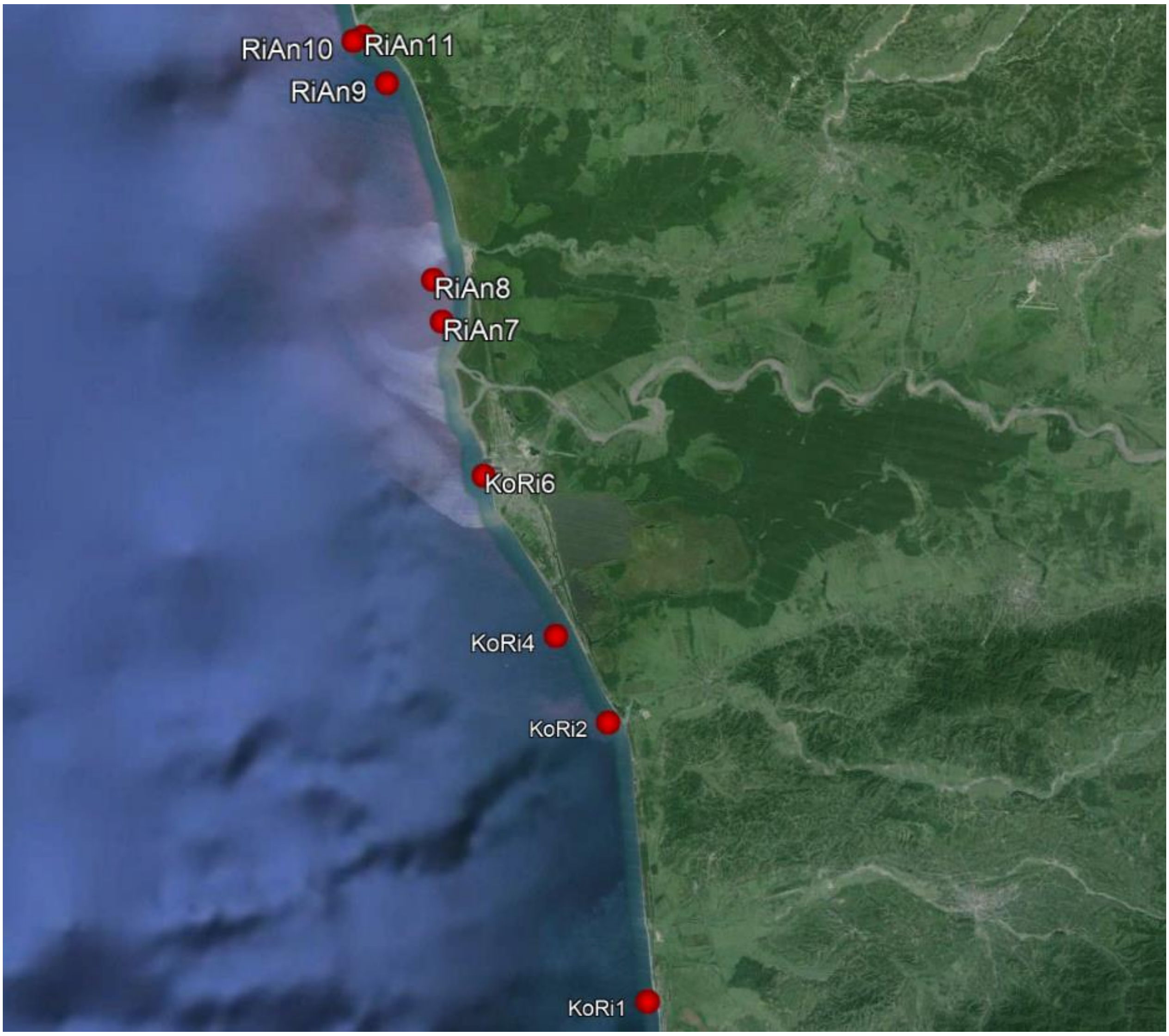


Figure 8: Coastal water sampling sites from Kobuleti to Anaklia in May 2023.

Figure 9: Monitoring stations in the estuaries of the Supsa (KoRi3, KoRi3a and KoRi3b) and the Rioni (RiAn7a and RiAn7b) in August 2022 and May 2023.

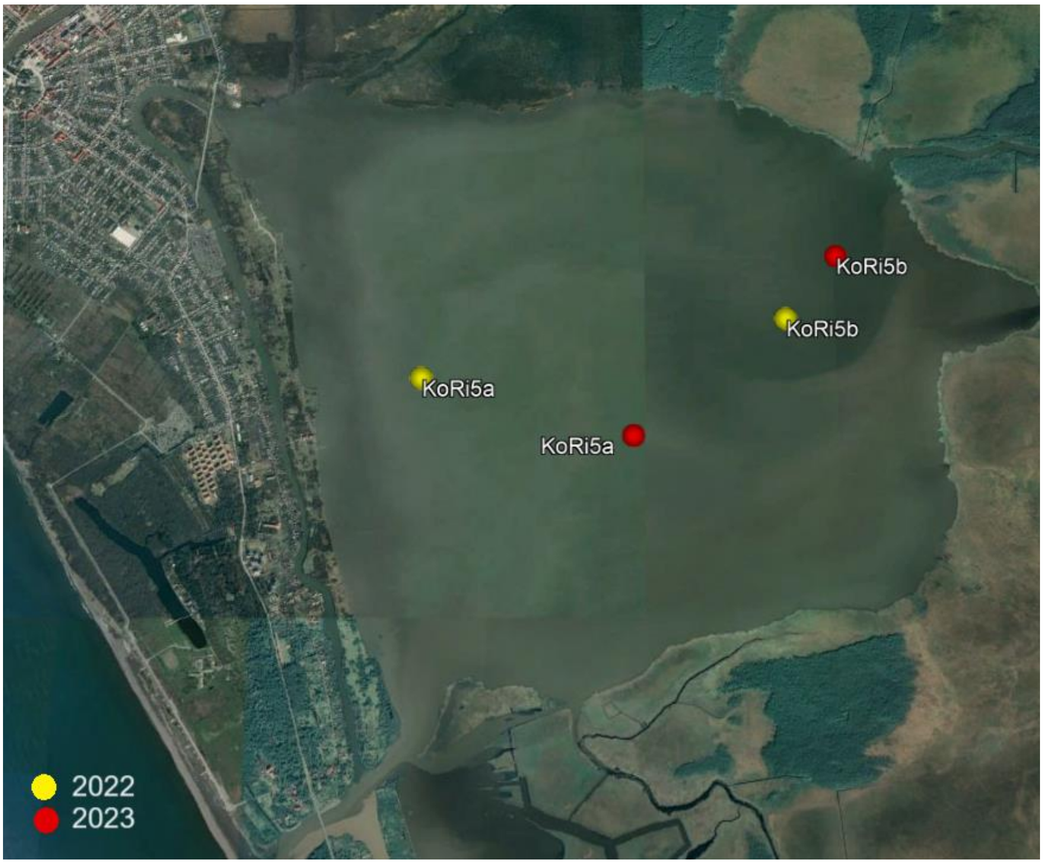


Figure 10: Monitoring stations in the transitional water body of Lake Paliastomi in August 2022 and May 2023.

Table 11: List of additional substrate sampling and temperature - salinity measurement sites in the coastal area form Kobuleti to Anaklia in 2022 and 2023

Water body	Station	Sampling	Latitude	Longitude	Measurements and sampling	
					Substrate	Temp-Sal
CW212_KoRi	Sed1a	Aug 2022	41,771950	51,509417	+	-
CW212_KoRi	Sed1b	Aug 2022	41,756500	55,408333	+	-
CW212_KoRi	Sed2a	Aug 2022	41,748667	59,764750	+	-
CW212_KoRi	Sed4b	Aug 2022	41,691417	42,082000	+	-
CW212_KoRi	Sed6b*	Aug 2022 May 2023	41,653417 41,653417	42,131000 42,131000	+ -	+ +
CW212_RiAn	Sed6c	Aug 2022 May 2023	41,641583 41,641587	42,151917 42,151935	+ -	+ +
CW212_RiAn	Sed6d	Aug 2022 May 2023	41,624000 41,623417	42,183917 42,183833	+ -	+ +
CW212_RiAn	Sed6e	Aug 2022	41,613367	42,202167	+	-
CW212_RiAn	Sed8d	Aug 2022	41,607033	18,409800	+	-
CW212_RiAn	Sed9a	Aug 2022	41,589167	21,187333	+	-

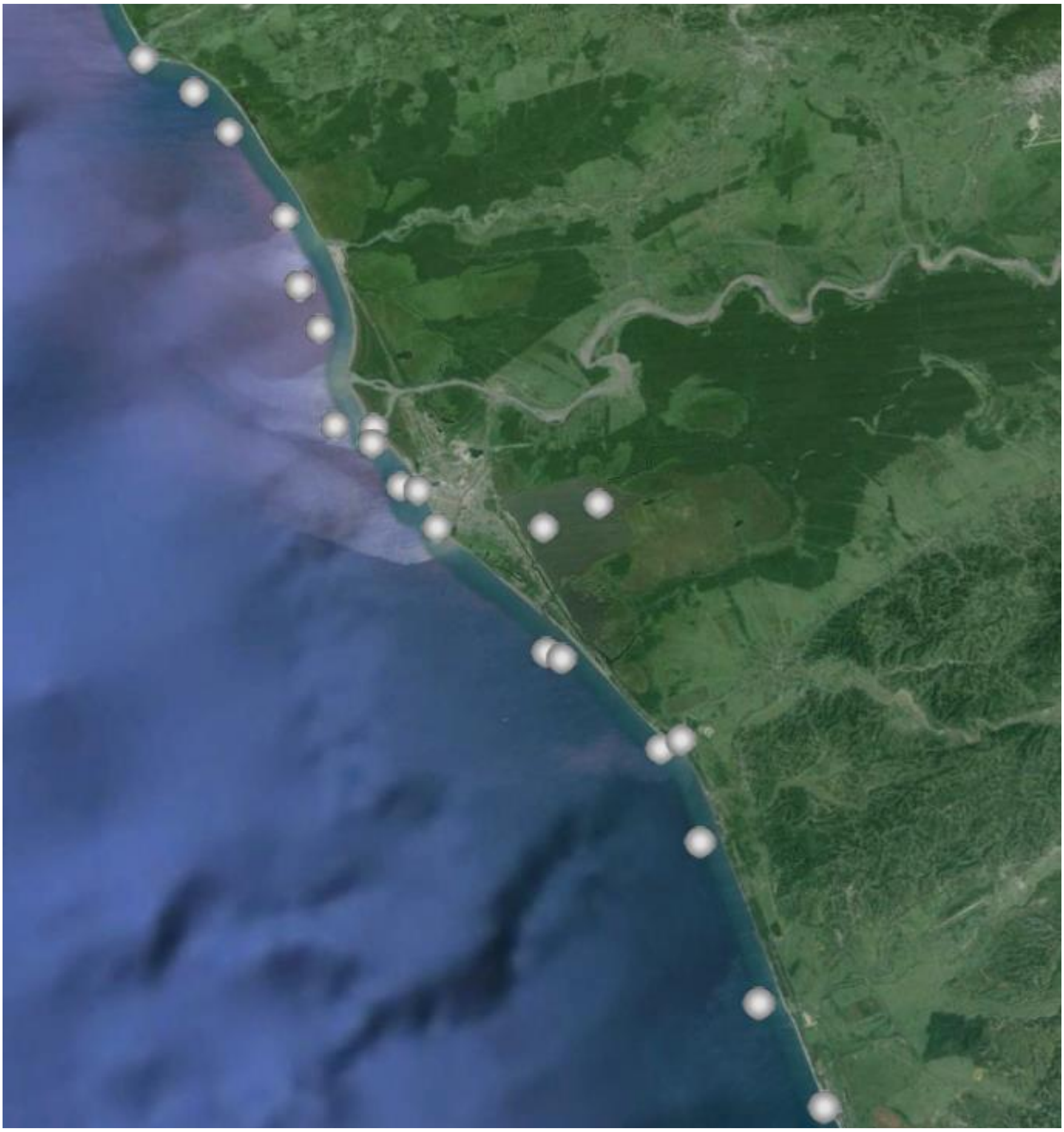


Figure 11: Sediment sampling sites from Kobuleti to Anaklia in August 2022.

All results of the substrate composition at particular stations are presented in table 12.

Table 12: Substrate composition at the investigated stations

STATION	SUBSTRATE
KoRi3	Sand
KoRi5a	Mud
KoRi5b	Mud
RiAn7a	Sand
Sed1a	Sand
KoRi1	Sand-Coarse sand
Sed1b	Sand
Sed2a	Sand
KoRi2	Sand
KoRi4	Sand
Sed4b	Sand
Sed6b	Mud
KoRi6	Mud
Sed6c	Sand/Mud
Sed6d	Mud
Sed6e	Clay-Mud
RiAn7	Clay-Mud
RiAn8	Clay-Sand
Sed8d	Sand-Mud
Sed9a	Sand-Mud-Clay
RiAn9	Sand-Mud
RiAn10	Sand

3.2.2. Sampling period and conditions

Water sampling and measurements of thermohaline properties and transparency were conducted from August 19 to 24, 2022 and from May 4 to 10, 2023.

August 2022 survey: The meteorological conditions during the entire survey were free of precipitation. The prevailing wind directions during the sampling period in the transitional waters (August 19-20) were southeast to southwest with moderate intensity. A moderate southwesterly wind also prevailed at the coastal stations KoRi1 to RiAn7, but changed to westerly winds at station RiAn8 and then (RiAn9 and RiAn10) to northwesterly winds.

May 2023 survey: The meteorological conditions were free of precipitation during the entire survey. On May 4 and 5, measurements and sampling were carried out at the coastal stations (RiAn10, RiAn9; RiAn8, RiAn7, KoRi4 and KoRi6) in a weak northerly wind. The sea surface at the stations was calm with a maximum sea state of 1 (corresponding to a wave height of 0.1 m). During the second part of the survey from May 6 to 10 (stations KoRi1, KoRi2, RiAn7b and RiAn11), the prevailing wind directions shifted to west and north-northwest at times, but this did not change the calm sea surface. The field work in Lake Paliastomi (transitional waters) was also carried out in calm weather and changing wind directions from south (KoRi5a) to northeast (KoRi5b).

3.2.3. Quality elements and sampling methods

Sampling and measurements at transitional water stations in the Supsa and Rioni estuaries were conducted from shore, while a Zodiac was used in Lake Paliastomi. In the coastal area, sampling and measurements were carried out from the vessel "Beshumi".

Of the physico-chemical quality elements in the coastal and transitional waters, temperature and salinity were measured in situ using a YSI EXO multiparameter probe.

Transparency was determined at all stations using a white Secchi disc, except for the shoreline sampling stations in the Supsa and Rioni estuaries where transparency could not be measured.

Dissolved oxygen and nutrient subsamples were collected using a Niskin 5L horizontal water sampler and subsequently determined in the laboratory.

Of the biological quality elements, phytoplankton were also sampled using the Niskin horizontal sampler and analysed abundance, biomass and composition. At all stations, water samples were collected from the surface and bottom layers (0.5 m and 2 m above the seafloor) and from standard oceanographic depths of 5 and 10 m, depending on station depth.

Substrate samples for macrozoobenthos analysis and sediment size determination were collected using a Van Veen sediment grab (0.127 m^2 surface area). Three replicates were taken at each site.

Mesozooplankton as an indicator of eutrophication were sampled only at the coastal stations using a Judy plankton net with a mesh size of 150 µm (total length 2.5 m, mouth area 0.1m^2) towed vertically from the bottom to the surface layer.

3.2.4. Analyses of supporting physico-chemical and biological quality elements and Mesozooplankton

Seawater temperature and salinity data were extracted from the YSI EXO internal memory. The top to bottom readings were used for thermohaline definition of the water column.

Transparency was measured by lowering a white-painted disc (d = 30 cm) from the shaded side of the ship into the sea until it was no longer visible. The measured depth is recorded as transparency.

Dissolved oxygen was measured by the iodometric method in subsamples of seawater collected in Winkler bottles (bottles of well-defined volume).

Samples for nutrient analysis (nitrate, nitrite, ammonia salts and orthophosphate) were deep frozen after subsampling and analyzed afterwards (ordinarily not later than 1 month after sampling) in the lab using standard photometric methods for the detection of nutrients in seawater, with a Skalar SAN+ Analyzer.

Phytoplankton subsamples were stored in 1L polyethylene bottles and fixed with 4% buffered formaldehyde. Then, phytoplankton cells were allowed to settle for two weeks. After that, the phytoplankton samples were concentrated via back filtration method using the special funnel and nylon filters (nuclear filters – pore size 1.09 µm). The samples were decanted to 30 – 50 ml. Identification of species and counting of cells were carried out under a microscope KRUSS with objectives of x20 and x40 magnification. A counting chamber Naujotte (0.05 ml) was used. Taxonomic identification was carried out mainly according to the Identifying Marine Phytoplankton Manuals (Carmelo R. Tomas, 1998; Proshkina, 1955; Kiselev, 1950). Taxonomical identification and quantification were provided as described in the Manual for Phytoplankton Sampling and Analysis in the Black Sea (Moncheva, Parr, 2010).

Substrate samples from coastal waters were sieved through a 1 mm mesh sieve to achieve coarse separation of macrofauna. The isolated organisms were fixed with a 4% formaldehyde solution, while the remaining sample of substrate on the sieve was preserved separately in the same way. This fraction was processed in detail in the laboratory in several steps:

1. complete separation of the organisms from the sediment remaining on the sieve;

2. sorting and classification of the benthic invertebrates at the level of higher taxonomic groups;

3. quantitative analysis of the macrofauna at the level of Phylum, Class, Order, Family, Genus and Species (total census method);

4. taxonomic determination of the predominant groups.

Samples of mesozooplankton were preserved in 4% formaldehyde buffered to pH 8-8.2 with disodium tetraborate (borax) ($Na_2B_4O_3$ x 10 H_2O) formalin solution (one part of 40% formaldehyde solution and nine parts of sample) and stored in plastic containers. In the laboratory, samples were concentrated to 100-150 cm^3 before being divided into subsamples. The Bogorov chamber was used for quantitative assessment (abundance and biomass calculation using individual species weight) and qualitative (taxonomic structure) processing of the subsamples. The subsamples were examined using a stereoscopic zoom microscope. At least 100 organisms from each of the three dominant species were counted in each subsample. The precision of the calculated abundances for organisms of the first three groups counted up to 100 specimens is 20% (Alexandrov et al., 2014). Species were determined according to Morduhay-Boltovskoy (1968, 1969, and 1972).

The list of investigated parameters and analytical methods is shown in Table 13.

Table 13: List of analysed parameters and analytical methods

Parameter	Unit	Method
Field measurements		
Temperature	°C	*In situ* measurement by YSI EXO Probe
Salinity	-	
Transparency	m	In situ measurement by Secchi disk
Laboratory analyses		
Nitrate	µmol/L	ISO 15923-1
Nitrate		
Ammonia		
Orthophosphate		
Dissolved oxygen	ml/L and %	ISO 5813:1983
Phytoplankton	Cells/L	Microscopic determination
Macrozoobenthos	Ind/m^2	Microscopic determination
Mesozooplankton	Ind/m^3	Microscopic determination

3.2.5. Responsibilities

The individuals responsible for field study preparation, instrument calibration, field work, and production of solutions, standards, and laboratory analyses are listed in Table 14. The ship "Beshumi" was rented from the private company Poseidoni LLC for sampling in the coastal area.

Table 14: Responsibilities during the CTW Surveys in 2022 and 2023

Responsibilities	Institution, contact person, email-address
General	
Responsible for the organisation of surface water body sampling	Institute/Laboratory: Fisheries, Aquaculture and Water Biodiversity Department, Batumi, NEA Contact person: Marina Mgeladze E-Mail: mari.mgeladze@gmail.com
Field work	
Responsible for field work (biological and chemical sampling)	Institute/Laboratory: Fisheries, Aquaculture and Water Biodiversity Department, Batumi, NEA Contact person: Ramaz Mikeladze, Paata Vadachkoria, E-Mail: rmikeladze@gmail.com; vadach@gmail.com
Responsible for functional check of sampling equipment	Institute/Laboratory: Fisheries, Aquaculture and Water Biodiversity Department, Batumi, NEA Contact persons: Paata Vadachkoria, Tinatin Joglidze E-Mail: vadach@gmail.com; joglidze.tinatin@gmail.com
Responsible for calibration of on-site measuring equipment	Institute/Laboratory: Fisheries, Aquaculture and Water Biodiversity Department, Batumi, NEA Contact persons: Paata Vadachkoria, Tinatin Joglidze E-Mail: vadach@gmail.com; joglidze.tinatin@gmail.com
Chemical analysis	
Overall responsible for the chemical analysis in the lab, including reporting and data delivery	Institute/Laboratory: Ambient Air, Water and Soil Analysis Laboratory, Batumi, NEA Contact person: Irina Baramidze E-Mail: Irine.Baramidze@nea.gov.ge
Responsible for sample transport from the field to the laboratory	Institute/Laboratory: Fisheries, Aquaculture and Water Biodiversity Department, Batumi, NEA Contact person: Paata Vadachkoria E-Mail: vadach@gmail.com
Analysing laboratory and contact person	Institute/Laboratory: Ambient Air, Water and Soil Analysis Laboratory, Batumi, NEA Contact person: Irina Baramidze E-Mail: Irine.Baramidze@nea.gov.ge
Biological analysis	
Overall responsible for the biological analysis in the lab, including reporting and data delivery	Institute/Laboratory: Fisheries, Aquaculture and Water Biodiversity Department, Batumi, NEA Contact person: Marina Mgeladze, Madona Varshanidze E-Mail: mari.mgeladze@gmail.com; varshanidzema@gmail.com

3.3. Results

3.3.1. Coastal waters

According to the improved delineation proposal for coastal and transitional waters (Chapter 1, this report), 5 coastal water types occur in the coastal zone from Sarpi to Kobuleti (Table 15), which were monitored during the EUWI+ project from September 2019 to July 2020 (EUWI+ Report, 2021).

In the coastal zone from Kobuleti to Anaklia, which was monitored during the EU4EnvWD surveys from 2022 to 2023, 4 coastal water types occur, of which measurements and sampling were carried out in three coastal water types (Table 16).

Table 15: Coastal water types appearing in the coastal zone from Sarpi to Kobuleti

Coastal water body type	Definition
GE_CW111	Mesohaline, shallow coastal water type with fine grained substrate
GE_CW211	Narrow mesohaline, shallow coastal water type with fine grained substrate
GE_CW212	Narrow mesohaline, shallow coastal water type with coarse grained substrate
GE_CW221	Narrow mesohaline, deep coastal water type with fine grained substrate
GE_CW222	Narrow mesohaline, deep coastal water type with coarse grained substrate

Table 16: Coastal water types appearing in the coastal zone from Kobuleti to Anaklia

Coastal water body type	Definition	Monitoring performed	Stations monitored
GE_CW111	Mesohaline, shallow coastal water type with fine grained substrate	No	-
GE_CW112	Mesohaline, shallow coastal water type with coarse grained substrate	Yes	RiAn11
GE_CW211	Narrow mesohaline, shallow coastal water type with fine grained substrate	Yes	KoRi6
GE_CW212	Narrow mesohaline, shallow coastal water type with coarse grained substrate	Yes	KoRi1 KoRi2 KoRi4 KoRi7a RiAn7 RiAn8 RiAn9 RiAn10

According to the provisions of the WFD, each water type requires type-specific thresholds. For the supporting quality elements, the type-specific thresholds should be defined for high, good and moderate status (Table 17), while additional thresholds for poor and bad status should be defined in the case of biological quality elements (Table 18) (CIS Guidance document No.5, 2003).

Table 17: General status definitions for supporting quality elements

Status	Definition
High	The physico-chemical elements correspond totally or nearly totally to undisturbed conditions. Nutrient concentrations remain within the range normally associated with undisturbed conditions. Temperature, oxygen balance and transparency do not show signs of anthropogenic disturbance and remain within the ranges normally associated with undisturbed conditions
Good	Temperature, oxygenation conditions and transparency do not reach levels outside the ranges established so as to ensure the functioning of the ecosystem and the achievement of the values specified above for the biological quality elements. Nutrient concentrations do not exceed the levels established so as to ensure the functioning of the ecosystem and the achievement of the values specified above for the biological quality elements
Moderate	Conditions consistent with the achievement of the values specified above for the biological quality element

Table 18: General status definitions for biological quality elements

Status	Definition
High	There are no, or only very minor, anthropogenic alterations to the values of the physicochemical and hydromorphological quality elements for the surface water body type from those normally associated with that type under undisturbed conditions. The values of the biological quality elements for the surface water body reflect those normally associated with that type under undisturbed conditions, and show no, or only very minor, evidence of distortion.
Good	The values of the biological quality elements for the surface water body type show low levels of distortion resulting from human activity, but deviate only slightly from those normally associated with the surface water body type under undisturbed conditions.
Moderate	The values of the biological quality elements for the surface water body type deviate moderately from those normally associated with the surface water body type under undisturbed conditions. The values show moderate signs of distortion resulting from human activity and are significantly more disturbed than under conditions of good status.
Poor	Water showing evidence of major alterations to the values of the biological quality elements for the surface water body type and in which the relevant biological communities deviate substantially from those normally associated with the surface water body type under undisturbed conditions, shall be classified as poor
Bad	Water showing evidence of severe alterations to the values of the biological quality elements for the surface water body type and in which large portions of the relevant biological communities normally associated with the surface water body type under undisturbed conditions are absent, shall be classified as bad.

Taking into account the status definitions presented in Tables 17 and 18 and the available historical data for certain parameters determined in the Georgian coastal zone under various anthropogenic pressures and under the influence of delineation factors (salinity, depth and substrate composition), type-specific threshold values are given in Table 19 for supporting quality elements and in Tables 20 to 22 for biological quality elements and mesozooplankton as an indicator of eutrophication.

Table 19: Type-specific thresholds (H/G and G/M) for supporting quality elements in coastal water types

Water category	Coastal waters (GE_)					
Type/Parameter	**CW111**	**CW112**	**CW211**	**CW212**	**CW 221**	**CW222**
Temperature	H/G Upper value 28 °C H/G Lower value 8 °C G/M Upper value 29 °C G/M Lower value 7 °C		H/G Upper value 28 °C H/G Lower value 10 °C G/M Upper value 29 °C G/M Lower value 9 °C			
Salinity	H/G Upper value 18 H/G Lower value 10 G/M Upper value 19 G/M Lower value 9		H/G Upper value 18 H/G Lower value 15 G/M Upper value 19 G/M Lower value 14			
Transparency	H/G = 5m G/M = 2,5m		H/G=6 m G/M=3 m			
Oxygen saturation	H/G Upper value = 118% H/G Lower value = 90% G/M Upper value = 125% G/M Lower value = 80%		H/G Upper value = 110% H/G Lower value = 95% G/M Upper value = 120% G/M Lower value = 80%			
Nutrients-Dissolved inorganic nitrogen	H/G = 6 µmol/L G/M = 8 µmol/L		H/G = 3 µmol/L G/M = 5 µmol/L		H/G=3,5 µmol/L G/M=5,5 µmol/L	
Nutrients - Orthophosphate	H/G = 0,12 µmol/L G/M = 0,17 µmol/L		H/G = 0,07 µmol/L G/M = 0,13 µmol/L		H/G=0,1 µmol/L G/M=0,15 µmol/L	

The type-specific threshold values for assessing the status of the supporting physico-chemical quality elements were established for transparency, oxygen saturation, dissolved inorganic nitrogen and orthophosphate (Table 19) as part of the EUWI+ activities in the coastal area from Sarpi to Kobuleti (EUWI+, Report 2021) in accordance with the provisions of the WFD (Table 17). These boundary values were also used for the status assessment of the water bodies from Kobuleti to Anaklia. All boundary values represent the annual average values. Among the EU-MS, no consensus has been reached on the selection of the statistical measure (average, geometric mean, media, 90th percentile…..) to be used as the boundary value. According to Ms Sandra Poikane (JRC, EC), the annual average value would be preferred (personal communication).

In contrast to the threshold values for transparency, oxygen conditions and nutrients from the previous project (EUWI+, Report 2021), the threshold values for temperature and salinity were changed slightly to take into account the influence of climatic changes in recent decades on these parameters.

Due the double role of salinity (supporting quality element and delineation factor), Ms Jeanne Boughaba (JRC, EC) provided an opinion stated below:

"Salinity is a typology factor for transitional and coastal (TRAC) waters (Annex II, 1.2.3 and 1.2.4) with clear salinity types as oligohaline-mesohaline-polyhaline and salinity thresholds for these types included in the typology descriptors. This is because TRAC waters are by definition saline waters and different salinity levels will mean different biota and different reactions to human pressures.

Thus, strictly speaking, salinity does not need to be used for the status classification of TRAC water bodies, since it is already used in typology.

On the other hand, salinity must be used for the classification of rivers and lakes, as it is part of their normative definition in Annex V.1.2.1 and 1.2.2.

However, even though salinity is not a quality element that is strictly required (in annex V 1.2.3. and 1.2.4 of the WFD) to be taken into account in the status classification of the TraC waters, as it is one of the parameters taken into account in the typology of those water bodies, Member States have to ensure that salinity values remain within the interval of the water body type.

Where there is a risk that the salinity may change, either due to human activities or natural reasons, this should be monitored and appropriate measures may be required to address such related pressure/impacts."

On the basis of this advice, the status of salinity in certain stations was assessed using threshold values (Table 19), but it was not used to assess the ecological status of coastal water bodies.

Among the required biological quality elements to be monitored in coastal waters phytoplankton and and macrozoobenthos were investigated during the surveys from Kobuleti to Anaklia while areas with macrophytes have not been identified in this coastal zone.

Probably the best index for phytoplankton status assessment is the multiparametric "Integrated Phytoplankton Index (IBI) developed by Moncheva and Boicenco and intercalibrated on EU level (Moncheva S., L. Boicenco, 2011).

The phytoplankton status assessment according to this index, is based on the phytoplankton abundance, biomass, Chl a biomass, total community abundance, total Dinophyceae abundance, Shannon biodiversity index and the Menhinik index.

Due to the lack of data on the biomass of chlorophyll a in our samples, we could not use this index, but only its two components, i.e. phytoplankton abundance and phytoplankton biomass. The assessment of the phytoplankton status based on these two indicators was also used in the EMBLAS project (EMBLAS, 2017).

The threshold values for H/G and G/M for phytoplankton are listed in Table 20.

Table 20: Threshold values for abundance (N) and biomass (B) of phytoplankton in coastal habitat

Status	N (Cells/L) * 1000	B (mg/m^3)
High	400 – 500	400 - 700
Good	501 - 800	701 - 950
Moderate	801 - 1500	951 – 2500
Poor	1501 -3000	2501 – 5000
Bad	> 3000	> 5000

For the benthic invetebrate status assessment the "M-AMBI" index (Bald et al., 2005; Muxika et al., 2007) was used with a predefined (AZTI Programme) thresholds (Table 21), valid for all Georgian coastal water types.

Table 21: Type-specific thresholds (EQR) for the BQE Benthic invertebrates in coastal water types

Index	Threshold	EQR
M-AMBI	H/G	0.8
	G/M	0.6
	M/P	0.4
	P/B	0.20

For the additional indicator “Mesozooplankton" which is not a mandatory biological quality element of the WFD, only one threshold value was proposed (Table 22), which is based on the total biomass of mesozooplankton (mg/m^3), indicating the trophic conditions of coastal waters.

Table 22: Oligo-mesotrophic/eutrophic thresholds for mesozooplankton in Georgian coastal waters

Water category	Coastal waters	
Type	**GE_CW111/_CW211/_CW221/_CW222**	
Parameter	**Trophic status**	**Threshold**
Mesozooplankton	Oligo-mesotrophic / Eutrophic	900 (mg/m^3)

The status of the investigated parameters at the monitoring stations from Kobuleti to Anaklia is presented in Chapters 3.3.1.1. to 3.3.1.4. according to the threshold values given in Tables 19 to 22.

3.3.1.1. Coastal water type Ge-CW112: Water body CW112_An-C

In the water body Ge_CW112_An-C, which is located near Anaklia measurements and sampling were carried out at one station (RiAn11) in May 2023 (Table 23).

Table 23: Quality elements (Temp - temperature, Sal – salinity, O2 - oxygen conditions, DIN – dissolved inorganic nitrogen, PO4 – orthophosphate, Phyto – Phytoplankton, BI – benthic invertebrates) and eutrophication indicator (Zoo – Zooplankton) investigated at station RiAn11

Water body: CW112_An-C									
Station	Physico-chemical QE						Biological QE		Eutrophication
	Temp	Sal	Secchi	O2	DIN	PO4	Phyto	BI	Zoo
RiAn11	+	+	/	+	+	+	+	/	/

As this station was only monitored once, the status of the parameters examined cannot be assessed. However, the data collected for this station are listed in Appendix 2 and reproduced in the following text.

Physico-chemical supporting quality elements

The temperature measured in the surface layer at station RiAn11 was 12.5 °C (Figure 12), which is within the “normal” temperature range (status = high) for coastal waters in Georgia. The salinity was relatively low (S = 9.11), probably because this station is under the influence of the Enguri River. The increased concentration of dissolved inorganic nitrogen (5.19 µmol dm-3) supports this hypothesis. In contrast to the dissolved inorganic nitrogen, the detected orthophosphate concentration was very low (0.08 µmol dm^{-3}). Since phosphorus is the limiting nutrient for primary production in Georgia, the low orthophosphate concentration did not ensure conditions for increased primary production, as shown by an oxygen saturation of 92 %.

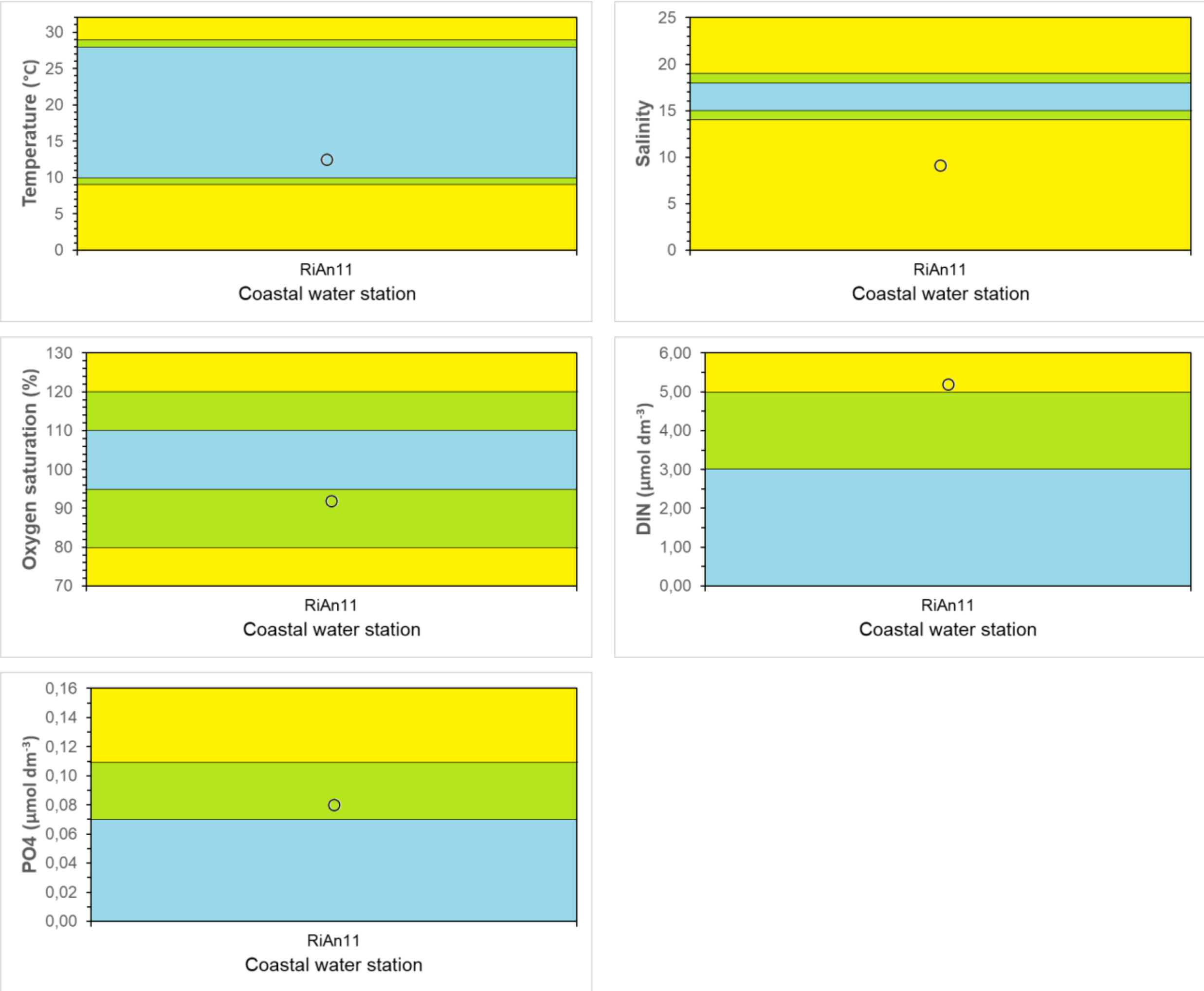


Figure 12: Temperature, salinity, oxygen saturation (O2 %), concentration of dissolved inorganic nitrogen (DIN) and orthophosphate (PO4) in the surface layer (0,5m depth) at station RiAn11 in May 2023.

Phytoplankton

If we evaluate the abundance and biomass of phytoplankton according to the threshold values for phytoplankton, we can conclude that the status of the phytoplankton at this station in May 2023 was high in terms of abundance and moderate in terms of biomass (Table 24).

Table 24: Assessed status of Phytoplankton according to the thresholds for abundance and biomass

Station	N (Cells/L)	B (mg/m^3)
RiAn11	99630	1375,14

3.3.1.2. Coastal water type Ge-CW211: Water body CW211_PoHa

In the water body CW211_PoHa, which is located in the port of Poti and is nominated as a candidate for the status of a "heavily modified water body", measurements and sampling were carried out at one station (KoRi6) during both surveys (Table 25).

Table 25: Parameters investigated at station KoRi6 in the coastal water body CW211_PoHa (Temp - temperature, Sal – salinity, O2 - oxygen conditions, DIN – dissolved inorganic nitrogen, PO4 – orthophosphate, Phyto – phytoplankton, BI – benthic invertebrates) and eutrophication indicator (Zoo – zooplankton)

Water body: CW211_PoHa									
Station	Physico-chemical QE						Biological QE		Eutrophication
	Temp	Sal	Secchi	O2	DIN	PO4	Phyto	BI	Zoo
KoRi6	+	+	+	+	+	+	+	+	+

<u>Physico-chemical supporting quality elements</u>

The assessed status of the physico-chemical parameters at station KoRi6 in the water body Ge_Cw212_PoHa is shown in Figure 13.

According to the results of the temperature measurements at station KoRi6, the status of this station can be described as good for August 2022 and high for May 2023. The salinity status at this station can be classified as good for both surveys carried out, while a moderate status was determined for transparency in both surveys. The values determined for oxygen saturation and nutrient concentrations in the upper layer (from the surface to 10 m depth) in August 2022 and May 2023 were in the status range from good to high (oxygen saturation and orthophosphate) and moderate to high for dissolved inorganic nitrogen. If the status of these parameters is assessed on an average basis, it can be described as high for oxygen saturation and orthophosphate concentration and good for dissolved inorganic nitrogen concentration.

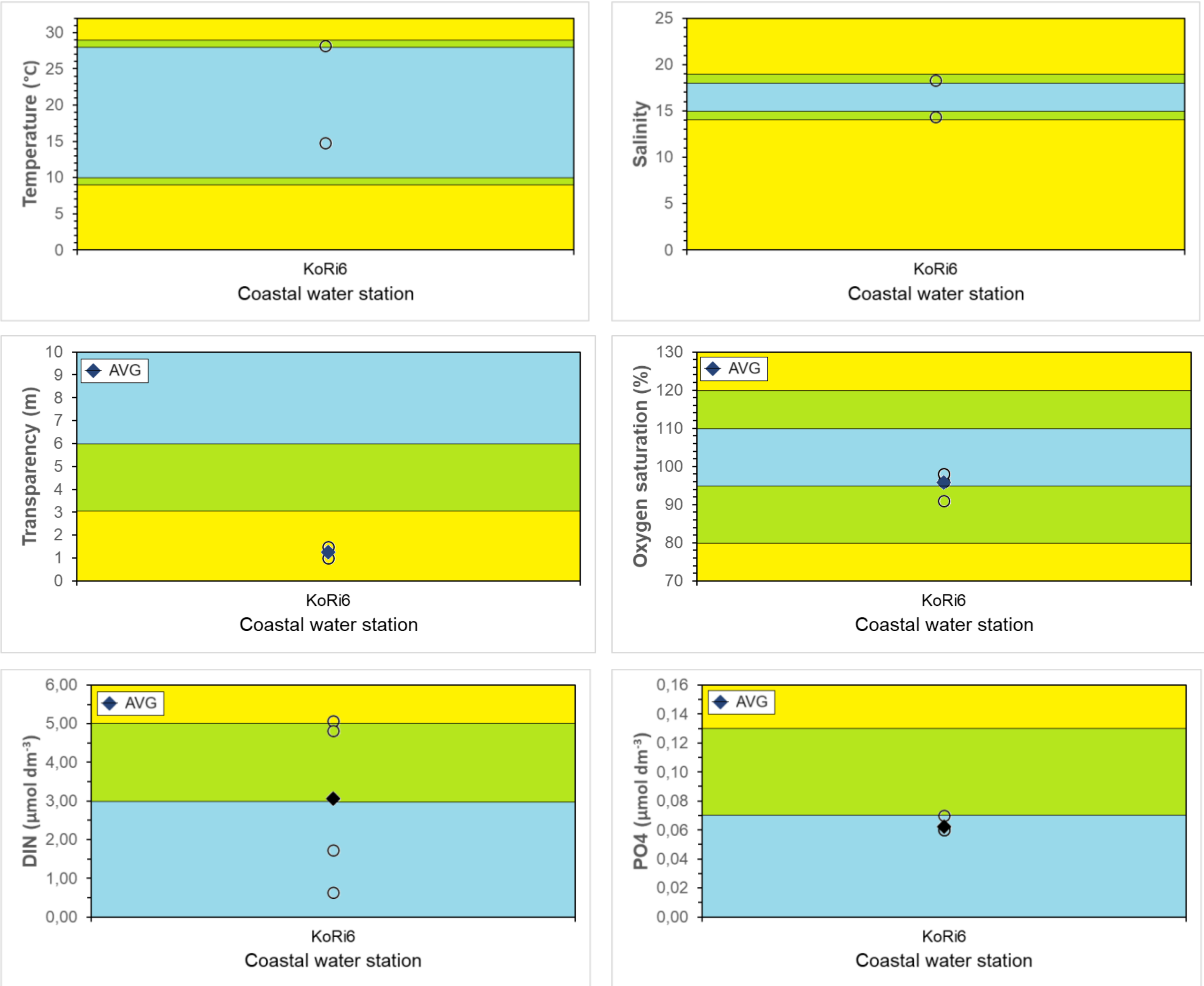


Figure 13: Surface temperature and salinity values at station KoRi6, individual and average values (AVG) for transparency and oxygen saturation and nutrients (DIN – dissolved inorganic nitrogen, PO4 – orthophosphate in the upper layer from the surface to 10 m depth) with the indicated ranges for high (blue), good (green) and moderate status (yellow).

Phytoplankton

According to the phytoplankton abundances and biomasses determined in August 2022 and May 2023, the status of the phytoplankton at this station can be assessed as high for both indicators (Table 26).

Table 26: Status of the biological quality element phytoplankton based on the average values for abundance (N) and biomass (B) determined at the KoRi6 station in August 2022 and May 2023

Station	Survey	N (Cells/L)	B (mg/m^3)
KoRi6	August 2022	14334	112,31
	May 2023	91649	365,97
	Average	**52991,5**	**239,14**

Benthic invertebrates

At station KoRi6, there was a pronounced predominance of one species from the phylum *Heteromastus filiformis* (EG IV, 83.84 %) and the gastropod mollusc *Hydrobia acuta* (EG III, 7.65 %). The proportion of the other species in the community composition mostly fluctuated between 0.28 and 3.49 %.

According to the calculated percentages of the ecological groups established at the KoRi6 station (Figure 14), the functional compositions (Table 27a) and the results of the multiparametric analysis (Table 27b), the ecological status of the station can be classified as poor.

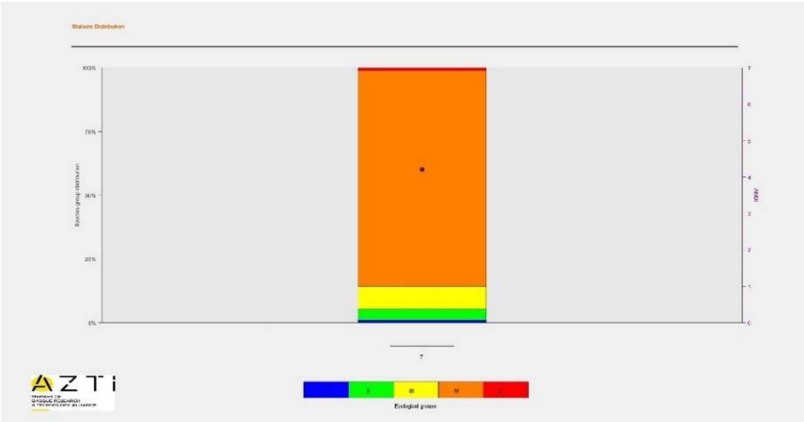


Figure 14: Percentage of ecological groups (EGI – EGV) at station KoRi 6.

Table 27a: Functional composition of benthic invertebrate fauna on station KoRi 6 including the percentage of sensitive species (EG I), indifferent species (EG II), tolerant species (EG III),1st order opportunist (EG IV). 2nd order opportunist (EG V) and unclassified species (n. a.) with calculated Biotic (BI) and AMBI indices

EG I	EG II	EG III	EG IV	EG V	n.a.	BI	AMBI
1.0	4.2	9.0	84.5	1.3	0.5	3	4.211

Table 27b: Results of the multiparametric analysis: AMBI index, d=species richness, H'= Shannon-Wiener biodiversity index, M-AMBI=multiparametric AMBI index, EQR=Ecological Quality Ratio

AMBI	d	H	M-AMBI / EQR	ECOLOGICAL STATUS
4.211	14	1.04	0.39	Poor

Mesozooplankton

The trophic status at station KoRi6, based on the total biomass of the mesozooplankton, determined in August 2022 and May 2023, is assessed as "eutrophic" (Table 28).

Table 28. Trophic status at station KoRi6 according to the total biomass of mesozooplankton (MZP TB) determined at the KoRi6 station in August 2022 and May 2023

Station	Survey	MZP TB (mg m^{-3})	Trophic status
KoRi6	August 2022	2629,77	Eutrophic
	May 2023	246,22	Oligo- mesotrophic
	Average	**1437,99**	**Eutrophic**

3.3.1.3. Coastal water type Ge-CW212: Water body CW212_KoRi

In the water body CW212_KoRi, which is located in the coastal zone between Kobuleti and Rioni river, measurements and sampling were carried out at four stations (Table 29).

Table 29: Parameters investigated at stations KoRi1, KoRi2, KoRi4 and KoRi7a in the coastal water body Ge_CW211_PoHa (Temp - temperature, Sal – salinity, O2 - oxygen conditions, DIN – dissolved inorganic nitrogen, PO4 – orthophosphate, Phyto – phytoplankton, BI – benthic invertebrates) and eutrophication indicator (Zoo – zooplankton)

Water body: CW212_KoRi									
Station:	Physico-chemical QE						Biological QE		Eutrophication
	Temp	Sal	Secchi	O2	DIN	PO4	Phyto	BI	Zoo
KoRi1	+	+	+	+	+	+	+	+	+
KoRi2	+	+	+	+	+	+	+	+	+
KoRi4	+	+	+	+	+	+	+	+	+
KoRi7a	+	+		+	+	+	+		

As the station KoRi7a was only monitored once, the status of the parameters examined cannot be assessed. However, the data collected for this station are listed in Annex 2 of this report.

Physico-chemical supporting quality elements

The assessed status of the physico-chemical parameters at the investigated stations is shown in Figure 15.

According to the results of the temperature measurements at stations KoRi1, KoRi2 and KoRi4, the status of these stations can be described as high (KoRi2 and KoRi4) and good (KoRi1) in August 2022 and as high for all stations in May 2023, while the salinity at these stations ranged from good to high in both surveys. Transparency was good in both surveys at station KoRi1, in the good to high range at station KoRi4 and moderate to good at station KoRi2. Based on the average transparency values, the status of this parameter can be assessed as good for stations KoRi1 and KoRi4 and as moderate for station KoRi2. The oxygen saturation values in the upper layer (0.5 m to 10 m depth) were all in the "good to high" saturation range. On average, the status for this parameter can be classified as high at all stations. The nutrient concentrations (individual values and average concentrations) for dissolved inorganic nitrogen and orthophosphate were in the high status range at stations KoRi1 and KoRi4, while some individual values for both nutrients were in the moderate range at station KoRi2. The concentration of dissolved inorganic nitrogen of 13.67 µmol dm^{-3} (determined in August 2022) can be regarded as a moderate increase, while the concentration of 1.66 µmol dm^{-3} for orthophosphate (determined in May 2023) represents an unusually extreme concentration for Georgian coastal waters. The average nutrient status can be assessed as high for both nutrients at the Kori1 and KoRi4 stations, good for dissolved inorganic nitrogen and moderate for orthophosphate at the KoRi2 station.

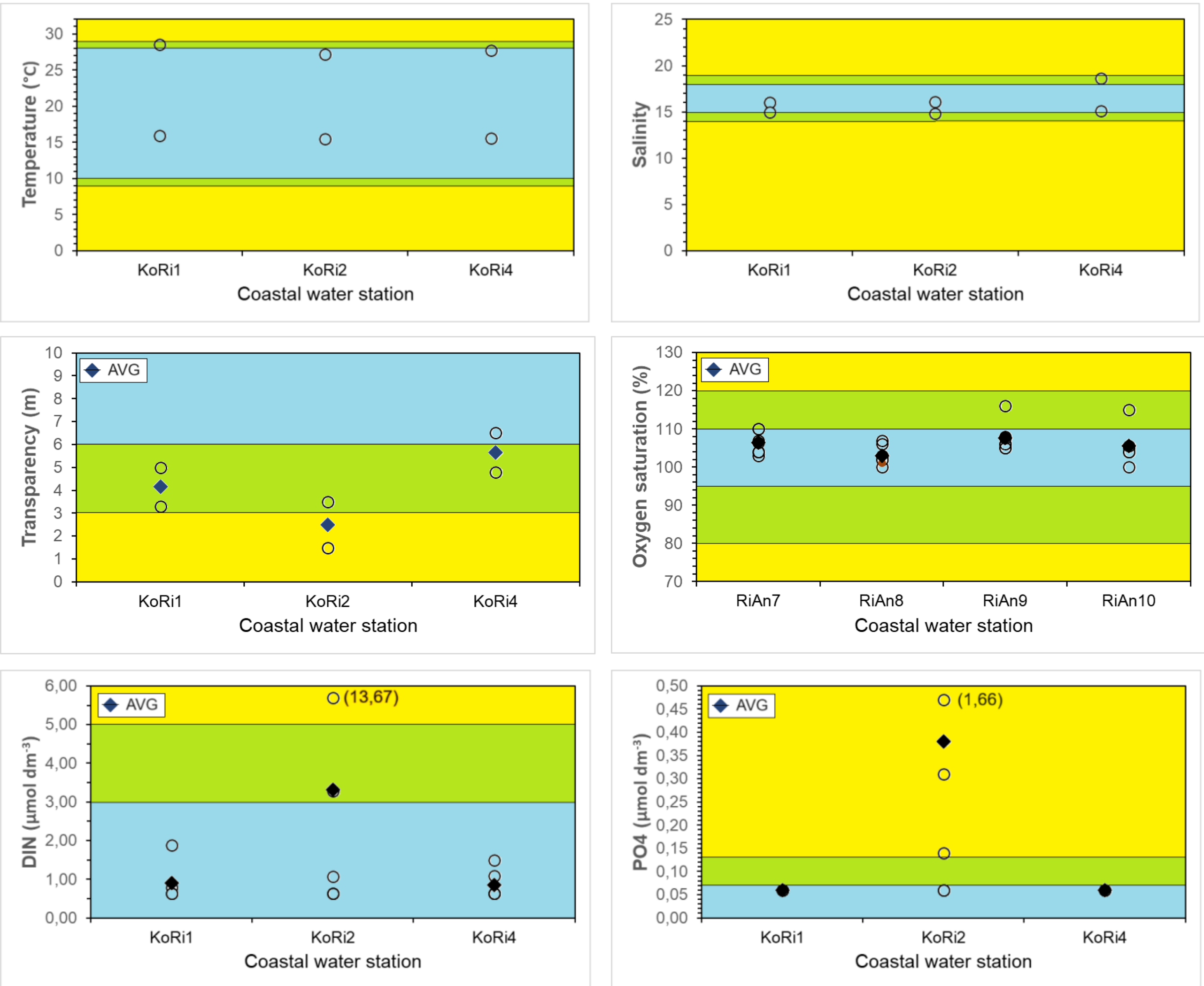


Figure 15: Surface temperature and salinity values at stations KoRi1, KoRi2 and KoRi4, individual and average values (AVG) for transparency and oxygen saturation and nutrients (DIN – dissolved inorganic nitrogen, PO4 – orthophosphate in the upper layer from the surface to 10 m depth) with the indicated ranges for high (blue), good (green) and moderate status (yellow).

Phytoplankton

According to the phytoplankton abundances and biomasses determined in August 2022 and May 2023, the status of the phytoplankton at this station can be assessed as high for both indicators (Table 30).

Table 30: Status of the biological quality element phytoplankton based on the average values for abundance (N) and biomass (B) determined at the stations KoRi1, KoRi2 and KoRi4 in August 2022 and May 2023

Station	Survey	N (Cells/L)	B (mg/m^3)
KoRi1	August 2022	58219	173,06
	May 2023	295294	828,84
	Average	**200464**	**566,53**
KoRi2	August 2022	30825	144,77
	May 2023	58413	300,51
	Average	**446189**	**222,64**
KoRi4	August 2022	41884	239,70
	May 2023	67158	352,98
	Average	**54521**	**296,34**

Benthic invertebrates

Station KoRi 1:

At station KoRi1, the predominance of a species *Lentidium mediterraneum* (EG II, 39.9 %) in the composition of the macrobenthos was pronounced followed by the bivalve mussel *Chamelea gallina* (EG I, 23.9 %), from the Phylum *Ampelisca sarsi* (EG I, 17.0 %). The proportion of other species in the community composition mostly varied between 0.4 and 3.1 %.

According to the calculated percentages of the ecological groups established at the station (Figure 16), the functional compositions (Tables 31a) and the results of the multiparametric analysis (Tables 31b), the ecological status of the water body can be assessed as high.

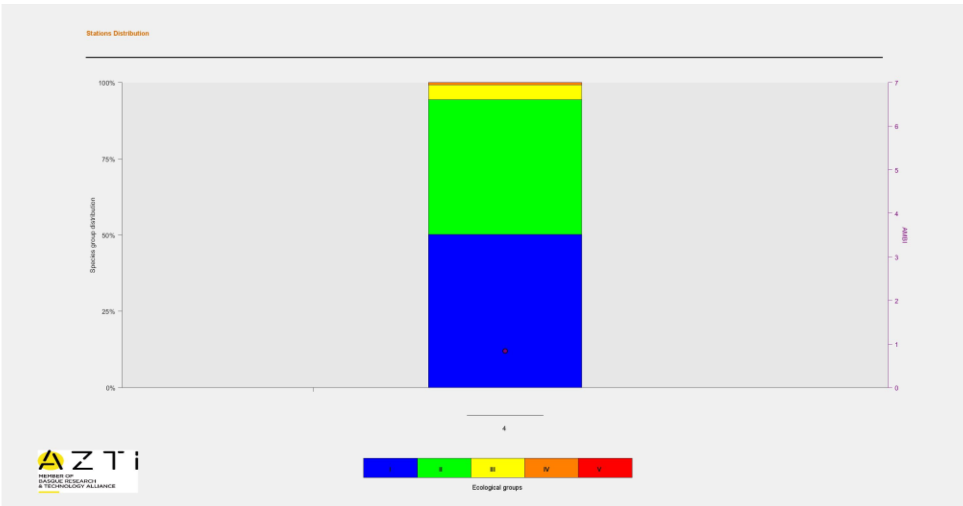


Figure 16: Percentage of ecological groups (EGI – EGV) at station KoRi1.

Table 31a: Functional composition of benthic invertebrate fauna on station KoRi1 including the percentage of sensitive species (EG I), indifferent species (EG II), tolerant species (EG III), 1st order opportunist (EG IV). 2nd order opportunist (EG V) and unclassified species (n. a.) with calculated Biotic (BI) and AMBI indices

EG I	EG II	EG III	EG IV	EG V	n.a.	BI	AMBI
50.177	44.214	4.903	0.707	0	0	1	0.842

Table 31b: Results of the multiparametric analysis: AMBI index, d=species richness, H'= Shannon-Wiener biodiversity index, M-AMBI=multiparametric AMBI index, EQR=Ecological Quality Ratio

AMBI	d	H	M-AMBI / EQR	ECOLOGICAL STATUS
0.842	19	2.53	0.82	High

Station KoRi2:

At station KoRi2, the predominance of a species *Lucinella divaricata* (EG I, 44.8 %) in the composition of the macrobenthos was pronounced followed by the bivalve mussel *Chamelea gallina* (EC I, 11.1 %), and mollusca from the group of Gastropoda *Hydrobia acuta* (EG III, 10.5 %) and Annelida-*Melinna palmata* (EG III, 9.6 %). The proportion of other species in the community composition mostly varied between 0.2 and 4.9 %.

According to the calculated percentages of the ecological groups established at particular stations (Figure 17), the functional compositions (Table 32a) and the results of the multiparametric analysis (Table 32b). The obtained value for the AMBI index indicates, based on the calculated M-AMBI / EQR value, the ecological status for station KoRi2 can be classified as high.

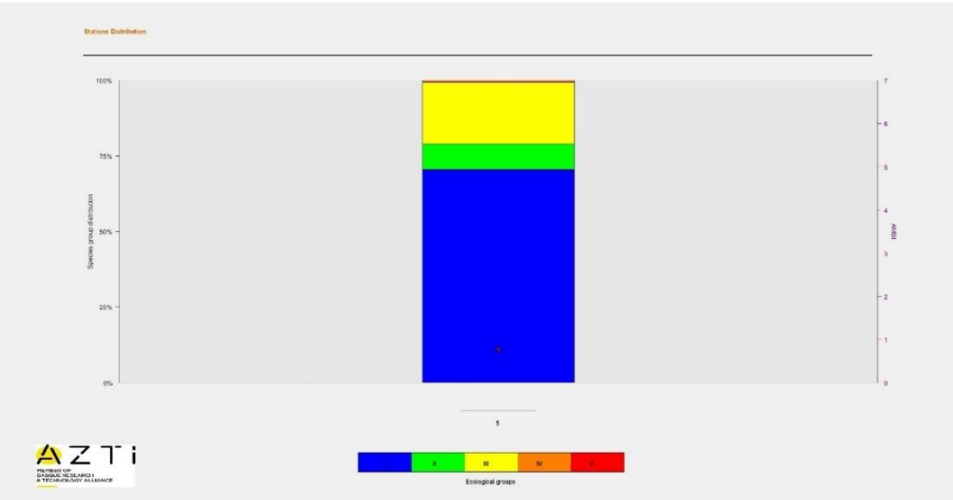


Figure 17: Percentage of ecological groups (EGI – EGV) at station KoRi2.

Table 32a: Functional composition of benthic invertebrate fauna on station KoRi2 including the percentage of sensitive species (EG I), indifferent species (EG II), tolerant species (EG III),1st order opportunist (EG IV). 2nd order opportunist (EG V) and unclassified species (n. a.) with calculated Biotic (BI) and AMBI indices

EG I	EG II	EG III	EG IV	EG V	n.a.	BI	AMBI
70.499	8.521	20.403	0.576	0	0	1	0.766

Table 32b: Results of the multiparametric analysis: AMBI index, d=species richness, H'= Shannon-Wiener biodiversity index, M-AMBI=multiparametric AMBI index, EQR=Ecological Quality Ratio

AMBI	d	H	M-AMBI / EQR	ECOLOGICAL STATUS
0.766	24	2.86	0.92	High

Station KoRi4:

At station KoRi4, the dominance of one species, *Chamelea gallina* (EG I, 42.7 %), was pronounced in the composition of the macrobenthos, followed by another bivalve mussel species, *Lucinella divaricata* (EG I, 35.7 %), Gastropoda *Hydrobia acuta* (EG III, 7.1 %), whereby the proportion of other species in the composition of the community mostly varied between 0.1 and 4.0 %.

According to the calculated percentages of the ecological groups established at particular stations (Figure 18), the functional compositions (Tables 33a) and the results of the multiparametric analysis (Tables 33b). The obtained value for the AMBI index indicates, based on the calculated M-AMBI / EQR value, the ecological status for station KoRi4 can be classified as high.

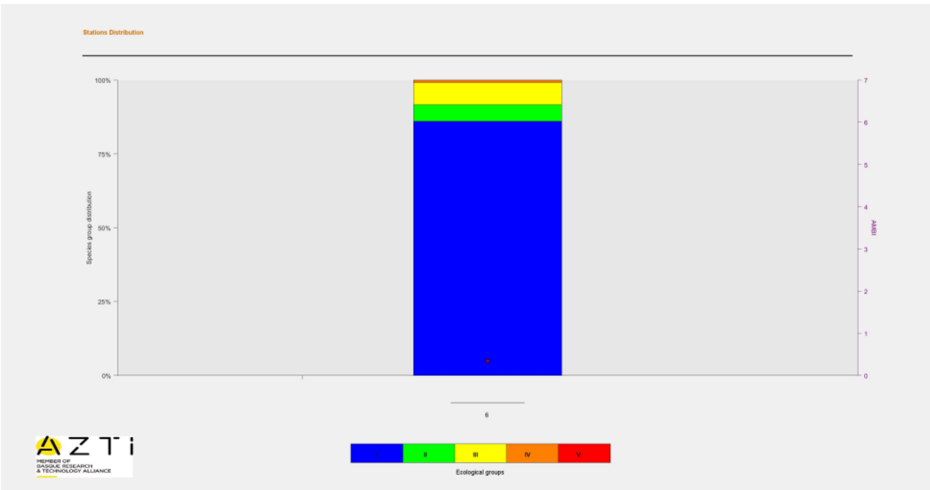


Figure 18: Percentage of ecological groups (EGI – EGV) at station KoRi4.

Table 33a: Functional composition of benthic invertebrate fauna on station KoRi4 including the percentage of sensitive species (EG I), indifferent species (EG II), tolerant species (EG III),1st order opportunist (EG IV). 2nd order opportunist (EG V) and unclassified species (n. a.) with calculated Biotic (BI) and AMBI indices

EG I	EG II	EG III	EG IV	EG V	n.a.	BI	AMBI
86.036	5.687	7.411	0.865	0	0	1	0.347

Table 33b: Results of the multiparametric analysis: AMBI index, d=species richness, H'= Shannon-Wiener biodiversity index, M-AMBI=multiparametric AMBI index, EQR=Ecological Quality Ratio

AMBI	d	H	M-AMBI / EQR	ECOLOGICAL STATUS
0.347	29	2.20	0.92	High

Mesozooplankton

The trophic status at stations KoRi1, KoRi2 and KoRi4, based on the total biomass of the mesozooplankton, determined in August 2022 and May 2023, is assessed as oligo-mesotrophic (Table 34.

Table 34. Trophic status at stations KoRi1, KoR2 and KoRi4 according to the total biomass of mesozooplankton (MZP TB) determined in August 2022 and May 2023

Station	Survey	MZP TB (mg m^{-3})	Trophic status
KoRi1	August 2022	818,1	Oligo-mesotrophic
	May 2023	393,1088	Oligo-mesotrophic
	Average	**605,6044**	**Oligo-mesotrophic**
KoRi2	August 2022	724,8436	Oligo-mesotrophic
	May 2023	32,99497	Oligo-mesotrophic
	Average	**378,9193**	**Oligo-mesotrophic**
KoRi4	August 2022	901,2648	Eutrophic
	May 2023	408,4665	Oligo-mesotrophic
	Average	**654,8656**	**Oligo-mesotrophic**

Oligo-mesotrophic conditions were found at all stations.

3.3.1.4. Coastal water type Ge-CW212: Water body CW212_RiAn

In the water body CW212_RiAn, which is located in the coastal zone Rioni river and Anaklia, measurements and sampling were carried out at four stations (RiAn7, RiAn8, RiAn9 and RiAn10 (Table 35).

Table 35: Parameters investigated at stations RiAn7, RiAn8, RiAn9 and RiAn10 in the coastal water body CW212_RiAn (Temp - temperature, Sal – salinity, O2 - oxygen conditions, DIN – dissolved inorganic nitrogen, PO4 – orthophosphate, Phyto – phytoplankton, BI – benthic invertebrates) and eutrophication indicator (Zoo – zooplankton)

Water body: CW212_RiAn									
Station	Physico-chemical QE						Biological QE		Eutrophication
	Temp	Sal	Secchi	O2	DIN	PO4	Phyto	BI	Zoo
RiAn7	+	+	+	+	+	+	+	+	+
RiAn8	+	+	+	+	+	+	+	+	+
RiAn9	+	+	+	+	+	+	+	+	+
RiAn10	+	+	+	+	+	+	+	+	+

<u>Physico-chemical supporting quality elements</u>

The assessed status of the physico-chemical parameters at the investigated stations is shown in Figure 19.

According to the results of the temperature measurements at stations RiAn7, RiAn8, RiAn9 and RiAn10, the status of these stations in August 2022 can be described as good for stations RiAn7, RiAn8 and RiAn10 and as moderate for station RiAn8. In May 2023, the temperatures for all stations were in the “high” range.

The salinity at these stations ranged from "good" (RiAn10) to "high" (RiAn7, RiAn8 and RiAn9) in August 2022, while the salinity was in the moderate range at all stations in May 2023.

The transparency values recorded in August 2022 show a good status at all stations, while a moderate status was recorded at all stations in May 2023. Based on the average transparency values, the status of this parameter can be assessed as good for stations RiAn9 and RiAn10 and as moderate for stations RiAn7 and RiAn8.

The oxygen saturation values in the upper layer (0.5 m to 10 m depth) were all in the “good to high” saturation range. On average, the status for this parameter can be classified as high at all stations.

The concentrations (individual values and average concentrations) for dissolved inorganic nitrogen can be classified as high for all stations. The orthophosphate concentrations (individual and average values) were also in the high range at stations RiAn9 and RiAn10, while some individual orthophosphate concentrations at stations RiAn7 and RiAn8 were in the “good” concentration range, but the status of these stations can still be described as high, based on the average concentrations.

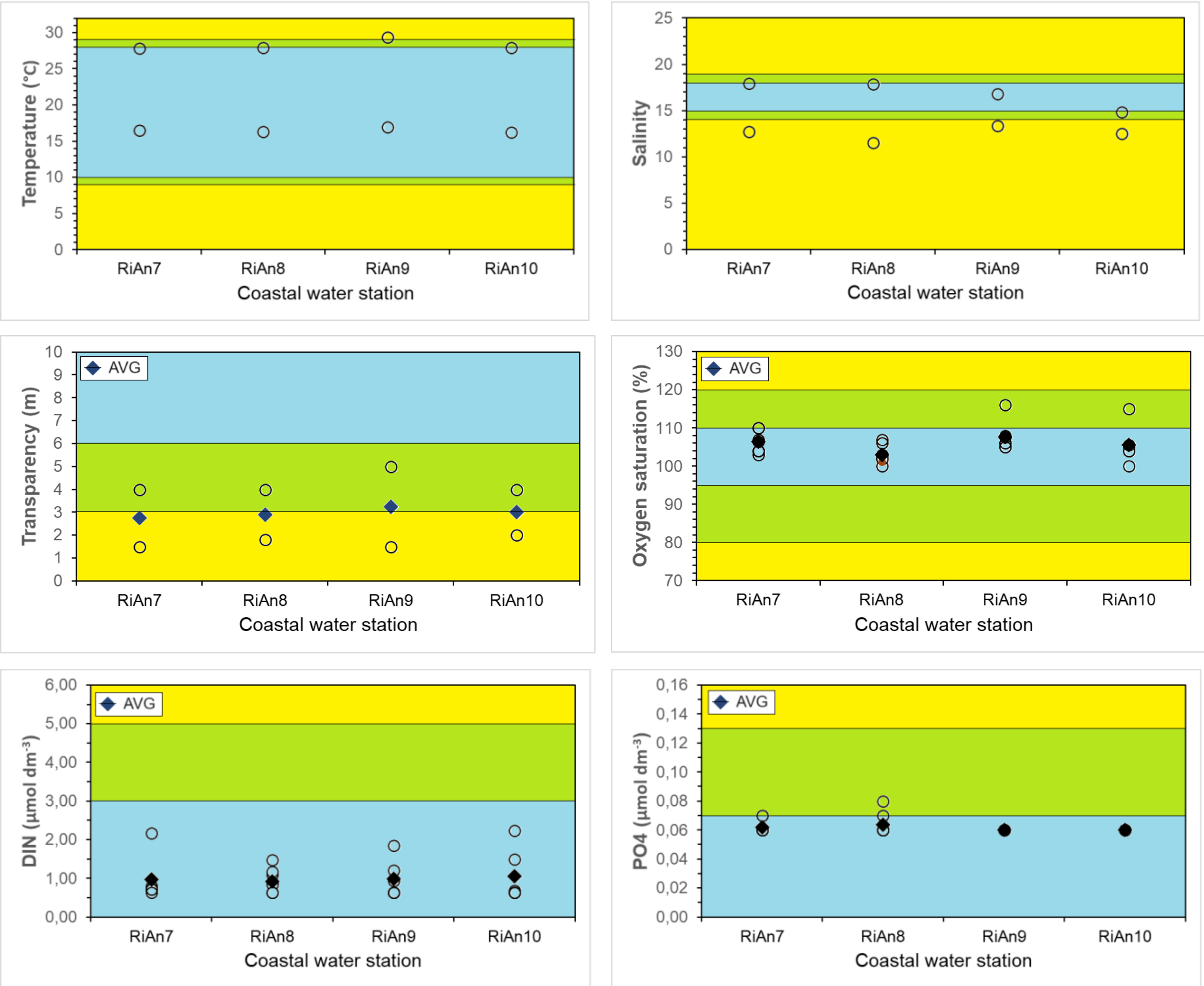


Figure 19: Surface temperature and salinity values at stations RiAn7, RiAn8, RiAn9 and RiAn10, individual and average values (AVG) for transparency and oxygen saturation and nutrients (DIN – dissolved inorganic nitrogen, PO4 – orthophosphate in the upper layer from the surface to 10 m depth) with the indicated ranges for high (blue), good (green) and moderate status (yellow).

Phytoplankton

According to the phytoplankton abundances and biomasses determined in August 2022 and May 2023 (Table 36) the status of the phytoplankton at these stations can be assessed as high for both indicators.

Table 36. Status of the biological quality element phytoplankton based on the average values for abundance (N) and biomass (B) determined at the stations RiAn7 to RiAn10 in August 2022 and May 2023

Station	Survey	N (Cells/L)	B (mg/m³)
RiAn7	August 2022	28047	136,25
	May 2023	128602	464,95
	Average	**78324**	**300,60**
RiAn8	August 2022	38121	161,58
	May 2023	91985	293,86
	Average	**65053**	**227,72**
RiAn9	August 2022	168342	165,64
	May 2023	142264	524,40
	Average	**155303**	**345,02**
RiAn10	August 2022	45003	107,79
	May 2023	159150	468,38
	Average	**102077**	**288,08**

Benthic invertebrates

Station RiAn7

At station RiAn7, the dominance of one species *Melinna palmata* (EG III, 40.21 %) in the composition of the macrobenthos was pronounced, followed by Annelida *Heteromastus filiformis* (EG IV, 37.57 %) and two species *Nephtys cirrosa, Nephtys hombergii* (EG II, 6.88 %). The proportion of the other species in the composition of the community mostly fluctuated between 1.59 and 2.65 %.

According to the calculated percentages of the ecological groups established at particular stations (Figure 20), the functional compositions (Tables 37a) and the results of the multiparametric analysis (Tables 37b). The obtained value for the AMBI index indicates a slightly disturbed state of the environment. Based on the calculated M-AMBI / EQR value, the ecological status for station RiAn7 can be classified as moderate.

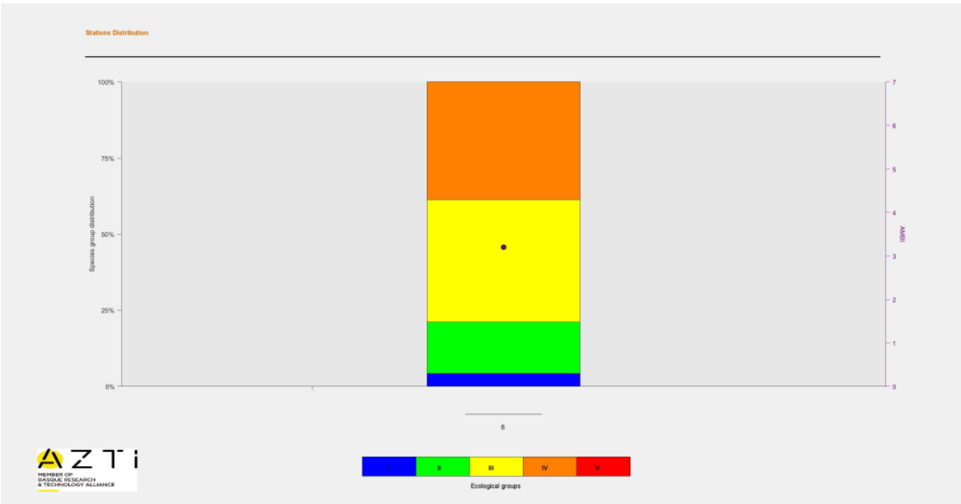


Figure 20: Percentage of ecological groups (EGI – EGV) at station RiAn7.

Table 37a: Functional composition of benthic invertebrate fauna on station RiAn7 including the percentage of sensitive species (EG I), indifferent species (EG II), tolerant species (EG III),1st order opportunist (EG IV). 2nd order opportunist (EG V) and unclassified species (n. a.) with calculated Biotic (BI) and AMBI indices

EG I	EG II	EG III	EG IV	EG V	n.a.	BI	AMBI
4.225	16.901	40.141	38.732	0	0	2	3.201

Table 37b: Results of the multiparametric analysis: AMBI index, d=species richness, H'= Shannon-Wiener biodiversity index, M-AMBI=multiparametric AMBI index, EQR=Ecological Quality Ratio

AMBI	d	H	M-AMBI / EQR	ECOLOGICAL STATUS
3.201	9	2.09	0.51	Moderate

Station RiAn8

At station RiAn 8, the dominance of one species, *Melinna palmata* (EG III, 61.37 %), in the composition of the macrobenthos was pronounced, followed by another Annelida *Heteromastus filiformis* (EG IV, 13.06 %) and *Aricidea (Acmira) cerrutii* (EG I, 10.8 %). The proportion of other species in the community composition mostly varied between 0.28 and 2.44 %.

According to the calculated percentages of the ecological groups established at particular stations (Figure 21), the functional compositions (Tables 38a) and the results of the multiparametric analysis (Tables 38b). The obtained value for the AMBI index indicates a slightly disturbed state of the environment. Based on the calculated M-AMBI / EQR value, the ecological status for station RiAn8 can be classified as good.

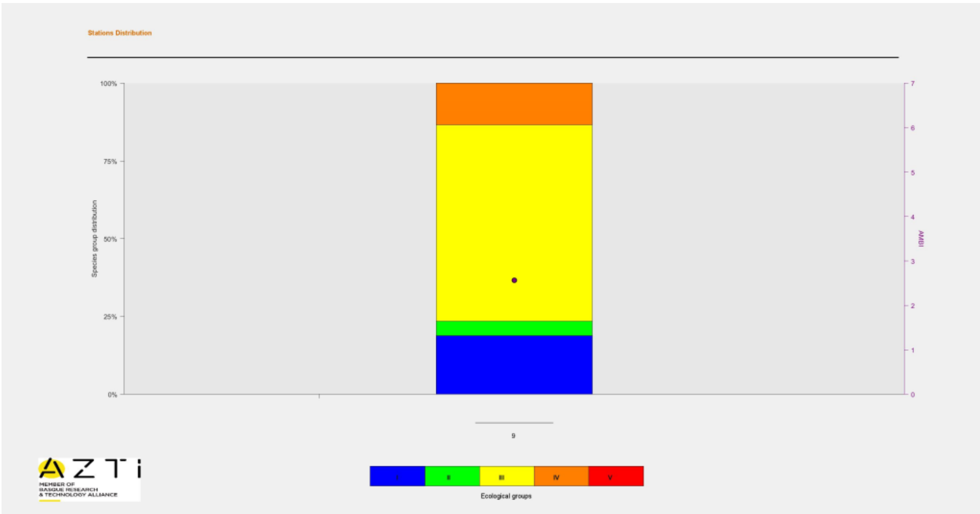


Figure 21: Percentage of ecological groups (EGI – EGV) at station RiAn8.

Table 38a: Functional composition of benthic invertebrate fauna on station RiAn8 including the percentage of sensitive species (EG I), indifferent species (EG II), tolerant species (EG III),1st order opportunist (EG IV). 2nd order opportunist (EG V) and unclassified species (n. a.) with calculated Biotic (BI) and AMBI indices

EG I	EG II	EG III	EG IV	EG V	n.a.	BI	AMBI
18.814	4.607	63.144	13.434	0	0.3	2	2.568

Table 38b: Results of the multiparametric analysis: AMBI index, d=species richness, H'= Shannon-Wiener biodiversity index, M-AMBI=multiparametric AMBI index, EQR=Ecological Quality Ratio

AMBI	d	H	M-AMBI / EQR	ECOLOGICAL STATUS
2.568	16	1.94	0.61	Good

Station RiAn9:

At station RiAn9, the dominance of one species, *Lucinella divaricata* (EG I, 41.32 %), in the composition of the macrobenthos was pronounced, followed by another bivalve mussel *Chamelea gallina* (EG I, 36.1 %) and Annelida *Melinna palmata* (EG III, 6.74 %) and Arthropoda *Amphibalanus improvisus* (EG, 5.22 %). The proportion of other species in the community composition mostly varied between 0.14 and 1.85 %.

According to the calculated percentages of the ecological groups established at particular stations (Figure 22), the functional compositions (Table 39a) and the results of the multiparametric analysis (Table 39b). The obtained value for the AMBI index indicates a slightly disturbed state of the environment. Based on the calculated M-AMBI / EQR value, the ecological status for station RiAn9 can be classified as high.

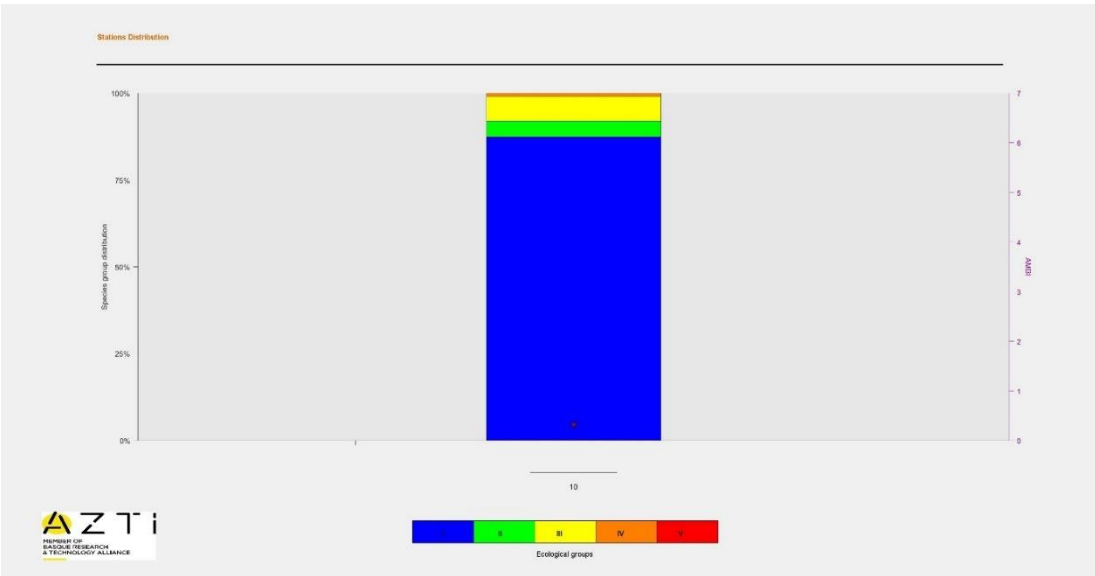


Figure 22: Percentage of ecological groups (EGI – EGV) at station RiAn9.

Table 39a: Functional composition of benthic invertebrate fauna on station RiAn9 including the percentage of sensitive species (EG I), indifferent species (EG II), tolerant species (EG III),1st order opportunist (EG IV). 2nd order opportunist (EG V) and unclassified species (n. a.) with calculated Biotic (BI) and AMBI indices

EG I	EG II	EG III	EG IV	EG V	n.a.	BI	AMBI
87.471	4.505	7.107	0.918	0	0	1	0.322

Table 39b: Results of the multiparametric analysis: AMBI index, d=species richness, H'= Shannon-Wiener biodiversity index, M-AMBI=multiparametric AMBI index, EQR=Ecological Quality Ratio

AMBI	d	H	M-AMBI / EQR	ECOLOGICAL STATUS
0.322	22	2.10	0.83	High

Station RiAn10

At station RiAn10, the dominance of one species, *Chamelea gallina* (EG I, 62.29 %), in the composition of the macrobenthos was pronounced, followed by another bivalve mussel *Lucinella divaricata* (EG I, 8.58 %) and Arthropoda *Amphibalanus improvisus* (EG, 6.02 %). The proportion of other species in the community composition mostly varied between 0.19 and 3.84 %.

According to the calculated percentages of the ecological groups established at particular stations (Figure 23), the functional compositions (Table 40a) and the results of the multiparametric analysis (Table 40b). The obtained value for the AMBI index indicates, based on the calculated M-AMBI / EQR value, the ecological status for station RiAn10 can be classified as high.

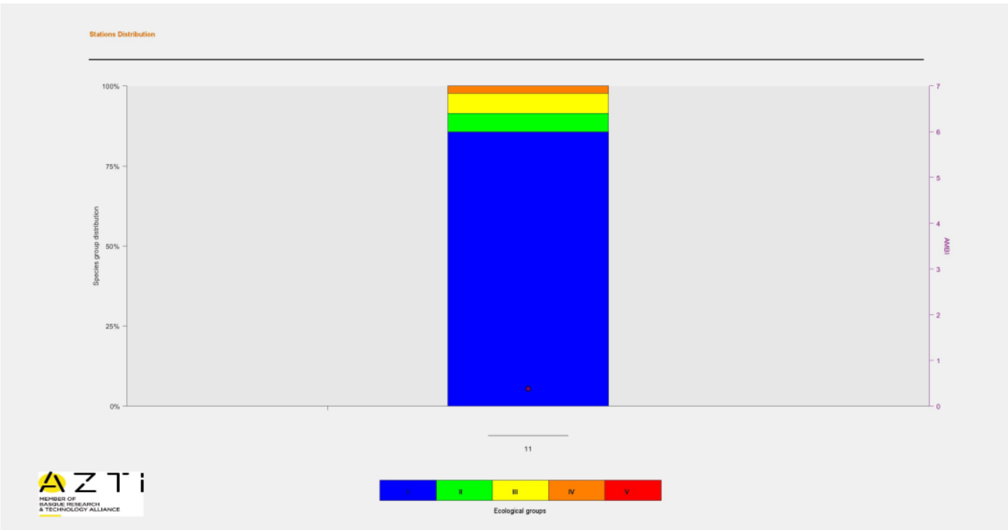


Figure 23: Percentage of ecological groups (EGI EGV) at station RiAn10.

Table 40a: Functional composition of benthic invertebrate fauna on station RiAn10 including the percentage of sensitive species (EG I), indifferent species (EG II), tolerant species (EG III),1st order opportunist (EG IV). 2nd order opportunist (EG V) and unclassified species (n. a.) with calculated Biotic (BI) and AMBI indices

EG I	EG II	EG III	EG IV	EG V	n.a.	BI	AMBI
85.692	5.746	6.223	2.339	0	0	1	0.378

Table 40b: Results of the multiparametric analysis: AMBI index, d=species richness, H'= Shannon-Wiener biodiversity index, M-AMBI=multiparametric AMBI index, EQR=Ecological Quality Ratio

AMBI	d	H	M-AMBI / EQR	ECOLOGICAL STATUS
0.378	24	2,15	0.86	High

Mesozooplaankton

The assessment of the trophic status at stations RiAn7 to RiAn10, based on the total biomass of the mesozooplankton, determined in August 2022 and May 2023, is shown in Table 41.

Table 41: Trophic status at stations RiAn7 to RiAn10 according to the total biomass of mesozooplankton (MZP TB) determined in August 2022 and May 2023

Station	Survey	MZP TB (mg m^{-3})	Trophic status
RiAn7	August 2022	1107,217	Eutrophic
	May 2023	468,2402	Oligo-mesotrophic
	Average	**787,7284**	**Oligo-mesotrophic**
RiAn8	August 2022	420,3233	Oligo-mesotrophic
	May 2023	432,9711	Oligo-mesotrophic
	Average	**426,6472**	**Oligo-mesotrophic**
RiAn9	August 2022	1336,01	Eutrophic
	May 2023	574,1652	Oligo-mesotrophic
	Average	**955,0875**	**Eutrophic**
RiAn10	August 2022	790,6748	Oligo-mesotrophic
	May 2023	344,715	Oligo-mesotrophic
	Average	**567,6949**	**Oligo-mesotrophic**

Oligo-mesotrophic conditions prevailed at most stations, while average eutrophic conditions were found at station RiAn9.

3.3.2. Invasive species

Invasive mesozooplankton species (*Acartia tonsa and Oithona davisae)* were detected at all stations in August 2022., while in May 2023 only *Oithona davisae* were detected at all coastal station with except of station KoRi4.

The invasive phyto- and mesozooplankton species detected in the samples from the coastal water stations in August 2022 and May 2023 are listed in Table 42 and 43.

In August 2022, three invasive phytoplankton species were found in all coastal water stations: *Leptocylindrus danicus* (diatom), *Pseudosolenia calcar-avis* (diatom) and *Scripsiella trochoidea* (dinoflagellate), while in May 2023 another invasive dinoflagellate species (*Gyrodinium sp*.) (together with *Leptocylindrus danicus*, *Pseudosolenia calcar-avis* and *Scripsiella trochoidea*) was found in the sample from station KoRi1. The occurrence of invasive species at the other stations varied, with only *Scripsiella trochoidea* found at stations KoRi2, KoRi6, KoRi9, KoRi10 and KoRi11, while at stations Ko4 and RiAn7, *Pseudosolenia calcar-avis* was also part of the phytoplankton community along with *Scripsiella trochoidea.*

Invasive mesozooplankton species (*Acartia tonsa* and *Oithona davisae)* were detected at all stations in August 2022, while in May 2023 only *Oithona davisae* was detected at all coastal stations with the exception of station KoRi4.

Table 42: Invasive phyto- and mesozooplankton species discovered in coastal waters in August 2022

Surface water type	Water body	Station	Detected invasive species	
			Phytoplankton	Mesozooplankton
Coastal waters Survey 2022	CW212_KORi	KoRi1	*Pseudosolenia calcar-avis* *Scripsiella trochoidea*	*Acartia tonsa* *Oithona davisae*
		KoRi2	*Pseudosolenia calcar-avis* *Scripsiella trochoidea*	*Acartia tonsa* *Oithona davisae*
		KoRi4	*Pseudosolenia calcar-avis* *Scripsiella trochoidea*	*Acartia tonsa* *Oithona davisae*
	CW211_PoHa	KoRi6	*Scripsiella trochoidea* *Pseudosolenia calcar-avis*	*Acartia tonsa* *Oithona davisae*
	CW212_RiKo	RiAn7	*Pseudosolenia calcar-avis* *Scripsiella trochoidea*	*Acartia tonsa* *Oithona davisae*
		RiAn8	*Pseudosolenia calcar-avis* *Scripsiella trochoidea*	*Acartia tonsa* *Oithona davisae*
		RiAn9	*Pseudosolenia calcar-avis* *Scripsiella trochoidea* *Leptocylindrus danicus*	*Acartia tonsa* *Oithona davisae*
		RiAn10	*Pseudosolenia calcar-avis* *Scripsiella trochoidea*	*Acartia tonsa* *Oithona davisae*

Table 43: Invasive phyto- and mesozooplankton species discovered in coastal waters in May 2023

Surface water type	Water body	Station	Detected invasive species	
			Phytoplankton	Mesozooplankton
Coastal waters (Survey 2023)	CW212_KbRi	KoRi1	*Leptocylindrus danicus* *Pseudosolenia calcar-avis* *Gyrodinium sp.* *Scripsiella trochoidea*	*Oithona davisae*
		KoRi2	*Scripsiella trochoidea*	*Oithona davisae*
		KoRi4	*Pseudosolenia calcar-avis* *Scripsiella trochoidea*	
	CW211_PoHa	KoRi6	*Scripsiella trochoidea*	*Oithona davisae*
	CW212_RiKo	RiAn7	*Pseudosolenia calcar-avis* *Scripsiella trochoidea*	*Oithona davisae*
		RiAn8	*Pseudosolenia calcar-avis* *Scripsiella trochoidea*	*Oithona davisae*
		RiAn9	*Scripsiella trochoidea*	*Oithona davisae*
		RiAn10	*Scripsiella trochoidea*	*Oithona davisae*
		RiAn11	*Scripsiella trochoidea*	*

* *Sample not taken*

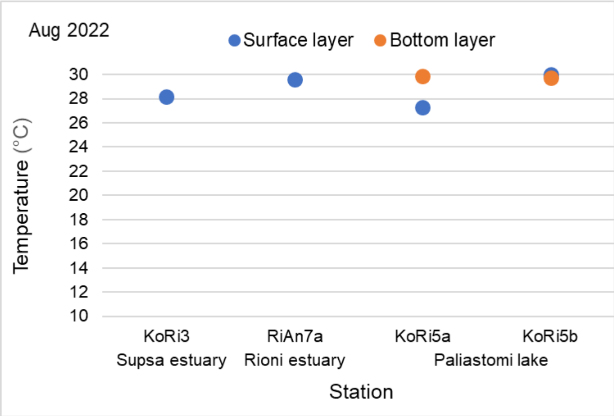
3.3.3. Transitional waters

3.3.2.1. Physico-chemical parameters

Physico-chemical parameters were measured during both surveys in the estuaries of Supsa and Rioni and in the transitional waters of Lake Paliastomi. In view of the shallow depths in the estuaries (up to 1 m), measurements and sampling were only possible from the surface layer, while in the somewhat deeper Lake Paliastoma (up to 2.5 m depth) measurements and sampling were also possible from the bottom layer.

The temperatures of the surface layer in the estuaries and at the stations of Lake Paliastomi ranged from 27.3 °C (KoRi5a, surface layer) to 30 °C (KoRi5b, surface and bottom layer) in August 2022. In May 2023, temperatures fell at all stations, with a low of 17.4 °C at station KoRi3a and a high of 18.8 °C at station KoRi5a in the surface layer (Figure 24). The temperatures measured in the estuaries and at Lake Paliastomi were higher than the temperatures measured in the surface layer of the coastal water stations in May 2023 and in the same range in August 2022 (Table 44).

The salinity levels in the estuaries of Supsa and Rioni and in Lake Paliastomi were in a range typical of transitional waters during both surveys, i.e. from 3.4, measured at station KoRi5b (in the surface and bottom layer) in August 2022, to 10.6, measured at station KoRi3b in the Supsa estuary in May 2023 (Figure 25).



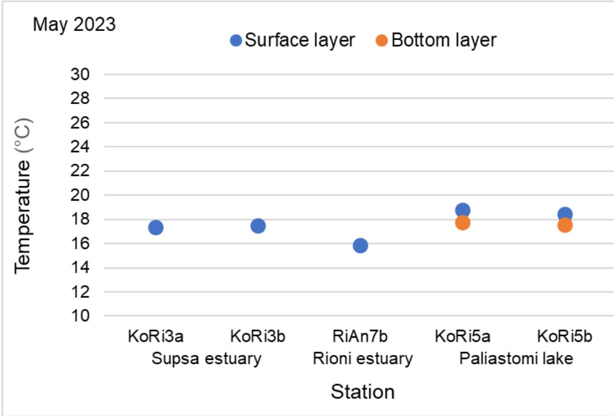
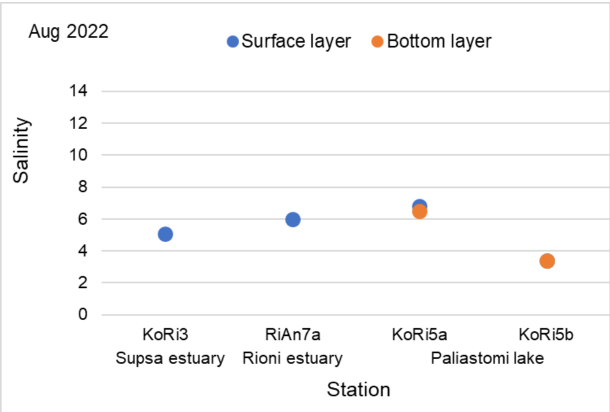


Figure 24: Temperature of the surface layer (0.5 m) at the stations in the estuaries of Supsa and Rioni and in the surface and bottom layer (2 m depth) in the transitional waters of Lake Paliastomi in August 2022 and May 2023.

Table 44: Minimum (MIN), average (AVG) and maximum (MAX) values for physico-chemical parameters in the surface layer of coastal waters in August 2022 and May 2023

Survey	August 2022			May 2023		
Parameter	**MIN**	**AVG**	**MAX**	**MIN**	**AVG**	**MAX**
Temperature (°C)	27,2	28,1	29,4	14,8	16,0	17,0
Salinity	14,8	17,0	18,6	11,52	13,67	15,14
Oxygen saturation (%)	96	104	110	98	108	116
Dissolved inorganic nitrogen (µmol dm^{-3})	0,73	1,98	5,07	0,55	0,89	2,17
Orthophosphate (µmol dm^{-3})	0,06	0,06	0,07	0,06	0,06	0,06



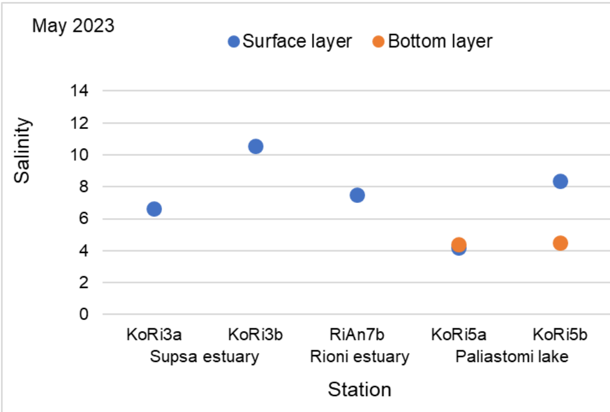


Figure 25: Salinity of the surface layer (0.5 m) at the stations in the estuaries of Supsa and Rioni and of the surface and bottom layer (2 m depth) in the transitional waters of Lake Paliastomi in August 2022 and May 2023.

Oxygen saturation at the stations in Lake Paliastomi ranged from 94 % (KoRi5b, surface layer) to 119 % (KoRi5a) in August 2022, while a lower saturation range was observed at the stations in the estuaries (100 to 106 %). According to these data, we can assume that Lake Paliastomi is a more productive area (in terms of organic matter production) than the areas in the estuaries. In May 2023, a relatively similar situation was observed with oxygen saturation values of 97 to 103 % at the stations in the estuaries and 91 to 114 % at the stations in Lake Palastomi (Figure 26).

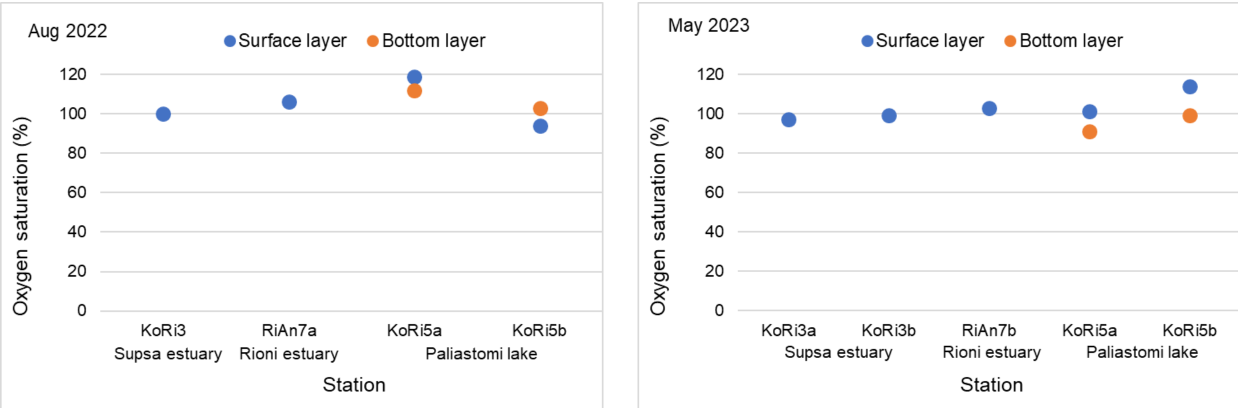


Figure 26: Saturation of the surface layer (0.5 m depth) with dissolved oxygen at the stations in in the Supsa and Rioni estuaries and of the surface and bottom layer (2 m depth) at the stations in the transitional waters of Lake Paliastomi i in August 2022 and May 2023.

The concentrations of dissolved inorganic nitrogen at the stations in Lake Paliastomi (0.63 to 3.02 µmol dm^{-3}) in August 2022 were lower than the concentrations found at the stations in the estuary (4.24 to 6.24 µmol dm^{-3}). These differences support the hypothesis of a higher primary production rate in Lake Palastomi. In May 2023, all concentrations were very low (< 1 µmol dm^{-3}, with one exception at station RiAn7b (Rioni estuary), where an elevated concentration of 6.63 µmol dm^{-3} was detected (Figure 27). The maximum concentrations detected during both surveys were higher than the maximum values at the coastal water stations (Table Y44).

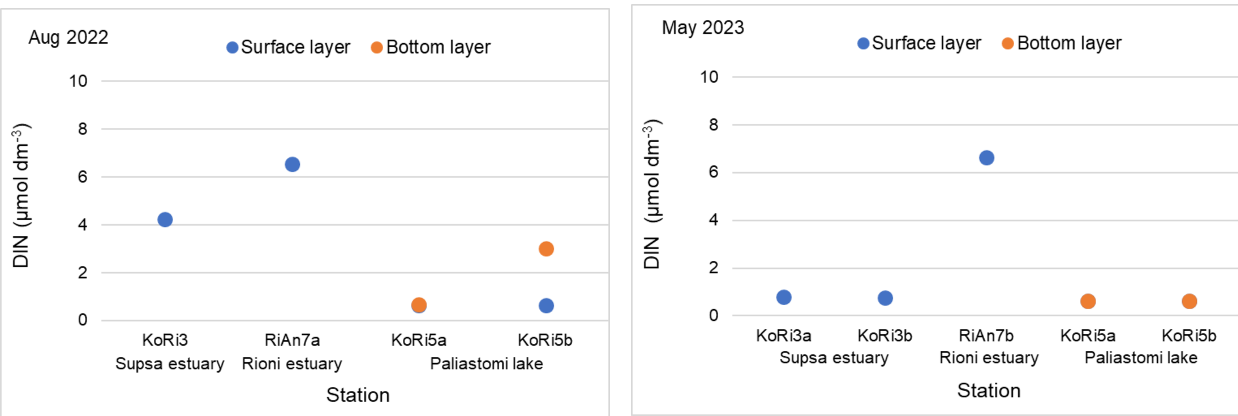


Figure 27: Concentrations of dissolved inorganic nitrogen in the surface layer (0.5 m depth) at the stations in the Supsa and Rioni estuaries and in the surface and bottom layer (2 m depth) at the stations in the transitional waters of Lake Paliastomi in August 2022 and May 2023.

The concentrations of orthophosphate were very low at all stations in August 2022 (0.07 – 0.06 µmol dm^{-3}) and were at the limit of quantification of the analytical method. In May 2023, similarly low concentrations were found at the stations in the Supsa estuary, while higher concentrations (0.11 to 0.12 µmol dm^{-3}) were found in Lake Paliastomi and an increased concentration (0.16 µmol dm^{-3}) at the station in the Rioni estuary (Figure 28). In August 2022, there were no differences to the orthophosphate concentrations in the surface layers of the coastal waters (Table 44), while in May 2023 the concentrations in Lake Pliastomi and the Rioni estuary were higher than in the coastal waters.

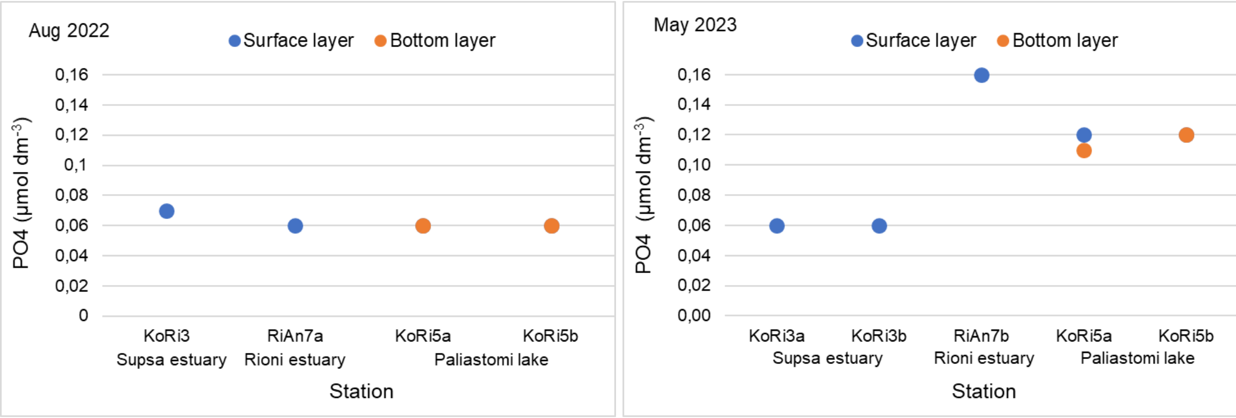


Figure 28: Concentrations of orthophosphates in the surface layer (0.5 m depth) at the stations in the Supsa and Rioni estuaries and in the surface and bottom layer (2 m depth) at the stations in the transitional waters of Lake Paliastomi i in August 2022 and May 2023.

3.3.2.2 Biological results

Phytoplankton

The abundance of phytoplankton at the stations in the estuaries of Supsa and Rioni and in Lake Paliastomi (Figure 29) ranged from 83681.7 cells/L (station KoRi5b, bottom layer) to 1199274.3 cells/L, detected at the same station in the surface layer in 2022, and from 36790.8 cells/L (RiAn7b, surface layer) to 1973647.2 cells/L recorded in the surface layer of station KoRi6a in Lake Paliastomi in 2023. If this maximum value is disregarded, the seasonal differences in abundance are not particularly pronounced. Among the stations, KoRi5a and KoRi5b stations stand out clearly from the stations in the Supsa and Rioni estuaries in terms of abundance, and if we compare the abundance of phytoplankton at these stations with the abundance of phytoplankton in the surface layer of coastal waters (Table 45), we can say that there are no significant differences between these two types of surface waters in both estuaries.

Table 45: Minimum (MIN), average (AVG) and maximum (MAX) phytoplankton biomass in the surface layer of coastal waters in August 2022 and May 2023

Survey	August 2022			May 2023		
Parameter	MIN	AVG	MAX	MIN	AVG	MAX
Phytoplankton abundance (cell/L)	8817.5	66240.6	292903.2	65787.5	180179.6	455737.5
Phytoplankton biomass (mg/m^3)	31.78	151.80	269.05	200.33	561.40	1238.72

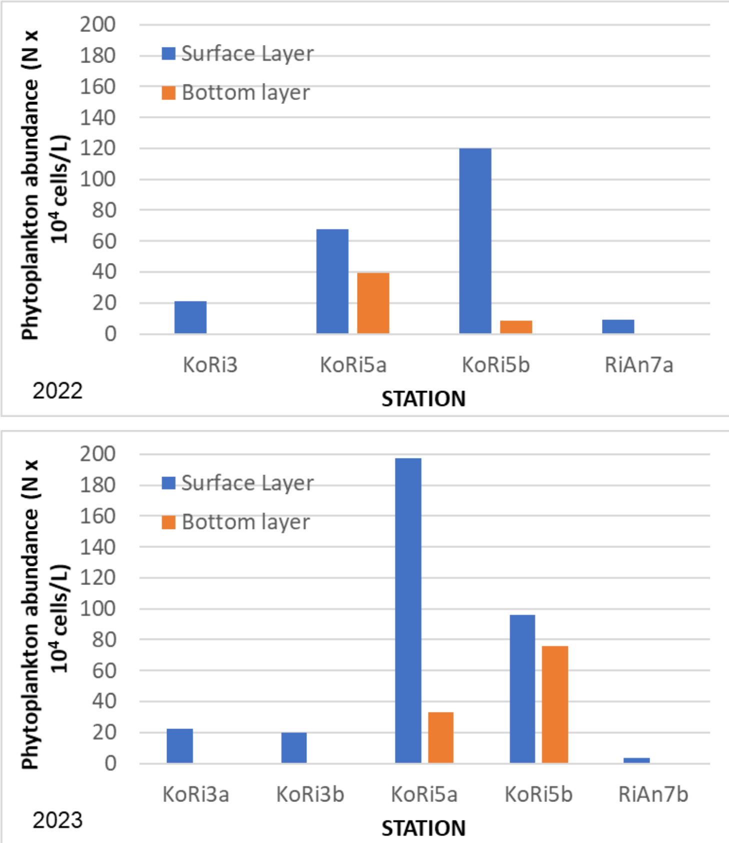
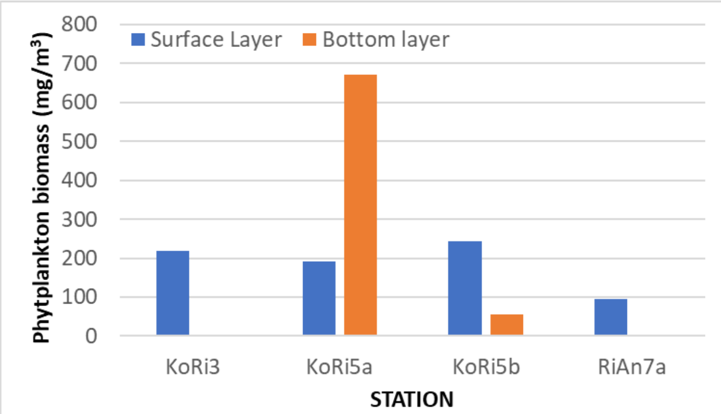


Figure 29: Phytoplankton abundance in the surface layers of the stations in the Supsa (KoRi3, KoRi3a and KoRi3b) and Rioni estuaries (RiAn7a and RiAn7b) and in the surface and bottom layers of the stations in the transitional waters of Lake Paliastomi (KoRi5a and KoRi5b) in August 2022 and May 2023.

The phytoplankton biomass in August 2022 ranged from 54.22 mg/m^3 (station KoRi5b, bottom layer) to 670.68 mg/m^3 (station KoRi5a, bottom layer) and from 82.48 mg/m^3 (station RiAn7b, surface layer) to 1434 mg/m^3 (station KoRi3a, surface layer) (Figure 30). With regard to the value ranges determined for phytoplankton biomass in the coastal waters (Table 45), it can be concluded that the biomasses in the estuaries and Lake Paliostomi are higher in August 2022 compared to the coastal waters, while no significant differences were found in May 2023.



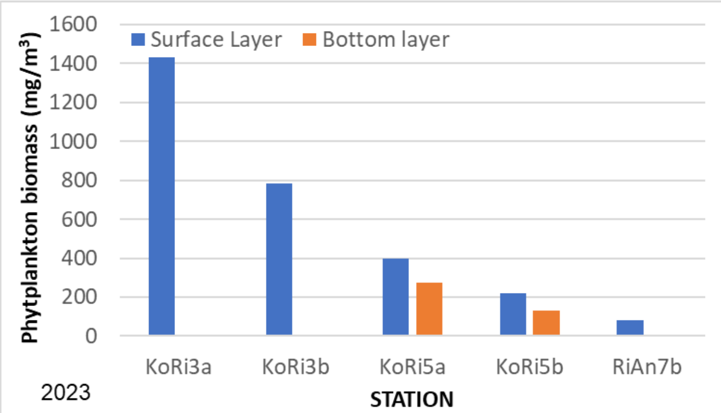
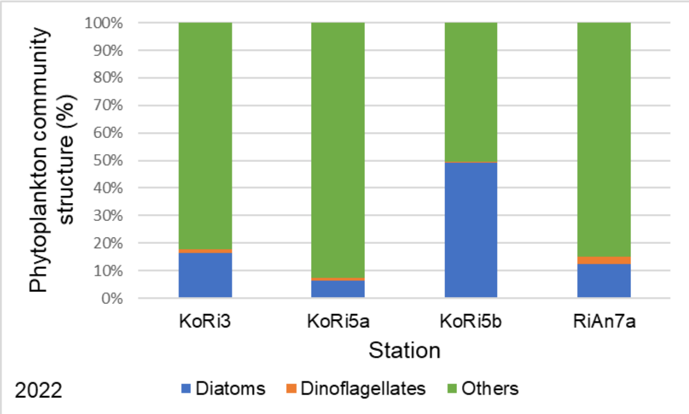


Figure 30: Phytoplankton biomass in the surface layers of the stations in the Supsa (KoRi3, KoRi3a and KoRi3b) and Rioni estuaries (RiAn7a and RiAn7b) as well as in the surface and bottom layers of the stations in the transitional waters of Lake Paliastomi (KoRi5a and KoRi5b) in August 2022 and May 2023.

In August 2022, at the stations of Lake Paliastomi (KoRi5a and KoRi5b), the highest number of phytoplankton species was recorded for the diatom group, while in the estuaries of Supsa (KoRi3) and the Rioni River (KoRi7), the Chlorophyta group predominated (Figure 31). In May 2023, the structure of the phytoplankton community group was relatively balanced between diatoms, dinoflagellates and other species present.



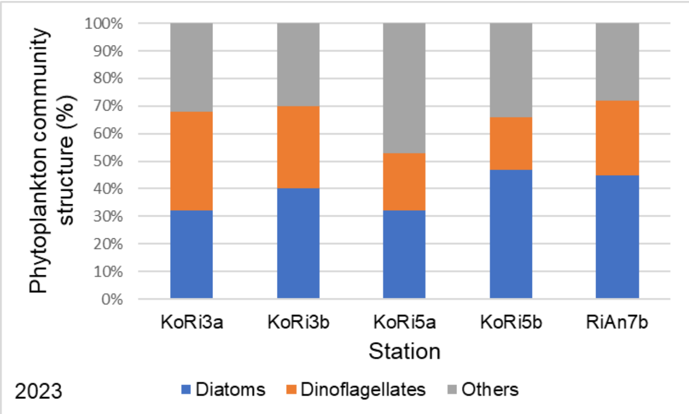


Figure 31: Structure of the phytoplankton community in the surface layers of the stations in the Supsa (KoRi3, KoRi3a and KoRi3b) and Rioni estuaries (RiAn7a and RiAn7b) as well as in the surface and bottom layers of the stations in the transitional waters of Lake Paliastomi (KoRi5a and KoRi5b) in August 2022 and May 2023.

Macrozoobenthos

The macrozoobenthos community was according to WFD proposals on the sampling frequency (every 6 years) (WFD; 2000) investigated only in 2022. At stations KoRi3, KoRi5a and KoRi5b, a total of 7 taxa of benthic invertebrates were found, most of which are characteristic of freshwater ecosystems (*Insecta, Clitellata, Acari*) and/or transitional waters with low salinity. Only one taxa (family *Chironomidae*) was found at all three stations, while the other taxa were characteristic of individual stations. Of the total of seven taxa, only two species could be identified, namely the amphipod crab *Chaetogammarus olivii* and the mullet *Streblospio shrubsolii*.

The number of macrozoobenthic species found in the substrate samples in the Supsa estuary (station KoRi3) and in the transitional water body of Lake Paliastomi (stations KoRi5a and KoRi5b) was significantly lower compared to the samples from the coastal waters (Figure 32). Despite the low number of species, the data were processed using the AZTI PC programme for AMBI and M-AMBI calculation, but the results were not meaningful and it was concluded that the AMBI and M-AMBI indices are not suitable for the assessment of macrozoobenthos status in Georgian transitional waters.

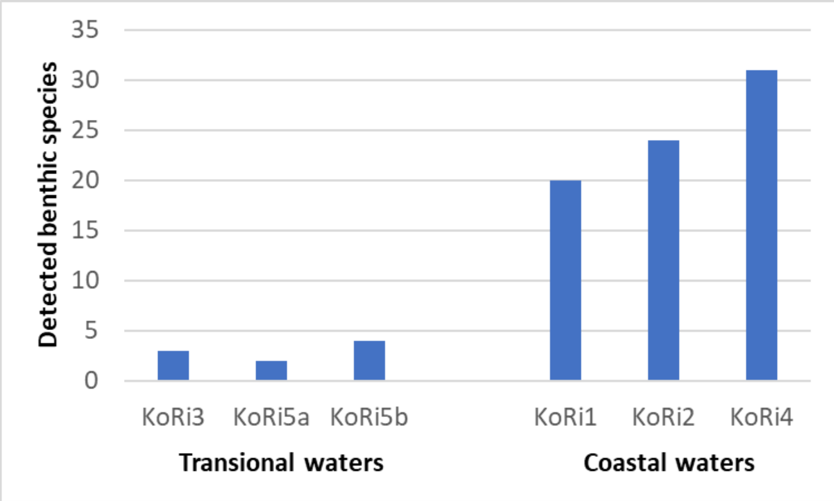


Figure 32: Number of macrozoobenthic species detected in transitional and coastal waters in August 2022.

3.3.2.3. Invasive species

The invasive phytoplankton species detected in the samples from the estuarine and transitional water stations are listed in Table 46.

Table 46: Invasive phytoplankton species detected in transitional waters in August 2022 and May 2023

Surface water type	Location (Water body)	Station	Detected invasive phytoplankton species	
			2022	2023
Transitional waters	Supsa estuary	KoRi3	*Gymnodinium fuscum* *Pseudosolenia calcar-avis* *Scripsiella trochoidea*	*
		KoRi3a	*	*Scripsiella trochoidea*
		KoRi3b	*	*Scripsiella trochoidea*
	Paliastomi lake (TW12_Pl)	KoRi5a	*Scripsiella trochoidea* *Gyrodinium sp.*	*Scripsiella trochoidea*
		KoRi5b	*	*Scripsiella trochoidea*
	Rioni estuary	RiAn7a	*Scripsiella trochoidea*	*
		RiAn7b	*	*Scripsiella trochoidea*

** Station not monitored*

4. DISCUSSION OF RESULTS

4.1. Delineation

The proposed delineation of coastal and transitional waters in Georgia cannot be considered definitive, but must be reconciled with the results of the new monitoring cycles for coastal and transitional waters.

4.2. Monitoring results

4.2.1. Status of the supporting physico-chemical quality elements in the coastal water bodies from Kobuleti to Anaklia for the period from August 2022 to May 2023

The status of the supporting physico-chemical parameters in the coastal water bodies from Kobuleti to Anaklia can be assessed on the basis of the results of the monitoring at the investigated stations (Chapter 3.3.1.1. to 3.3.1.4.). The assessment is based on the threshold values listed in Table 19 and the calculated average values for the results of the years 2022 and 2023 at the stations within the water bodies. The results of station RiAn11 (coastal water body CW_112_RiAn-C) were not included in the assessment of the water body due to the single measurement and sampling.

Temperature

Based on the average surface temperatures in the water bodies CW211_PoHa, CW212_KoRi and CW212_RiAn (Figure 33), the status of the water bodies CW211_PoHa and CW212_RiAn can be assessed as good, while the condition of the water body CW212_KoRi is high. The lower status, determined in August 2022 or May 2023, was used for the assessment.

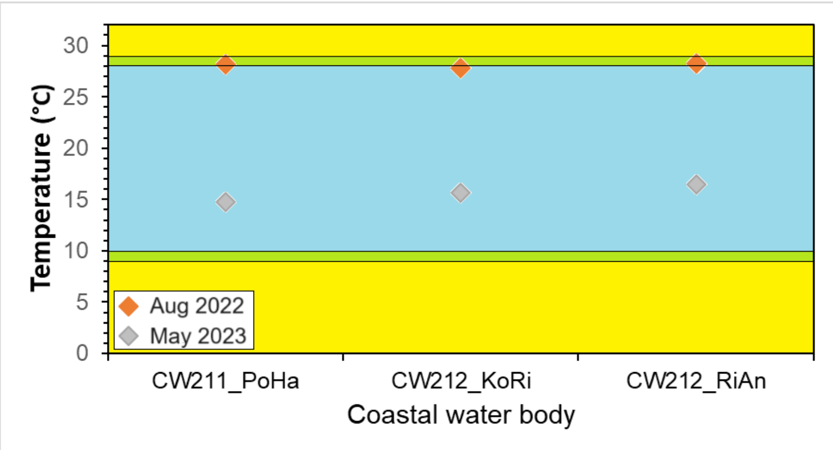


Figure 33: Average surface temperatures in monitored coastal water bodies for two surveys conducted in August 2022 and May 2023 with indicated threshold values.

Salinity

The average surface salinity determined in certain coastal water bodies (Figure 34) shows a good status in water body CW211_PoHa, a high status in water body CW212_KoRi and a moderate status in water body CW212_RiAn. As with the temperature, the lower status determined in August 2022 or May 2023 was used for the assessment.

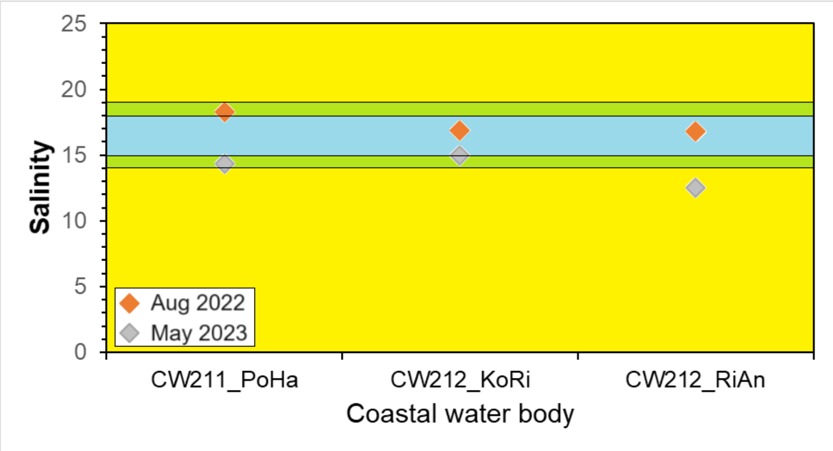


Figure 34: Average surface salinities in monitored coastal water bodies for two surveys conducted in August 2022 and May 2023 with indicated threshold values.

Transparency

The average transparency values indicate a moderate status in the water body CW211_PoHa and a good status in the water bodies CW212_KoRi and CW212_RiAn (Figure 35).

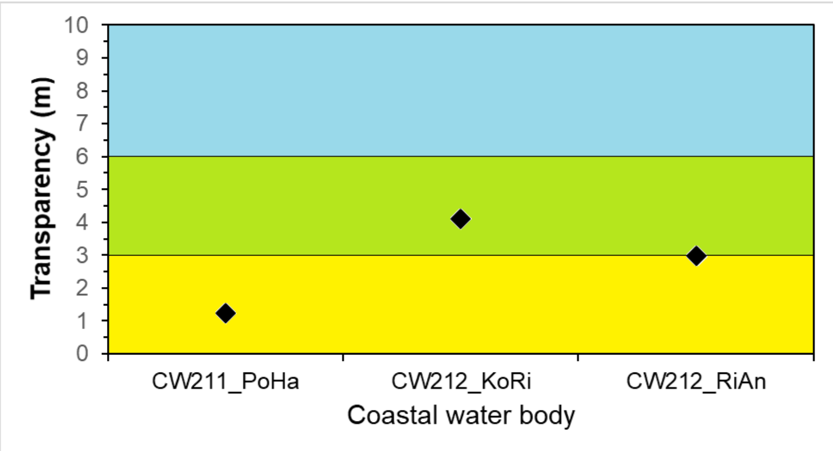


Figure 35: Average transparencies in monitored coastal water bodies for two surveys conducted in August 2022 and May 2023 with indicated threshold values.

Oxygen saturation

The average oxygen saturation values in the water bodies investigated are all in the high status range (Figure 36).

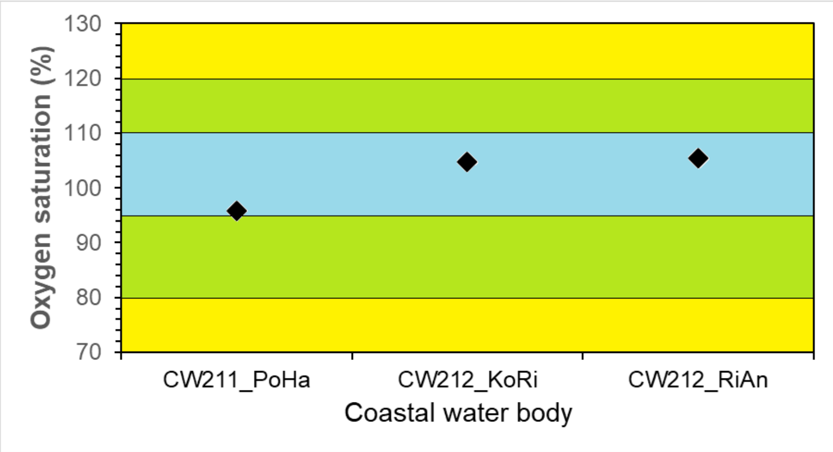


Figure 36: Average oxygen saturation values in the upper layer (0.5 to 10 m depth) in monitored coastal water bodies for two surveys conducted in August 2022 and May 2023 with indicated threshold values.

Nutrients

According to the average concentrations of dissolved inorganic nitrogen and orthophosphate (Figure 37), a high status was determined for both nutrients at station CW212_RiAn, while a good (DIN) to high (PO4) status was determined in the coastal water body CW211_PoHa. The water body CW212_KoRi can be characterized with a high (DIN) and moderate (PO4) status.

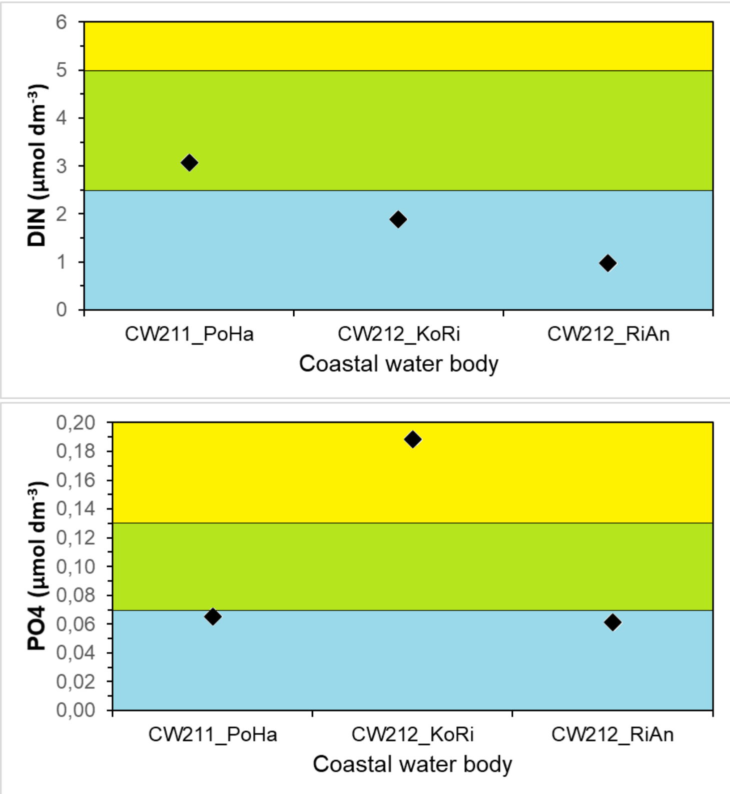


Figure 37: Average dissolved inorganic nitrogen and orthophosphate concentrations in the upper layer (0.5 to 10 m depth) in monitored coastal water bodies for two surveys conducted in August 2022 and May 2023 with indicated threshold values.

These results are also present in the table 47.

Table 47: Results of the status assessment of temperature, salinity, transparency, oxgen saturation and nutrients in the coastal water bodies from Kobuleti to Anaklia for two surveys conducted in August 2022 and May 2023 (high = blue, good = green, moderate = yellow)

Coastal water body	CW211_PoHa	CW212_KoRi	CW212_RiKo
Temperature			
Salinity			
Transparency			
Oxygen saturation			
Dissolved inorganic nitrogen			
Orthophosphate			

The overall assessment of the status of the coastal water bodies for the physico-chemical quality elements is shown in Table 48 according to the “weakest link principle”. The status of the salinity parameter was not used for this assessment (see Chapter 3.3.1).

Table 48 Results of the summary status assessment of physico-chemical quality elements in the coastal water bodies from Kobuleti to Anaklia for two surveys conducted in August 2022 and May 2023 (high = blue, good = green, moderate = yellow)

Coastal water body	CW211_PoHa	CW212_KoRi	CW212_RiKo
Physico-chemical quality elements			

When evaluating these results, it should be noted that the measurements and sampling in these water bodies were only carried out twice, in autumn 2022 and spring 2023. Considering that all these parameters are subject to strong seasonal fluctuations, seasonal monitoring would provide a better insight into the condition of the water bodies.

4.2.2. Status of the biological quality elements phytoplankton and macrozoobenthos in the coastal water bodies from Kobuleti to Anaklia for the period from August 2022 to May 2023

Phytoplankton

The average phytoplankton abundances and biomasses in the coastal water bodies from Kobuleti to Anaklia are shown in Figure 38. The threshold values for these parameters are given in the figure, but also in Table 20. The coastal water body CW112_RiAn-C is not included in the figures due to the single measurement and sampling in 2023.

According to obtained data, the status of the phytoplankton in all three water bodies can be classified as high.

It is important to point out that the values for abundance and biomass of phytoplankton are at the very bottom of the scale. Such low abundance and biomass in Georgian coastal areas compared to the values measured on the Ukrainian coast was also observed during the EMBLAS cruise in 2017 (EMBLAS, 2017). The threshold values used for the assessment of phytoplankton status (Table 20) were taken from the

"State of Environment Report of the Western Black Sea based on Joint MISIS cruise" (MISIS, 2012); these values were also used in the EMBLAS project (EMBAS, 2017).

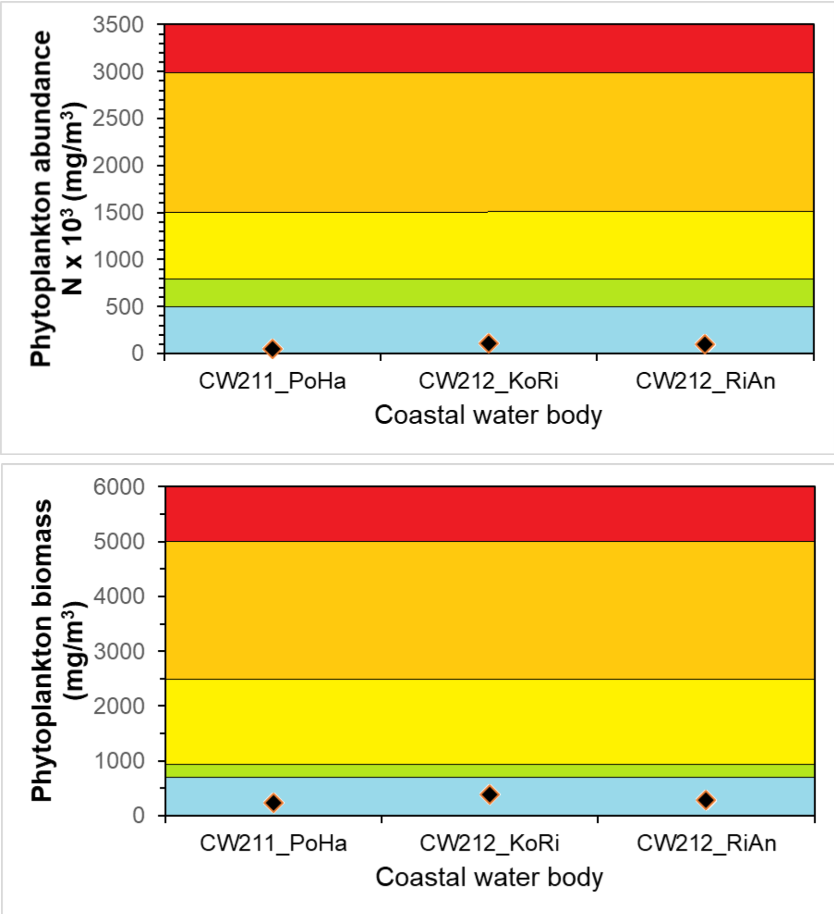


Figure 38: Average phytoplankton abundance and biomass in monitored coastal water bodies for two surveys conducted in August 2022 and May 2023 with indicated threshold values.

Macrozoobenthos

The status of the macrozoobenthos according to the ecological quality ratios (Figure 39) can be described as poor for the coastal water body CW211_PoHa, high for the water body CW21_KoRi and good for the water body CW212_RiAn.

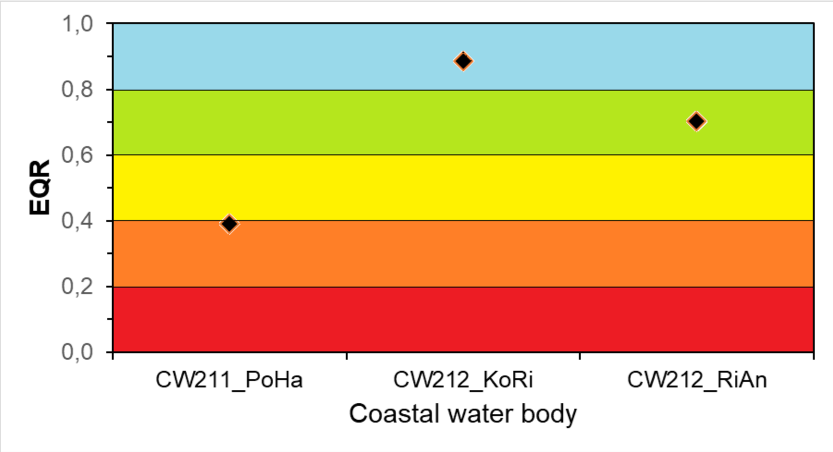


Figure 39: Calculated ecological quality ratios for the BQE Macrozoobenthos in the coastal water bodies from Kobuleti to Anaklia with indicated threshold values.

The status determined for both biological quality elements is shown in Table 49, while the overall status of the BQEs examined (according to the "weakest link principle") is shown in Table 50.

Table 49: Results of the status assessment for the biological quality elements Phytoplankton and Macrozoobenthos in the coastal water bodies from Kobuleti to Anaklia for two surveys conducted in August 2022 and May 2023 (high = blue, good = green, moderate = yellow, poor = orange and red = bad)

Coastal water body	CW211_PoHa	CW212_KoRi	CW212_RiKo
Phytoplankton			
Macrozoobenthos			

Table 50: Summary status assessment for the biological quality elements in the coastal water bodies from Kobuleti to Anaklia for two surveys conducted in August 2022 and May 2023 (high = blue, good = green, moderate = yellow, poor = orange and red = bad)

Coastal water body	CW211_PoHa	CW212_KoRi	CW212_RiKo
Biological quality elements			

<u>Ecological status</u>

The ecological status of coastal water bodies with regard to individual physico-chemical parameters and biological quality elements is summarized in Table 51 according to the WFD classification scheme for ecological status assessment (Figure 40).

Table 51: Assessment of the Ecological status of coastal water bodies from Kobuleti to Anaklia from August 2022 to May 2023

Coastal water body	CW211_PoHa	CW212_KoRi	CW212_RiKo
Status of physico-chemical quality elements			
Status of biological quality elements			
Ecological status			

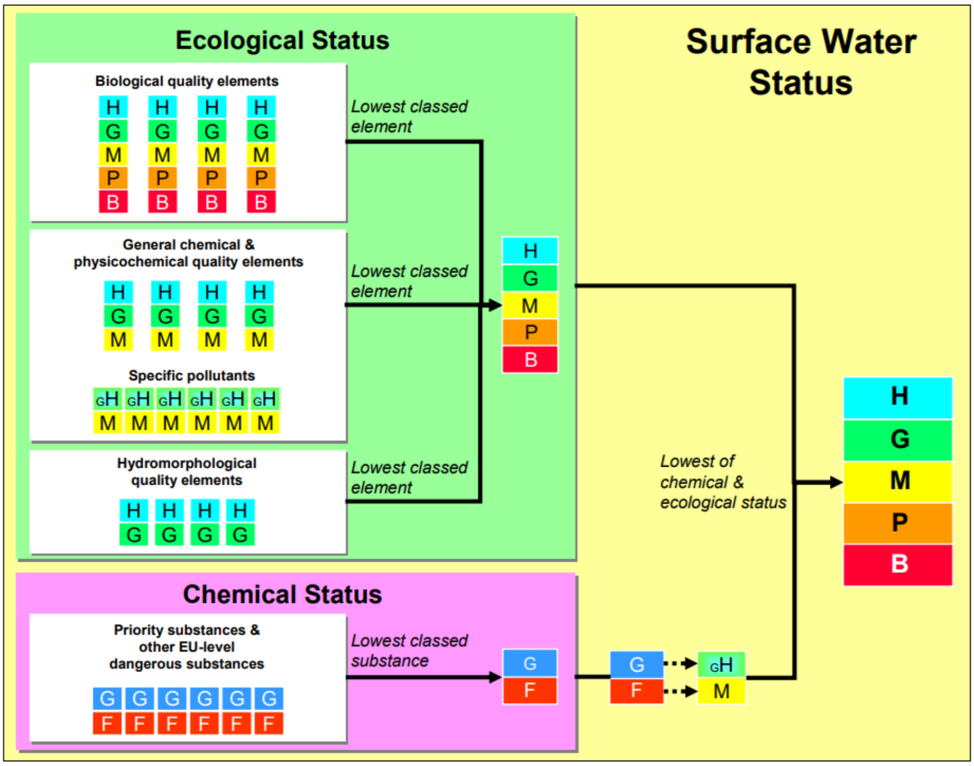


Figure 40: The Water Framework Directive classification scheme of the ecological, chemical and surface water status (H = High; G = Good; M = Moderate, P = Poor, B = Bad, GH = Good or better and is normally treated as High for calculating surface water status, F = failing to achieve good surface water chemical status).

When evaluating these results, it should again be noted that the measurements and sampling in these water bodies were only carried out twice, in autumn 2022 and spring 2023. In view of the fact that the biological quality element Phytoplankton is subject to strong seasonal fluctuations similar to the physico-chemical parameters, seasonal monitoring would provide a better insight into the status of the water bodies. It should also be noted that this assessment of ecological status does not include the status of specific pollutants and the status of hydromorphological quality elements.

The lack of data on specific pollutants and hydromorphological status is due to the fact that Georgia has not yet identified national specific pollutants, i.e. pollutants of concern for Georgian surface waters, which are not included in the list of priority substances or identified as priority hazardous substances (EC,

2013) and that a classification system for assessing the hydromorphological status of coastal and transitional waters in Georgia was recently proposed as part of the EU4 EnvWD programme (Eu4EnvWD, 2024).

4.2.3. Assessment of the trophic status of the coastal water bodies from Kobuleti to Anaklia based on the biomass of mesozooplankton

According to the average mesozooplankton biomass for August 2022 and May 2023 the trophic status of the investigated water bodies (Figure 41) can be described as Oligo-mesotrophic for the water bodies CW212_KoRi and CW212_RiAn and as eutrophic for the water body CW211_PoHa.

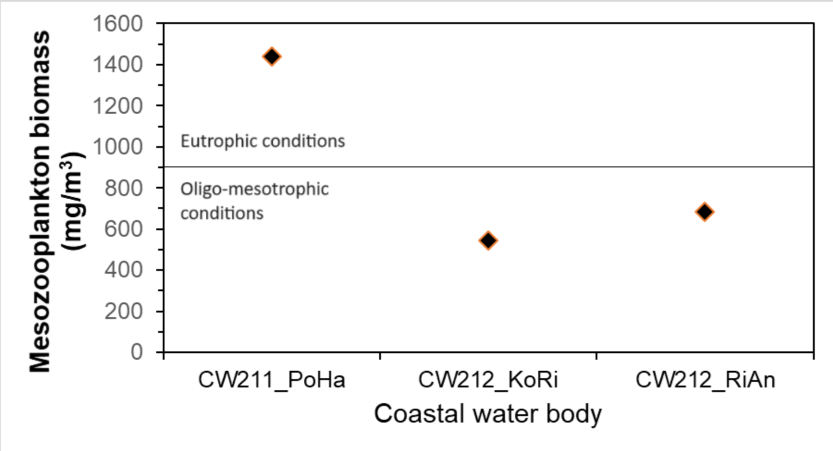


Figure 41: Average mesozooplankton biomass in monitored coastal water bodies for two surveys conducted in August 2022 and May 2023 with indicated threshold value.

4.2.4. Monitoring results from the stations in the estuaries of the Supsa and Rioni rivers and in the transitional waters of Lake Paliastomi

The investigation of physico-chemical and biological parameters in Georgian estuaries was started in 2019 as part of the EUWI+ project in the estuaries of the Chorokhi, Kintrishi and Supsa rivers (EUWI+ Report, 2021). Based on the results of the investigations, threshold values for physico-chemical parameters in transitional waters were even defined.

These investigations were continued as part of the EU4EnvWD programme in the estuaries of the Supsa, Rioni and Enguri rivers and in Lake Paliastomi to collect further data on the status of physico-chemical and biological parameters under conditions of reduced salinity.

After evaluating all the results, including those of the EUWI+ project, it was found that in none of the estuaries of the above-mentioned rivers is the area of reduced salinity (S = 0.5 to 10) large enough to be considered as a transitional water body. Although there is no minimum limited area for the designation of a transitional water body under the WFD (EC, 2000), the areas of transitional waters even in large rivers such as Chorokhi and Rioni were so small that they would not justify the establishment of a transitional water body, and only the area of Lake Paliastomi was nominated as a transitional water body in Georgia (this report, Chapter 1).

According to the results of research carried out in the estuaries of the rivers Supsa and Rioni and in Lake Paliatomi in August 2022 and May 2023, we can conclude that significant differences in the state of physico-chemical parameters in these areas compared to coastal waters (except for salinity) have not been established.

Slightly higher deviations of oxygen saturation from equilibrium (100 %) observed in Lake Paliastomi indicate that primary production of organic matter in the lake is probably higher compared to estuarine or coastal areas. Occasionally observed elevated concentrations of dissolved inorganic nitrogen at estuarine stations can be considered a common phenomenon in areas with lower salinity, as dissolved inorganic nitrogen concentrations are significantly higher in rivers compared to coastal waters.

At certain stations in the estuaries and in Lake Paliastomi, elevated concentrations of orthophosphate have occasionally been detected, but these are not of natural origin but indicate an occasional anthropogenic influence.

Of the biological quality elements, the BQE Phytoplankton was examined at all these stations in both surveys, while the BQE Macrozoobenthos was examined in August 2022 at stations KoRi3 (Supsa estuary) and KoRi5a and KoRi5b in the transitional waters of Lake Paliastomi.

It was found that the abundance of phytoplankton in the surface layer of Lake Paliastomi was six (August 2022) to nine (May 2023) times higher than in the surface layers of the stations in the estuary. In contrast to abundance, no significant differences were found in phytoplankton biomass in the surface layers of the estuary and Lake Paliastomi stations in August 2022, while in May 2023 the biomass at the estuary stations KoRi3a and KoRi3b was significantly higher than at the stations in Lake Paliastomi.

The results for the analysis of the macrozoobenthos community showed that at the investigated stations only a total of 7 taxa of benthic invertebrates were found, most of which are characteristic of freshwater ecosystems. Due to the low taxa number the calculation of the AMBI and M-AMBI indices were not possible.

As there is currently little data available on the physico-chemical and biological characteristics of Lake Paliastomi, it was not possible to develop threshold values for any WFD quality element for the transitional water body TW12_Pl and no status assessment could be carried out.

5. CONCLUSIONS

Two monitoring surveys were carried out in the Georgian coastal zone from Kobulti to Anaklia in August 2022 and May 2023. During the surveys, measurements and sampling were carried out at 9 coastal water stations, 2 transitional water stations and at 5 stations in the estuaries of the Supsa and Rioni rivers.

The physico-chemical quality elements temperature, salinity, transparency, oxygen and nutrient conditions and the biological quality elements phytoplankton and macrozoobenthos were investigated at the coastal and transitional water stations. At the coastal water stations, mesozooplankton was also examined as an indicator of trophic status. At the estuarine stations, only temperature, salinity, dissolved oxygen, nutrients and phytoplankton were analysed.

In addition to these parameters, sediment samples were taken from 21 stations to determine the substrate composition of the investigated water bodies.

Based on the results obtained for the salinity and substrate distribution in the coastal zone from Kobuleti to Anaklia, an improved delineation proposal was formulated for all coastal and transitional waters occurring in Georgia.

Special attention was paid before and after the surveys to the planning of the surveys, the selection of the stations, the survey protocols, the sample storage and the analysis and ecological status assessment. It can be concluded that the staff of the Department of Fisheries, Aquaculture and Biodiversity of Waters and the Laboratory of Air, Water and Soil Analysis in Batumi, NEA, is capable of independently planning and conducting surveillance monitoring of transitional and coastal waters in Georgia in the future.

The results of the assessment of the ecological status of the investigated coastal water bodies indicate a poor status of the water body CW211_PoHA (located in the port of Poti and nominated as a candidate for the status of heavily modified water body), a moderate status of the water body CW212_KoRi (located from Kobuleti to the Rioni river) and a good status of the water body tCW212_RiAn (located from the Rioni river to Anaklia).

As the investigations in the transitional waters of Lake Paliastomi in 2022 and 2023 are the first investigations of this kind in this special ecosystem, the ecological status could not be assessed for the time being.

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7. Annexes

Annex 1: CTW Delineation shape files

Annex 2: CTW Survey & Analysis data (in Excel format)

Annex 3: CTW Survey_Photo documentation

Annex 4: CTW Survey_Metadata

Annexes are available as separate files and documents

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