Black Sea Biodiversity

Situation Analysis

Tbilisi, 2012

Supported by German Agency for International Cooperation (GIZ)

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We would like to express our gratitude for the assistance to

Mr. Irakli Chavchanidze – Head of the Convention Inspection for Protection of Black Sea

Mr. Mamuka Modebadze – Head of the Marine Technology Service of Ilia State University

Mr. Avtandil Tskhvediani – Administrator of Grigoleti Marine Center of Ilia State University

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Summary

The Black Sea is an internal European sea most isolated from the world ocean. It is the largest meromictic water area in which water is permanently stratified. The upper layer of the water takes oxygen from the atmosphere, whereas below 130–150 meters water is rich in hydrogen sulfide. As a result of this, about 87–90% of the water is anoxic. The catchment area of the Black Sea basin comprises 2 million square kilometers, which is five times more than the area of the sea itself. Hence, the rivers bring a large volume of substances into the Black Sea.

The Black Sea is comparatively poor in species. This is due to the lack of vital space and the contrast of its temperature and salinity to the adjacent water areas. Development in difficult and comparatively isolated environment has caused specific adaptations in Black Sea species, which differentiates them from their related species and the same species of other populations.

The Black Sea is considered one of the most polluted seas in the world. Therefore, protection of the Black Sea is a concern of numerous states and it largely depends on international cooperation. The key international political tools aimed at the protection of the Black Sea ecosystems are the Convention on the Protection of the BLack Sea Against Pollution (Bucharest Convention, ratified in 1994) and the Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (1996, updated in 2009). Georgia is part of both documents. The implementation of the Action Plan differed by countries. The transboundary diagnostic analysis of the Black Sea, carried out 2007, has proved that the Action Plan has not been implemented, or implemented to a small extent on the territories of Bulgaria, Ukraine and Georgia.

Georgian territory embraces a 320 km stretch of the Black Sea coast in the South-Eastern and Eastern parts of the sea, between the mouths of the rivers Sarpi and Psou. About 150 rivers flow into the Black Sea from Georgian territory (including minor rivers). Among these, the most full-flowing is the Rioni, which yields 406 m^3/s of water and the average of 4.7 million tons of solid substances annually.

The population of Georgian Black Sea coast and its adjacent territories is about 450000. Until the crisis of the 1990s Georgian coast of the Black Sea was an industrial-agricultural

region with well-developed fields of industry (mechanical engineering, thermal power and chemical industry, electrical energy etc.). In 1988–2002 the production of industrial goods and the number of employed people decreased radically, the index of emigration increased. The year 2004 marked the start of the process of rehabilitation of the economy and integration in the nation-wide and international economy. One of the most prospective fields of economy on the Georgian coast of the Black Sea is tourism. Sharp growth of tourism investments and the number of tourists is planned for the nearest future.

The Georgian part of the Black Sea coast includes the following natural habitats: 1) sandy shore with a thin layer of sea water; 2) Delta (estuary); 3) Coastal lagoon; 4) shallow water and bay; 5) Sea rocks and stony coast *(according to EU Directive 92/43/EEC).* However, in accordance with the documents aimed at the protection of the Black Sea, habitats (shelf, continental slope and sea caves) should be described based on the needs of endangered species (e.g. a significant habitat for *Mytilus galloprovincialis*, a habitat dominated by *Cystoseria* etc./ BSERP/TDA).

One of the important components of the Black Sea ecosystems is plankton. Its diversity, biomass and its change reflect the state of the sea. Therefore, plankton is an important tool for long-term monitoring.

The assessment of species of phytoplankton on the entire Georgian coast was implemented in 1980–90. In all, 116 species have been described, biomass and its seasonal change have been evaluated, dominant species have been singled out. The phytoplankton is dominated by diatomic algae.

Since 1980 the zooplankton of the Black Sea has undergone the decrease of the biomass and change in the structure. This was predominantly due to the invasion of comb jelly - *Mnemiopsis leidyi.* No study has been implemented recently with regard to the structure of zooplankton and zoobenthos in the Georgian water area. The existing data reveal 128 zoobenthic species, out of which there are 60 species of *Polychaeta,* 42 species of *Mollusca* and 19 species of *Crustacea.*

According to the data of 2002, 171 fish species are found in the Black Sea, out of which especially endangered are Acipenser species. According to the Red List of the International Union for Conservation of Nature (IUCN Red List), the critically endangered species are: *Acipenser gueldenstaedtii*, *Acipenser stellatus, Acipenser sturio, Acipenser*

nudiventris, Huso huso and *Acipenser persicus*. A vulnerable species on the Red List of IUCN is *Acipenser ruthenus*. The international Red List also mentions the decreasing tendency of an important benthos specie - *Platichthys flesus* (European flounder). The Red List of the Black Sea also makes mention of *Belone belone euxini* and *Mullus barbatus* as endangered species.

The inventory of the species of ichthyofauna should be compiled with regard to the entire Georgian coastline, the number of key species and their seasonal distribution should be defined based on modern methodology in harmony with the methodology of the Black Sea countries. Of special importance is the monitoring of commercial species and the creation of a database of results in order to reveal the species population tendencies.

The Eastern coast of the Black Sea, Kolkheti Valley and the fore part of the Meskheti Chain are an important area for migrating birds. This territory is a migration area of tens of thousands of water birds, 900000 predators of 34 species and 16000 passerine birds of 84 species. Georgian coast is a significant migration area for the birds of the Western part of the Palearctic region and is the third in size worldwide.

As for mammals, there are three dolphin species in Georgian water area (*Tursiops truncatus ponticus, Delphinus delphis ponticus, Phocoena phocoena relicta*). According to the assessment implemented in 2009-2011, the largest in number is common dolphin (about 6000 individuals), followed by harbor porpoise (about 4000), whereas bottle-nosed dolphins are the least in number (about 60 individuals). Research should be implemented on the Georgian territory in order to find out the reasons for the dolphin stranding. The system of monitoring of species should be created, genetic research of the population should be carried out in order to reveal site-specificity of various groups of different species.

The key threats affecting the Black Sea ecosystems are: eutrophication, chemical pollution, overfishing and invasive species. The main reason of eutrophication at Georgian Black Sea Coast, as well as on the entire Black Sea, is pollution by rivers and domestic sewage. In the years 2006-2011, according to official data, domestic faecal waste was the main source of pollution from ships in Georgian territorial waters, added by uncontrolled domestic waste from the shore.

In the same period there were 27 cases of pollution by oil products (the so-called minor pollution). In December 2011 pyrolysis tar was spilt near Poti port.

The research implemented in the 1990s revealed the pollution of Georgian territorial waters by mercury Hg, iron Fe, copper Cu, arsenic As and 25 types of pesticides. Cobalt Co, lead Pb, nickel Ni, copper Cu, zinc Zn and bismuth Bi were found in fish tissues.

In 2010, the test of water samples on the content of heavy metals proved that the content of Zn varies from 0.005 to 0.016 mg/l, the content of Cd is ess than 0.001 mg/l, that of Hg is less than 0.0001 mg/l, that of Pb is less than 0.015 mg/l. These indexes do not exceed the possible limit. However, in order to identify pollution by heavy metals, it is necessary to analyze sediments and hydrocole tissues. It is important to elaborate a monitoring program with regard to the chemical pollution of Georgian territorial waters. For this purpose, a list of pollutants should be compiled and used for the assessment of the state of water. The list and pollution standards should be agreed with the Black Sea countries and international norms in order to obtain a complete picture of the state of the Black Sea.

The potential sources of pollution are Kulevi and Supsa oil terminals. Kulevi terminal is located at the estuary of the Khobistskjali river. Supsa terminal, the final point of Baku-Supsa pipeline, is located on the right bank of the Supsa river. It consists of 4 reservoirs, each with the capacity of 40 000 tons of oil.

The above-mentioned terminals are located near the territories that are important dolphin feedeng area and also actively used by migrating birds. In case of spilling, the damage to biodiversity will be irrevocable. Therefore it is necessary to monitor the impact of Kulevi and Supsa terminals on biodiversity and to ensure the transparency of the results of monitoring.

As for overfishing, in the period of 2006 – 2012, fishing was most excessive in 2009-2010 - approximately 40000 tons. The most affected specie is anchovy. It is likely that overfishing is the reason for the decrease of anchovy population at the Georgian coast. Although there is no permanent monitoring of the populations of commercial fish species in the territorial waters of Georgia, the amount of fish caught by the same companies is a proof of the decrease in the number of fish. A specie caught in large amount the previous year, is less next year. This also affects the fishers, especially the licensed fishers who

pay large fees but are unable to meet the quotas. Decrease in the of anchovy, herring, shi drum and other species catches has led to significant increase in the prices and affected the consumers. Therefore, protection of fish species is important not only from the viewpoint of retaining the biodiversity, but also for the development of fishing. In order to improve the situation, it is necessary to establish quotas based on modern scientific research methods, and to implement a systematic monitoring of the commercial fish populations.

Pressure on commercial and occasionally caught species, benthic and pelagic communities was caused by amendments in the decree of April 6, 2011 on "The List of Objects of Fauna, Obtaining of Species, Terms and Allowed Weapons and Tools". The amendments involve a permission to use bottom trawls and reduce the size of net loops.

In the Georgian part of the Black Sea the use of bottom trawls is permitted almost on the entire area (see map #5). The territory includes the estuaries of large rivers with fish breeding areas, rich benthic communities and important feeding areas for all the three dolphin species. Bottom trawls may cause additional problems in the territorial waters of Georgia. Besides, no study has been made as to the depth of the water rich in hydrogen sulfide, its change by place and season. Therefore, a trawl may cause the mixing of this water with the aerobic layer of water, which will deteriorate the quality of water.

Out of 26 invasive species inhabiting the Black Sea, six have most affected the ecosystem. These are: *Mnemiopsis leidyi, Rhithopanopeus harrisi, Rapana thomasiana, or Rapana venosa*, mollusks *Mya arenaria* and *Cunearca cornea* and fish *Mugil soiuy, or Liza haematocheilus*. The highest negative impact is caused by comb jelly *Mnemiopsis leidyi*. This specie especially affects the fish spawning in summer, especially anchovy. There is negative correlation between the density of fish spawning in winter and the density of *Mnemiopsis leidyi*

Mnemiopsis leidyi was found in Georgian territorial waters from 2009 to 2011. In spring 2011 *Mn. leidyi*, the size of which reached 8 centimeters was found in the shallow water at the sandy coast. This was the period of spawning for various fish species. Existence of *Mnemiopsis leidyi* in the places of spawning is a significant threat for the spawns and larvae.

Another invasive specie affecting the Black Sea ecosystems is rapa whelk (*Rapana thomasiana, or Rapana venosa*). It has significantly decreased the population of mollusks that filter the water. Decrease in their number leads to the deterioration of the quality of water. Besides, these mollusks and mussels are food for benthos fish, including rare species (e.g. sturgeon). Thus, decrease in food resources leads to the decrease in the number of fish.

According to the data of mass media, construction of Lazika - a town with half million population – is planned on the Black Sea coast. This will lead to the modification of natural systems, including the reclamation of relict bogs. This territory is a migrating place for water birds, birds of prey and passerines. Therefore, destruction of the already deteriorated natural ecosystem may be considered a threat of global importance. Information has been spread regarding the construction of a new port along Anaklia, which includes one of the deepest canyons on the Black Sea coast. This territory is a spawning place for numerous fish species. This is also an important territory with regard to sturgeon species mentioned in Georgian and International Red Lists. This is a feeding area for all the three dolphin species (bottle-nosed dolphin, common dolphin and harbor poprpoise). Hence, these mammals on the international Red List are also endangered.

It should be mentioned that Georgia has signed all the international documents aimed at the protection and restoration of the Black Sea ecosystems. However, the implemented activities (e.g. the amendments to the legislation in 2011) contradict Georgia's obligations with regard to the international community.

Introduction

The Black Sea is considered one of the most polluted seas in the world. It is polluted by the six countries located on its coast (Georgia, Turkey, Russia, Ukraine, Bulgaria, Romania) and several large rivers of Europe that flow into the Black Sea.

The state of Black Sea ecosystems has significantly deteriorated in the past decades. Pollution has been added by overfishing, which has aggravated the state of this comparatively small, partly closed water body. Human impact is added by the natural conditions in the Black Sea: water is mainly anaerobic (87-90%), devoid of oxygen and inhabited by bacteria that reduce sulfate and archaebacteria that create methane.

Pollution activates the process of reduction of sulfate and decreases the life zone. Therefore, protection of the Black Sea is a concern of numerous states and it largely depends on international cooperation. On April 21, 1992 Turkey, Georgia, Ukraine, Romania, Bulgaria and Russian Federation signed a Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention), which was ratified on January 15, 1994.

In 1996 the countries of the Black Sea basin worked out and signed a strategic action plan for the protection and rehabilitation of the Black Sea. According to the action plan, Georgia, Romania, Ukraine, Bulgaria, Russian Federation and Turkey are responsible for the rehabilitation and protection of the Black Sea ecosystems and sustainable use of the natural resources. In 2009 in Sofia the Black Sea countries updated the strategic plan envisaging current situation. Based on the activities implemented under transboundary cooperation, the plan aimed at the preservation of biodiversity and habitats, reduction of the process of eutrophication, improvement of the quality of water etc.

The first transboundary diagnostic analysis of the Black Sea (TDA) was carried out in 1996. As a result of the analysis, the ecological state of the Black Sea was identified. In 2007 TDA was implemented for the second time. This time it focused on four key problems:

1) Eutrophication/enrichment with food substances

2) The change of live resources in the Sea

3) Chemical pollution

4) The change of biodiversity/habitats including introduction of species.

As compared to 1996, in 2007 the organic pollution of the Black Sea by the rivers of its basin decreased by 30%. This was chiefly due to the agricultural and industrial decline in several countries of the Black Sea rather than governmental actions aimed at the protection of the sea. It should be mentioned that the Black Sea ecosystem responds to the above-mentioned change rather slowly. Many years have to pass until the decrease in the organic pollution has its positive impact on the Black Sea ecosystem (in case pollution does not increase again)

In the past years obtaining of the live resources in the Black Sea increased, although it is halved as compared to the 1980s. With regard to chemical pollution, the situation differs by territories: In certain places the degree of pollution is extremely high, whereas in other places it is low. There is an increased risk of pollution due to ships as well as gas and oil pipelines installed on the coastline.

It should be stressed that at least one habitat is degraded in the territorial waters of every country.

One of the important threats for the Black Sea ecosystem is invasion which continues till today. Almost nothing is done to avoid this process. Ships and aquacultures are the key source of invasion of alien species.

By 2007 the state of biodiversity improved near the shelf. The number of the so-called dead zones (devoid of oxygen, saturated with hydrogen sulfide) has decreased. However, in certain parts of the Black Sea shelf, especially in the outfall of the Dniester river, the low content of oxygen is still a problem. Implementation of the Black Sea Action Plan differed by countries. No actions or only part of actions have been implemented on the territory of Bulgaria, Ukraine and Georgia.

Taking into consideration the above-mentioned, it is important to work out a new action plan envisaging the current state of the biodiversity of the Georgian part of the Black Sea. This plan should be based on the current legislation and correspond to the international laws regarding the protection of the Black Sea.

The given document covers the state of biodiversity and related problems in the Georgian territorial waters of the Black Sea.

I. The Uniqueness of the Black Sea

The Black Sea is an internal European sea isolated from the world ocean. Its key features are given in Table N1. The strait of Kerch to the North-East connects it with Azov Sea, the Bosphorus strait to the South-West connects it with the Sea of Marmara, whereas the Dardanelles strait connects it with the Aegean and Mediterranean Seas. According to scientific research, The Black Sea basin was periodically separated from or connected to the world ocean due to mountain-forming processes. The Black Sea obtained its present

shape about 10000 years ago when it was connected to the world ocean via Bosphorus and Dardanelles straits.

The Black Sea is the world's largest meromixis water area where the water is permanently stratified: the deeper layers do not mix with the upper layers. The upper layer of water obtains oxygen from the atmosphere, whereas below 130-150 meters the water is rich is hydrogen sulfide. As a result of this, about 87-90% of the water is anoxic i.e. devoid of oxygen. There is oxygen only in the upper layers and shelf waters. Salty water flows into The Black Sea from the Mediterranean via the Bosphorus strait. The salty water is heavier. Instead, the fresh water of The Black Sea (obtained due to the inflow of the rivers) flows out. This increases density: halocline, which changes as a result of flows. As a rule, the zone of hydrogen sulfide begins under the halocline, which hampers the movement of oxygen from the upper to the lower layers.

Table. 1 .Key characteristics of the Black Sea

Geographical coordinates	46°33' - 40°56' N 27°27' - 41°42' E
Length of the coastline	4340 km
Length of the Georgian coastline	*320 km*
Water surface area	*432 000 square km*
Volume of water	*547 000 cubic km*
Maximum depth	*2 212 meters*
The volume of water brought by rivers	*340, 6 cubic km*
Salinity	*18-22 per mille*
Biodiversity	*fungi, algae, high plants - about 1619 species* *Invertebrates - about 1983 species* *Fish – about 168 species* *Sea mammals – 4 species*

The anoxic conditions were created in the depth of The Black Sea about 7300 years ago. It is considered that this process was due to the flow of the Mediterranean via the Bosphorus strait which took place 9000 years ago.

The bacteria that form hydrogen sulfide yield about 10000 tons of sulfur per day. Below 150-200 meters the concentration of hydrogen sulfide increases to the depth of 1000 meters, where the concentration is comparatively stable, namely 9.5 mg/liter to the depth of 1500 meters.

The size of the layer of hydrogen sulfide depends on the geographic peculiarities of different areas of the Black Sea. It changes by years and seasons. Seasonal atmospheric changes cause significant changes in the circulation, which affects the layer of hydrogen sulfide. Its upper limit is the deepest in summer and the highest in spring.

Apart from hydrogen sulfide, the Black Sea contains another gas of anaerobic bacterial origin – methane. Nowadays methane is formed as a result of the vital activity of Archaea. In conditions of salinity, high pressure and low temperature, methane forms gas-hydrates. They resemble ice. One volume of such "warm ice" contains several tens of volumes of methane. The location of gas-hydrates in the Black Sea is identified by means of acoustic tools.

The Black Sea is characterized by unique bacterial reefs. In anoxic environment, in the areas with intense formation of gas and high concentration of methane, there are formations of various types: round-shaped porous plates and tower-shaped or tree-shaped plates that are 30-100 centimeters in height. Coral-shaped sprouts are brownish-pinkish, covered with 2-3 centimeters of bacterial mucous layer or mat. The coral-shaped sprouts consist of 99.6% aragonite ($CaCo_3$).

In the mats of "microbial reefs" of the Black Sea, at 230 meters' depth there were bacteria of Desulfosarcina/Desulfococcus group, capable of reduction of sulfate, as well as methane oxidizing bacteria of Archaea clade, ANME-1 cluster. The most widespread structure of the Black Sea reefs is: superficial mat, pink inner layer and porous carbonate solid axis.

In fact, there is an actively functioning coenosis of microorganisms, formed in anaerobic conditions, a part of which, namely bacterial mats, form an anaerobic methane filter in the Black Sea.

The exact age of microbial mats is unknown, although it is considered that these coenoses are several thousand years of age. According to scientific research, the microbe reefs are similar to the first forms of life on the earth. In ancient times, oceans contained such reefs. Their study will explain how the first live organisms existed and multiplied at an early stage of development of the earth.

The Black Sea is comparatively poor in species. The number of species widespread in the Black Sea comprises about 1/3 of the species widespread in the Mediterranean Sea. This

indicates the inefficiency of the process of biological invasion of the Mediterranean species in the Black Sea. The factors that hamper the process of invasion are as follows: 1) Significant contrast of the temperatures between the two basins: 15-16 degrees in the Aegean Sea and 7-8 degrees in the Black Sea in winter; 2) The difference in salinity: 39 in the Aegean Sea, 18-19 psu[1] in the Black Sea; 3) The double layer of the flow in the system of Turkish straits (Bosphorus and Dardanelles); 4) Significant vertical and horizontal contrast between temperature and salinity, caused by the double layer of flow. The difference in temperature and salinity and the lack of oxygen lead to physiological stress, which is a physiological barrier for live organisms in the process of migration. This barrier hampers the spreading of the Mediterranean species to the North-east. The process of Mediterranization of the Black Sea would be possible only after a long period of physiological adaptation, which implies behavioral, ecological and evolutionary aspects for each of the species.

For certain species, the Sea of Marmara is an intermediate buffer zone between the two different sea basins. The adjacent narrow and shallow straits create a bottle neck for pelagic and bottom dweller species. The organisms that manage to pass the Bosphorus Strait undergo the process of adaptation in the South-eastern shelf zone. Despite the physical and physiological barriers, certain Mediterranean species penetrate the Black Sea, although the process is slow and often unsuccessful. It is highly probable that current climatic changes also influence this process. However, this argument requires a detailed study without which it is impossible to observe the natural processes in the Black Sea as well as processes caused by human impact.

One thing is obvious: despite the comparatively little number of species (caused by the lack of life space), the Black Sea species are unique in their adaptation ability. Development in difficult and relatively isolated conditions has led to the formation of specific adaptation abilities which distinguish the Black Sea species from the related species or other populations of the same species.

[1] Psu-practical salinity unit – salinity unit that corresponds to per mille i.e. one hundredth of per cent ‰

II. Georgian Black Sea Coast

The Georgian part of the Black Sea coast is located in the South-Eastern and Eastern parts of the Black Sea, between the mouths of the rivers Sarpi and Psou. The Caucasus chain protects it from North winds. The average speed of the wind is lowest in Batumi. The volume of the tide-in and tide-out is insignificant on the Georgian coast. For instance, in Poti it is 8-9 centimeters and is of semi-diurnal character. As compared to the oceans, the Black Sea, as the internal continental sea, is characterized by low force of waves. Stormy phenomena occur in case of cyclone impact. The South and South-East winds are related to the Mediterranean cyclones. The Atlantic cyclones cause Westward winds and waves that reach the Georgian coast in the form of strong billows.

The bottom of the Black Sea is rather steep at the Georgian coast. The underwater relief of the bottom of the Georgian coast is widened by former gorges and deltas that are continuations of the superficial gorges of all significant rivers. The relief of the bottom consists of shelf, continental slopes and sea caves. By the Georgian coast the shelf has the form of a narrow dotted line.

The water temperature in the Georgian part of the Black Sea ranges from 9 to 11 degrees in winter (Southward). At 60 km from the coast, on the contrary, the water temperature increases Northward: from 19.4 to 20.7 degrees.

In January the average temperature on the Georgian coast of the Black Sea is 4-7 ^{0}C, the average temperature in July is - 22-23 ^{0}C. Precipitation is ample in all seasons. Rain is especially typical of the Southern part of Kolkhis, with over 2500 mm precipitation per year. Precipitation is less to the North ranging from 1650 mm (in the central part) to 1400 mm (in the North-Western part).

The geomorphology of the Georgian coast is influenced by about 150 rivers of the region (including minor rivers). The entire annual flow comprises 50 km^3. The inflow of Georgian rivers comprises 16% of the total continental inflow of the sea. The Georgian rivers flowing into the Black Sea are: Bzipi, Kodori, Enguri, Rioni, Khobi, Supsa, Natanebi, Chorokhi and other minor rivers.

The most full-flowing river on the Georgian territory is the Rioni, the largest river that flows entirely on the Georgian territory. Its length is 327 km, the area of its basin is 13400 km².

Annually, the Rioni fills the Black Sea with **a large mass of solid substances - average** 4,7 million tons per year.

The inflow of some rivers into the Black Sea (based on the assessment of 2005)

- Rioni 406 m^3/s
- Supsa 46.0 m^3/s
- Chorokhi 300.0 m^3/s
- Natanebi 24.5 m^3/s
- Khobi 50.5 m^3/s

III. The Socio- Economic Situation on the Georgian Coast of the Black Sea

By 2010, approximately 450 000 people comprised the population of the Georgian part of the Black Sea coast and its adjacent territories.

Until the crisis of the 1990s Georgian coast of the Black Sea was industrial-agricultural region with well-developed fields of industry (machine industry, fuel and chemical industry, electrical energy, light industry, food industry, building materials industry etc.). In 1988-2002 the production and the number of employed people decreased significantly. Agriculture also deteriorated.

In the 1990s a major portion of the region's population emigrated (e.g. over 50 thousand people i.e. 13.1% of the population emigrated from Achara).

Since 2004 the economy started to develop rapidly. It was rehabilitated and integrated into national and global economic systems. Hence, the total domestic product of the region started to grow.

The developed fields of industry are:

- Textile industry;
- Food industry;

- Production of building materials;
- Processing of secondary metals;
- Pharmaceutical industry.

Agriculture is still in crisis. The lack of agricultural lands hampers the development of farms. Therefore, the given field is chiefly represented by minor farms and the volume of agricultural produce is insignificant.

Georgia has two major ports n the Black Sea: Poti and Batumi ports.

Poti port is located on 49 hectares and functions all the year round. Currently it owns a complex of transportation of cargo, consisting of 14 harbours and 2650 meters in length. 11 harbours are equipped with portable cranes of 6-40 tons capacity. Transportation conditions are suitable for all kinds of cargo and liquid products. The turnover permanently grows. 7 terminals are leased on long-term basis.

Part of Poti port is connected to Ilichevsk (Ukraine), Varna (Bulgaria) and Caucasia (Russia) ports via direct train ferry, and to Novosibirsk (Russia), Burgas (Bulgaria) and Rize (Turkey) ports via direct car ferrries.

Batumi port is a bridge connecting the transport corridors between Europe and Asia. Oil and oil products are loaded in Batumi Port on the area of 8 hectares and 4 harbours of 755 meters' length. Dry cargo is loaded on two harbours embracing 17.5 hectares and 1590 meters in length. The port has a capacity to transport 15-18 million tons of oil products per year. For dry cargo, this index equals 2.3-2.5 million tons per year. The turnover of container transportation terminal is 47-50 thousand containers per year.

One of the most rapidly growing fields of economy on the Georgian part of the Black Sea coast is tourism. According to the concept of development of tourism in the region, rapid growth of investments and number of tourists is planned for the nearest future.

IV.The Biodiversity of Georgian Black Sea Coast

IV.1.Habitats

Open Sea and Circulation Zone

1110. Sand coasts thinly covered with the sea water

PAL.CLASS.*: 11.125, 11.22, 11.31, 11.333*

The water level from the sand surface does not exceed 20 meters. It consists of sedimentary sand, but also contains larger stones and pebbles or smaller granules that form mud on the coastline. The sandy-rocky line stretches from Abkhazian coast to Guria and Achara (including). The biotic elements are chiefly represented by algae, invertebrate sea animals and plankton. Various species of fish either inhabit or pass these places; all the three species of dolphin are frequent (*Tursiops truncatus, Delphinus delphis, Phocoena phocoena).*

1130. Deltas (estuaries)

PAL.CLASS.: 13.2, 11.2

A delta is the end of the river-bed where it joins the sea and is influenced by the tides. The delta of the river forms part of the coastline, where the bay contains mixed fresh and salty water. This zone is characterized by a large amount of sedimantary rocks brought to the coastline by the river. It constantly changes the type of tide and causes the formation of mud, decomposed rocks and other sediments. The largest delta is formed by the Rioni river. Other significant deltas are those of the Enguri and Chorokhi rivers. Other rivers join the sea in the form of a narrower line.

21150. Coastal Lagoon

PAL.CLASS.: 21

The lagoon is a part of the salty water of the sea. It has cut into land and is separated from the sea so that during the tide in the sea and the lagoon are connected and their

waters are mixed. The lagoon is often separated from the coast by means of rocks or sandy hills. The salinity of water depends on the volume of precipitation. During hard rains, salinity is decreased. Such formation is found near Grigoleti Village.

1160. Shallow water and bay

PAL.CLASS.: 12

A bay and shallow water occupy certain places on the coast. Unlike delta, here fresh water is not mixed with the sea water. It is affected only by the movement of the sea waves, which brings sedimentary rocks from the bottom of the sea and constantly changes the structure of the bottom. This, in its turn, affects the biotic content of benthos.

1.2. Sea rocks and stony coast

1210GE –Georgian code

With regard to this habitat, literature makes mention of surface plant species. The flora of water-covered sea rocks and stony bottom has not been described yet.
It should be mentioned that no specific research has been carried out on the Georgian territory with regard to the precise description of the structure of the Black Sea habitats, which would cover the shelf, continental slopes and sea caves, their distribution and assessment of their state. There is little information regarding the habitats of the entire Black Sea.

Plant species by habitats is described in Table #1 (appendix)

IV.2. Phytoplankton

The diversity of phytoplankton largely depends on the following factors: salinity, temperature, the amount of nutrients and turbidity of water. The waters of the Black Sea coast and continental shelf are eutrophic, i.e. rich in organic substances (nutrients). Concentration of food substances defines the biomass of phytoplankton and the content

of species. The content of species of phytoplankton alongside the entire Georgian coastline was evaluated in the 80s of the past century. 116 species were identified:

- Bacilariophyta-62 species
- Pyrrophyta -40 species
- Euglenophyta-3 species
- Chryzophyta-6 species
- Cyanophyta-3 species
- Chlorophyta-2 species

The most frequent among phytoplankton species were diatomic sea algae, out of which most dominant were:

- Thalassiosira parva
- Nitzschia seriata
- Nitzschia longissima
- Rhizosolenia alata
- Rhizosolenia calcar-avis

Northern forms were also frequent:

- Sceletonema costatum
- Cyclotella caspia
- Cerataulina bergonii

The seasonal change of the phytoplankton is given in the Appendix (Table #2)

The research of the phytoplankton of the entire Georgian coastline was imeplemented in the 70-80s of the past century. Only episodic research was implemented later. Therefore, current data should be obtained with regard to the content of phytoplankton species, its seasonal change, distribution by habitats etc. This research should be based on modern methodology.

IV. 3. Zooplankton

The micro zooplankton fed on phytoplankton is dominated by *Cladocera* and *Copepoda*. Recently the zooplankton of the entire Black Sea has revealed a decreasing tendency. This might be due to the growth of the mass of phytoplankton species that are unsuitable food for zooplankton coenoses. On certain territories of the Black Sea the density and biomass of *Noctiluca* has increased. Some scientists consider it part of phytoplankton, but due to its heterotrophy and comparatively large size, it is used for the monitoring of zooplankton. The growth of *Noctiluca* is stimulated by the accumulation of organic and other food substances (nutrients) in the water, which is a result of pollution. In the abundance period it comprises 90% of zooplankton at certain shores of the Black Sea.

Invasion of *Mnemiopsis leidyi* (Ctenophora) was an important reason for the decrease of the biomass and change of its structure. This hermaphrodite, capable of rapid reproduction, penetrated the Black Sea in the beginning of the 1980s and multiplied so fast that in the 1990s its amount reached billion tons in the Black and Asov seas. In this period zooplankton represented a gellike mass due to the high content of *Mnemiopsis leidyi.* In this period *Mnemiopsis leidyi* annihilated spawns and larvae of certain fish. In 1997 another invasive specie, predator *Beroe ovata* was discovered in the Black Sea, which feeds solely on *Mnemiopsis leidyi.* Since this period the zooplankton feeding on phytoplankton has increased. However, due to its seasonal propagation, it is unlikely that it will entirely annihilate *Mnemiopsis leidyi*. In general, in conditions of eutrophication, the large amount of gellike plankton organisms (consisting of 98-99% water) is characteristic of see zooplankton.

Out of medusa species (Scyphozoa), the most widespread in the Black Sea are: *Rhizostoma pulmo* and *Aurelia aurita.* On the stage of larvae they form an important component of zooplankton.

The largest organisms of zooplankton are fish larvae, including the larvae of anchovy (*Engraulis*). Their amount is especially high in the samples of plankton taken in May.

A major portion of the Black Sea organisms spends at least one stage of life cycle in the plankton content. Thus, research of zooplankton, including the content of species, seasonal change, biomass and density, is extremely important for the assessment of the state of the entire ecosystem.

No research based on modern methodology has been implemented recently with regard to zooplankton of the entire Black Sea coastline.

IV. 4. Zoobenthos

The macro zoobenthos of the Black Sea includes over 800 species. Their number decreases rapidly with the increase of the depth. Viability of zoobenthos depends on several key benthic habitats of transboundary importance: favourable habitat for *Mytilus galloprovincialis* (mussels), *Cystoseria* (algae) habitats, *Zostera* beds and sublittoral sands.

In the 1990s the study of bottom samples at the Georgian coast revealed 128 zoobenthic species:

Polychaeta - 60 species

Mollusca - 42 species

Crustacea - 19 species

Other -7 species

The list of species is given in the Appendix, Table #3.

Assessment of the current state of zoobenthos should be based on the following indexes: species richness, biomass, seasonal change. None of these indexes have been studied at the Georgian coast of the Black Sea.

Polychaeta

Some species of Polychaeta, widespread in the Atlantic Ocean and the Mediterranean Sea, have been found at the Georgian coast.

Magellona papilicornis is found in the Atlantic Ocean and the Mediterranean Sea. At the Georgian coastline this specie was found at the depth of 5-25 meters. At the depth of 5-15 meters *Eteone siphonodonta* was discovered. One more Atlantic specie - *Ancistrosyllis tentaculata* – was discovered in the Red Sea and the Noth Caucasian coast of the Black Sea, at the depth of 16-28 meters. On the Georgian coast this specie was abundant at the depth of 5- 40 meters.

Streblospio shrubsolii is also found in the Atlantic Ocean. It was first discovered in the Black Sea at the Bulgarian coast. As for the Georgian coast, this specie is found in two places near Abkhazian shore, at the depth of 20- 30 meters.

Giycera capitata is widespread in the Atlantic and Pacific oceans as well as in the Arctic and Antarctic seas. In the Black Sea it was discovered in the sublittoral area above the sand in the region of Evpatoria. On sandy soil, this specie is found on the entire Georgian coast.

The existence of the Atlantic species of Polychaeta in the Black Sea proves that the double-layer of the stream of water in straits, significant difference in salinity or temperature gradient do not represent a problem for this group of animals.

Crustaceans

In the 80s of the past century research revealed two species of *Callianass* - *C. pestai* and *C. truncata*. *C. Pestai* is widespread in the Adriatic, Mediterranean and Black seas. At the Georgian coast it was found everywhere at the depth of 5-50 meters.

IV. 5.Mollusks

The following species are found at the Georgian coast:

Venus gallina	**Venus gallina <4 cm. One of the dominant species on sandy bottom. Its density being reduced in Black Sea in last years.**
Scapharca inaequivalis	**Scapharca inaequivalis <8 cm. Evolutionary old bivalve of Indo-Pacific origin, invaded the Black Sea in 1960s. One of the dominant species on sandy bottom to 40m depth. Edible bivalve with orange-yellow flesh**
Donax trunculus	**<4 ს Donax trunculus <4 cm. Dominant bivalvian species of Black Sea sandy shallows**
Calyptraea chinensis	**Calyptraea chinensis - Chinese hat <4 cm, one of few gastropods living on the soft sediment bottom; the mollusk is housed in a tiny half-volute of the shell, the**

	rest of the wide shell
Moerella (Tellina) donacina	**<2 cm, lives in soft sediments deeper than 10m, annual species**
Lucinella divaricata	**<0.5 cm, one of dominant annual species of the Black Sea shallow sandy bottom**
Modiolus phaseolinus	**Modiolus phaseolinus <4 cm. Most abundant bivalve in the Black Sea. Dominant species deeper then 40m. Most of the bottom sediments at those depths originate from Modiolus shells**
Rapana venosa	***Veined rapa whelk <15 cm, the largest marine gastropod, and one of most ruthless predators in the Black Sea; it eats bivalves so efficiently that bivalve diversity in the Black Sea reduced about two-fold since Rapana invasion in 1947. Small-sized Rapana drill bivalve shells with its radula, inject digestive enzymes inside, and then suck the digested flesh out; they even do the same to crabs! Adult Rapanas just open bivalves with their large versatile leg. There are no predators for adult Rapana venosa in the Black Sea the starfish that normally prey on this gastropod can't tolerate the low salinity of the Black Sea***
Mytilus galloprovincialis	**Mytilus galloprovincialis, blue mussel <12 cm, attaches to underwater rocks with a bunch super-strong bissus threads, deeper it lives on soft sediments where several mussels make a bunch attaching to each other, and putting bissus into sand or silt - like roots. Mussel is cultured at marine farms where its planktonic larvae settle on the special collecting ropes. Inhabits rocky shores where comparatively large waves are formed. It is also found on sandy bottom. It plays an important role in the ecosystem as a filter. 10-70 mm mollusks filter 6-70 liters of water per day. There is a strong reduction tendency, one of the reasons for which is rapana rapacity.**

In summer 2010, while diving near Tsikhisdziri (at 10 – 20 meters), numerous empty shells of mussel were found at the depth of 10-12 meters. There were no rapa whelks on this territory, but their concentration was high near Kvariati. In summer 2011 minor live mussels were found attached to rocks near Tsikhisdziri. It is highly probable that rapa whellks annihilated large-size mussels near Tsikhisdziri and moved southwards to Kvariati to gain food.

On the entire Georgian coast there are mollusk species widespread on the European coast of the Atlantic ocean, the Mediterranean, Aegean and Marmara Seas. One of such mollusks is *Cylichnina strigella,* spread at the depth of 40 meters. Aegean *Proneritula westwrlundi* was found at the depth of 30 meters at the Georgian coast, by the estuary of the Supsa river.

Hypanis anqusticostata ang., found in still waters and the delta of the Danube, was discovered on the Georgian coast by the estuary of river Supsa.

IV.6. Fish

According to the data of 2002, there are 171 fish species in the Black Sea. Some species are spread via fisheries: - *Mugil soiy* (*Liza haematocheilus*) and *Oryzias latipes* .

The most endangered species of the Black Sea are the representatives of sturgeon genus. The endangered species under IUCN Red List are: *Acipenser gueldenstaedtii, Acipenser stellatus, Acipenser sturio, Acipenser nudiventris, Huso huso* and *Acipenser persicus*. *Acipenser ruthenus* is listed as a vulnerable specie. IUCN Red List also mentions the reducing tendency of an important benthos species - *Platichthys flesus*.

Endangered species protected under the Black Sea Red List are: *Belone belone euxini, Mullus barbatus*.

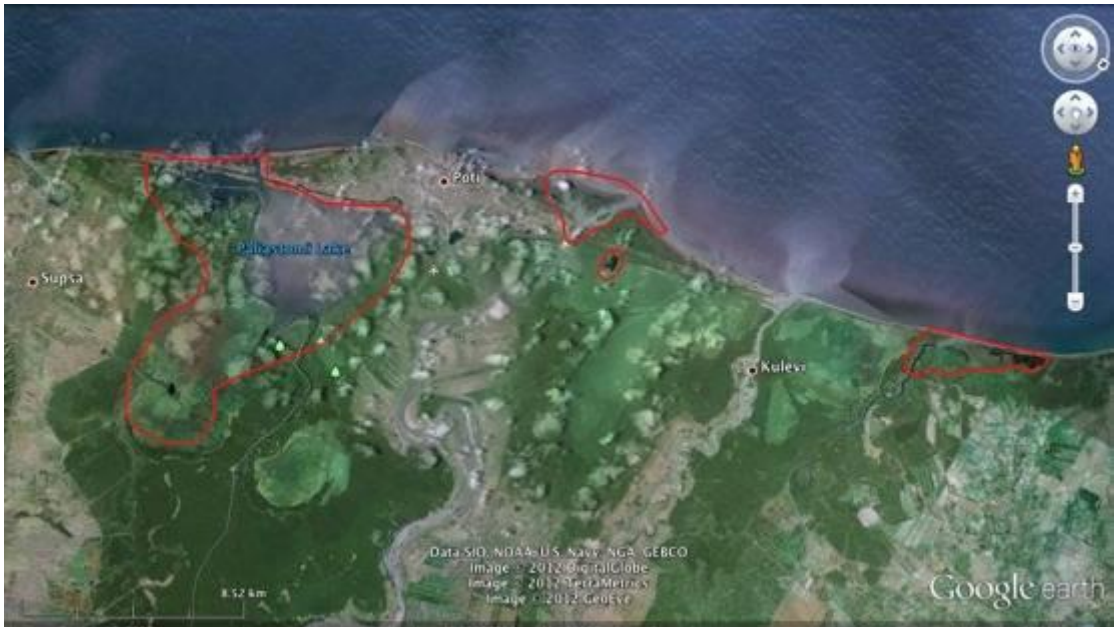
Apart from sturgeons, Georgian Red List mentions Black Sea herring *(Alosa pontica).*

Certain Black Sea species found at the coast of Georgia, their habitats, propagation periods and other related information is given in Tables N3,4.

With regard to the entire Georgian coastline, it is necessary to compile the inventory of ichthyofauna species, their number and seasonal distribution. The inventory should be based on modern methodology, harmonized with the methodology used in other Black Sea countries. It is especially important to monitor commercial species and compile a database that will enable assess the species population trands.

IV.7. Birds

The Caucasus, at the border of Europe and Asia, is important for two life cycle stages of wild water birds (migration and Wintering) and three flyways converge in the Caucasus region (The Central Asian, East Africa-West Asia and Mediterranean/Black Sea). Eastern Black Sea shore, Kolkheti Lowland and adjacent foothills of Meskheti Ridge are important sites for migrating birds. Tens of thousands of migratory waterbirds are using Kolkheti marshes and lakes as well as river deltas and sea for stopover and wintering.



Map N1. Important migration sites for water birds, from North to East: river Churia, lake Partottskali, Rioni delta, Paliastomi lake

Kolkheti lowland wetlands and costal areas are important for autumn and spring migration of waders and other shorebirds. Thousands of plovers (Calidris spp., Pluvialis spp.), Lapwings (Vanellus spp.), Red knot (Calidris canutus), Sanderling (C. alba), Curlew sandpiper (C. ferruginea), Turnstone (Arenaria interpres), Dunlin (Calidris alpina), Broad-billed sandpiper (Limicola falcinellus), Temminck's Stint (Calidris temminckii), Little Stint (Calidris minuta), Sandpipers (Tringa spp.), Godwits (Limosa spp.), Curlews (Numenius spp.), Snipes (Gallinago spp.), Woodcock (Scolopax rusticola), Ruff (Philomachus pugnax), Gulls (Larus spp.), Terns (Sterna spp., Chlidonias spp.), Crakes (Rallus spp.), Moorhen (Gellinula chloropus), Coot (Fulica atra), Purple Swamphen (Porphyrio porphyrio) and Herons (Botaurus spp., Egretta spp.,Ardea spp.) migrate through Kolkheti lowland (Map1,2). Disturbance from grazing animals, motorboat activities, reed burning, seashore development, uncontrolled hunting and poaching are major threats affecting wader and shorebird populations during migration.

Map N2. Important migration site for water birds: Chorokhi delta

Thousands of waterfowl birds of more than 25 species use Kolkheti wetlands and coastal areas for migration and wintering. Swans (Cygnus spp.), Geese (Anser spp.), Ducks (Tadorna spp., Anas spp., Aythya spp.) and Mergansers (Mergus spp.) winter and

migrate on the Eastern Black Sea shore (Map 1,2). Disturbance from motorboat activities, reed burning, seashore development, unmanaged hunting and poaching are major threats effecting wader and shorebird populations during migration and wintering.

Full autumn raptor migration counts were conducted in 2008 near Batumi. Since then, about 900 000 migrating raptors of 34 species have been counted annually. Such an amazing number of migrating raptors makes Eastern Black Sea bottleneck most important raptor migration site of Western palearctic and third largest (4-6 mln. raptors at Veracruz, Mexico; 2 mln. raptors at Eilat, Israel) raptor migration site on the planet.

In 2010 and 2011 international Batumi bird ringing camp was trapping and ringing passerine birds in Chorokhi river delta near Batumi. 6 000 birds of 84 different species were ringed during 3 week period in the august of 2010 and 16 000 birds of over 80 species during august-September of 2011. The two ringing attempts showed the importance of the Eastern Black Sea migration corridor for passerine migration. Habitat degradation and coastal tourism infrastructure development as well as illegal shooting are major threats for migrating passerines.

IV.8. Mammals

There are four mammal species in the Black Sea: Black Sea seal (*Monachus monachus),* critically endangered according to the IUCN Red List, bottlenose dolphin (*Tursiops truncatus ponticus*), common dolphin (*Delphinus delphis ponticus*) and harbour porpoise (*Phocaena phocaena relicta*).

Seal is not found on the Georgian coast, as there are almost no habitats suitable for this animal. Only once, in the 30s of the past century, seal was registered in the Georgian Black Sea area.

In 2009-2011 observation of dolphins along the Georgian Coast (*Tursiops truncatus ponticus, Delphinus delphis ponticus, Phocoena phocoena relicta*) proved that all the three species are found in all seasons. However, their frequency (except bottlenose dolphin) differs by seasons. Detection probability is highest (nearly 100) in spring, whereas for common dolphin detection probability equals *81.4* in summer.

According to the 2009-2011 assessment, the most widespread dolphin specie in Georgian territorial waters is common dolphin (6000 individuals in summer), next comes harbour porpoise (4000 individuals in spring), whereas bottle-nose dolphin is much less in number (about 60 individuals in all seasons, including spring 2011).

Feeding areas of dolphins are identified based on the data of 2010-2011 distribution and behavior (see Map N3)

Map N3.Dolphin food territories: 1-Khobi riv. delta; 2-Delta of the Northern Branch of the Rioni riv.; 3 –Delta of the Southern branch of the Rioni riv.; 4-Supsa riv. delta

All the three subspecies of dolphin are on IUCN Red List (See Table N 2)

Dolphin specie	Conservation status according to IUCN Red List	Conservation status according to the Black Sea Red Book	Conservation status according to Georgian Red List
Tursiops truncatus ssp. ponticus	**EN** Endangered	**DD** Data Deficient	**EN** Endangered
Delphinus delphis ssp. ponticus	**VU** Vulnerable	**DD** Data Deficient	Not on the list
Phocoena phocoena ssp. relicta	**EN** endangered	**DD** Data Deficient	Not on the list

Table N2. Conservation Status for all the three dolphin species

The issue of adding common dolphin and harbour porpoise to the Red List of Georgia should be considered. Harbour porpoise frequently fall victim to bycatching. There are frequent cases when they are emitted to the shore for various reasons.

Research should also identify the reasons for the stranding of dolphins to the Georgian shore. The system of monitoring of the species should be elaborated. Population-genetic research should be implemented in order to identify the site-specificity of different groups of species (i.e. the attachment of groups to certain territories seasonally or all the year round).

V. Main Threats Affecting the Black Sea Biodiversity

V.1. Eutrophication

The reason for the increasing eutrophication of the Black Sea is the increased amount of nutrients brought by the rivers into the sea. The water-collecting basin of the Black Sea embraces 2 million square kilometers, which is five times more than the sea area itself. The largest amount of substances is brought in the North-eastern part of the sea, as in this place the most full-flowing river - the Danube – joins the sea (8695 m^3/second).

Eutrophication of the Black Sea is a threat for the remaining 10-13% of water, rich in oxygen. Pollution of water by various organic compounds leads to the abundance of phytoplankton, namely flagellates. As a result of their death, a significant resource of oxygen is used in the process of oxidation of organic substances. On the area of approximately 40 000 square kilometers, the waters of the North-West shelf of the Black Sea become hypoxic. The layer of hydrogen sulfide also increases. At the depth of 10-30 meters in the North-Western part, there is high concentration of hydrogen sulfide: 1.5 - 2.25 ml/l. The hypoxia of certain layers leads to mass lethality of animals and formation of the “dead zones”.

Sewage and water brought by rivers that are polluted with mineral salts and different organic compounds of anthopogenic origin, as well as mass lethality of animals in the anoxic zones, enhance the process of bacterial sulfate reduction. As a result, hydrogen sulfide is formed in the water and sediments. The analysis of highly polluted water at the estuaries of the Danube and the Dniester has proved that the water contains a large amount of hydrogen sulfide. This was caused by the activation of bacterial sulfate reduction. The increase of the dead zones with hydrogen sulfide coincides with the development of industry and agriculture in the Black Sea countries. Besides hydrogen sulfide, there is high content of methane in the water at the estuaries of the Danube and the Dniester. The problem consists in the following: methane, coming up from the depth of the sea, is unable to oxidate by aerobic microorganisms in the thick water, hence, it appears in the atmosphere, increasing the concentration of thermal gases. In the past century, there were several sites in the Black Sea where underwater gas was yielded: the North-Western area of the Black Sea at 60-650 meters’ depth; Caucasian coast**;** the strait of Kerch and the coast of Bulgaria.

In 1996-2005 the process was slightly reduced as a result of industrial and agricultural crisis in some countries. For instance, in 2004 the volume of goods produced in the Black Sea countries comprised one third of the produce of 1998. As a result of the disintegration of the Soviet Union, numerous factories stopped functioning, agricultural produce also decreased considerably. Therefore, pollution of rivers and the sea was reduced. However, rehabilitation of ecosystems, especially that of benthos, is a longtime process.

Eutrophication of the Black Sea is a result of two simultaneous processes: anthopogenic and natural. Pollution of rivers and seas for anthopogenic reasons stimulates the growth of bacteria that yield hydrogen sulfide and methane. This leads to the increase in dead zones rich in hydrogen sulfide. Lack of oxygen leads to the death of live organisms and more organic pollution, which in its turn, increases the content of hydrogen sulfide. According to a pessimistic forecast, by 2020 the Black Sea will be dead.

Eutrophication of the Black Sea is also due to excessive fishing. According to official data, in the 1970s the amount of annually obtained fish in the Black Sea comprised 300000-400000 tons. By the 1980s this index increased to 700000- 800000 tons. Part of commercial species feed on phytoplankton. Therefore, decrease in their number leads to mass increase in the amount of phytoplankton.

The key reason for eutrophication of the entire Black Sea, including its Georgian coast, is sewage and substances brought by rivers. In order to identify the degree of eutrophication at the Georgian coast, it is necessary to implement annual seasonal monitoring. The diagnostic analysis of the Black Sea, implemented in 2007, stresses the necessity of such monitoring, using unitary methodology and comparing the data of Bulgaria, Georgia and Ukraine.

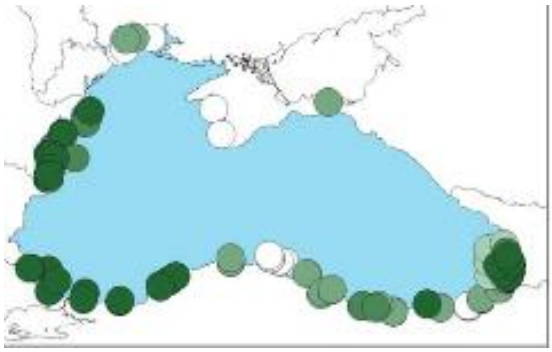
V.2.Chemical pollution

In the 1990s the Black Sea Institute studied various types of pollution by the Georgian coast in collaboration with the Asov Sea Fishing Research Institute. In order to identify metals, atomic emission spectrometer was used. In order to identify pesticides, gas mass spectrometry was used. Pollution by oil products was studied using high performance liquid chromatography (HPLC) and gas chromatographic mass spectrometry (GCMS).

In the water and fish, there were substances (polyciclic aromatic hydrocarbon PAH, benzpyrene- BP) confirming pollution by oil. The highest concentration of cancerogenic benzpyrene was observed in benthos *Platichthys flesus*, followed by benthopelagic *Mullus barbatus*, *Spicara smaris*, Black Sea anchovy *(Engraulis encrasicholus)*, mackerel (*Trachurus mediterraneus ponticus*).

Concentration of bezpyrine was extremely high in mussel tissues. It is well known that this mollusk capable of filtration accumulates the substances in the environment, including toxins. Mussels are important for the monitoring of the state of water. Pollution by oil products not only accumulates toxins in mussels, but also hampers the filtration of water. In case of oil pollution, the speed of filtration by bivalve mollusks falls, and this affects the quality of water.

As a result of the analysis implemented in 2005, pollution by benzine hydrocarbon was observed at the Georgian coast (see Map 4)



Map N 4.Pollution of the Black Sea Coast by benzene hydrocarbon. The dark green colour denotes concentration exceeding 0.18 mg/l (according to BSERP-TDA2)

As for pollution by metals, research of the 1990s identified pollution of Georgian territorial waters by mercury Hg, iron Fe, copper Cu, arsenic As. 6 elements: cobalt Co, lead Pb, nickel Ni, copper Cu, zinc Zn and bismuth Bi were found in fish tissues. Some samples also contained cadmium Cd and chrome Cr.

25 pesticides were found in the water. Chiefly α, β, γ - HCH, DDT metabolites and isomers were found in fish, accumulated mostly in liver, also in gonads, less in gills and even less in the muscles.

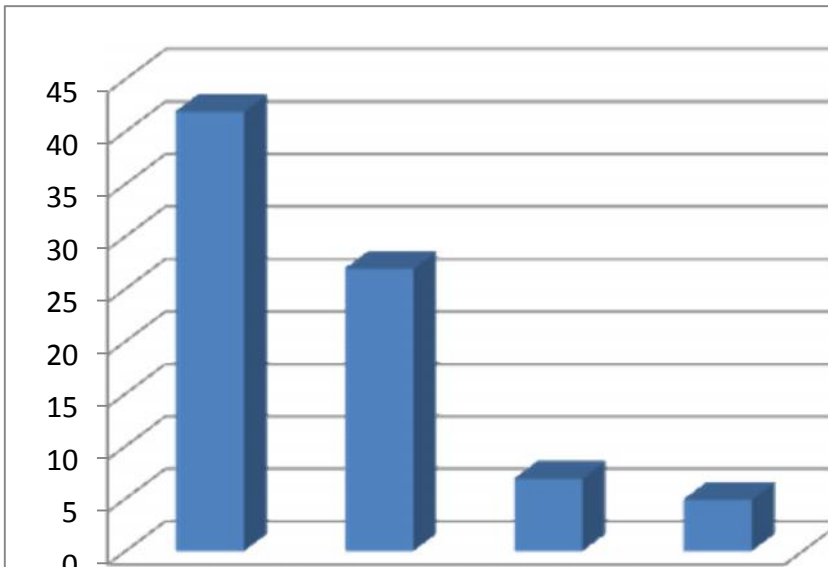
In 2003 research was implemented in order to identify the content of heavy metals in one of the bivalve species - *Mytilaster lineatus.* Research was implemented in various seasons on individuals of different size. It was concluded that the indexes regarding certain metals do not exceed the permissible concentration limits.
In 2010 in various parts of the Black Sea coast water samples were taken and their chemical analysis was carried out. The results are given in Table # 6 (Appendix).

The analysis of heavy metals in various samples in 2010 proved that the content of Zn (mg/l) varied from 0.005 to 0.016, that of Cd was less than 0.001 mg/l, that of Hg was less than 0.0001. These indexes do not exceed the permissible limit. However, conclusions cannot be based solely on water analysis. Heavy metals are capable of sedimentation. Therefore, their concentration must be higher on the bottom. It is also necessary to analyse the tissues of live organisms. All the above-mentioned tests will enable us make conclusions concerning the quality of water.

According to the official data, from 2006 to 2011 the key source of pollution from ships were industrial-faecal waters and oil products (See Chart #1). In the given period there were 42 cases of pollution by industrial faecal waters and 27 cases of pollution by oil products. In December 2011 pyrolysis tar was spilt near Poti port. There were also 6 cases of spilling of hydraulic oil. The faulting persons were fined according to the legislation.

The data concerning sewage are not given here, as it was impossible to obtain these data.

Kulevi oil terminal and Supsa terimal are a potential source of pollution. Kulevi oil terminal is located at the estuary of Khobistskali river. Supsa terminal, the final spot of Baku-Supsa



Chart*N1.Key sources of pollution from ships:* faecal spilling (1), oil products (2), hydraulic oil (3), sea ballast(4)

pipeline, is located on the right bank of the Supsa river and contains 4 reservoirs, each of 40 000 tons capacity.

These terminals are located near important feeding sites of dolphins and are frequently used by migtrating birds. In case of spilling, damage to biodiversity will be irrevocable. Therefore the impact of these terminals on biodiversity should be monitored and the results of monitoring should be transparent.

According to IUCN classification of threats (version. 3.0), the given threats are categorized as: 9.0 : 9.1., 9.3.1.; 9.3.3; 9.4. (*9.0 is pollution, whereas its sub-paragraphs are various forms of pollution*).

It is important to work out a program of monitoring of chemical pollution of Georgian territorial waters. With this aim, a list of polluting substances should be compiled and used for the assessment of the state of water. The substances and pollution standards should be harmonized with those of the Black Sea countries and international norms in order to obtain a complete picture of the state of the Black Sea.

V.3. Overfishing

According to various sources, overfishing in the Black Sea was especially high in the 1970-80s (800000-900000 tons per year). Excessive exploitation of the fishing territories, expansion of fishing and development of fishing technologies, combined with other threats, caused significant damage to numerous fish species in the entire Black Sea. The most affected were predator species (bonito, horse mackerel, bluefish etc.). There was strong pressure on sprats (*Sprattus sprattus)* and anchovy *(Engraulis encrasicolus)*. Thus, the number of commercial species of fish decreased from 20 to five in the entire Black Sea. It should also be mentioned that recently the number of major fishing boats has increased in the Black Sea.

By 2005, 1200 kilotons of fish were caught in the Black Sea. In this period at least 1300 fishing boats, the size of which exceeded 12 meters, were engaged in obtaining fish. This increased pressure on commercial and occasionally caught species of fish.

In 2011-2012 the main commercial Black Sea fish species for Georgia are: anchovy *Engraulis encrasicolus;* sprat *Sprattus sprattus*, whiting *Merlangius merlangus*, horse mackerel *Trachurus mediterraneus ponticus*, goatfish *Mullus barbatus*, mullet *Mugil spp.,* spurdog *Squalus acanthias,* bonito *Sarda sarda*, stargazer, bullhead, flounder *Platichthys flesus* , turbot *Psetta spp.,* herring *Alosa immaculata.*

Besides fish, there are permitted quotas on mollusk rapana (1000 tons per year) (see Table 3)

anchovy	sprat	whiting	horse mackerel	goatfish	mullet	spurdog	stargazer
80 000	840	780	700	680	100	80	56
bonito	gobies	turbot	herring	pickerel	bluefish	garfish	scat
38	**36**	**32**	**28**	**24**	**12**	**12**	**12**

Table #3. Quotas permitted on Georgian territory in 2011-2012 (in tons)

In the years 2006-2011, the highest fish catch was in 2009-2010 (see chart #1) - about 40 000 tons. Pressure was highest with regard to anchovy. It is likely that excessive obtaining is one of the main reasons for the decrease in the number of anchovy at the Georgian coast. The tendency to decrease is proved by the decrease in anchovy catch in 2011 (see chart #3)

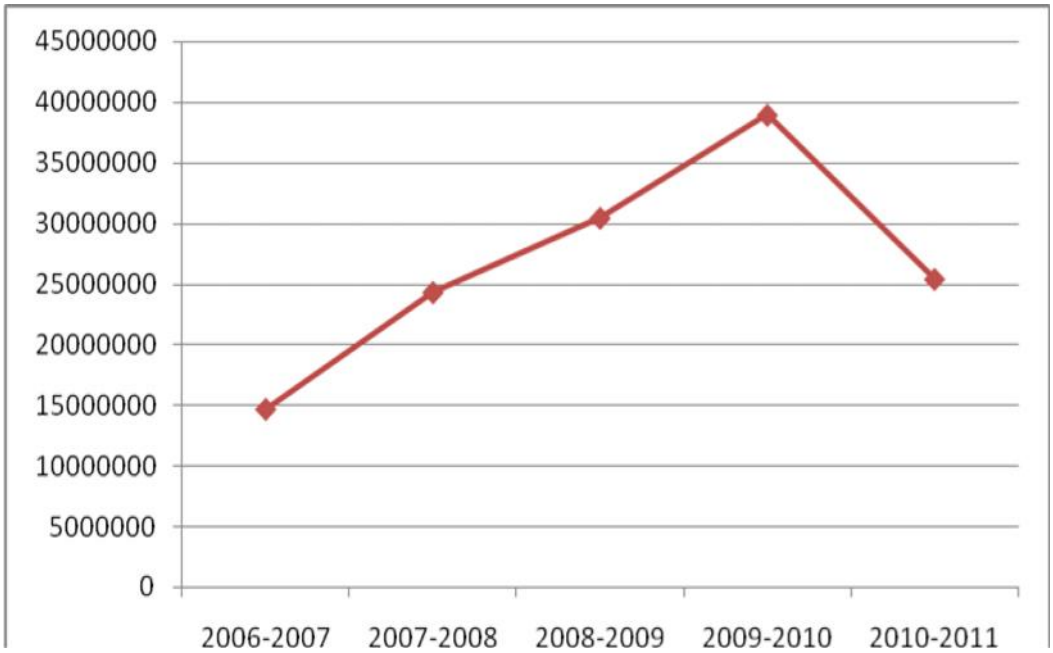


Chart.#2.the amount of fish caught in 2006-2011 (in kg)

In February 2012 the survey of fishermen owning seiners and smaller vessels revealed decrease in the number of anchovy as compared to the previous years. Anchovy is found at the Georgian coast in winter and spring. It is caught in winter. Spring and Summer is the reproduction seasons. The fishermen explained that anchovy had decreased in number due to climatic conditions (low temperature during the season), spilling of pyrolysis tar and increase in the number of seiners. Yet, the key reason is overfishing.

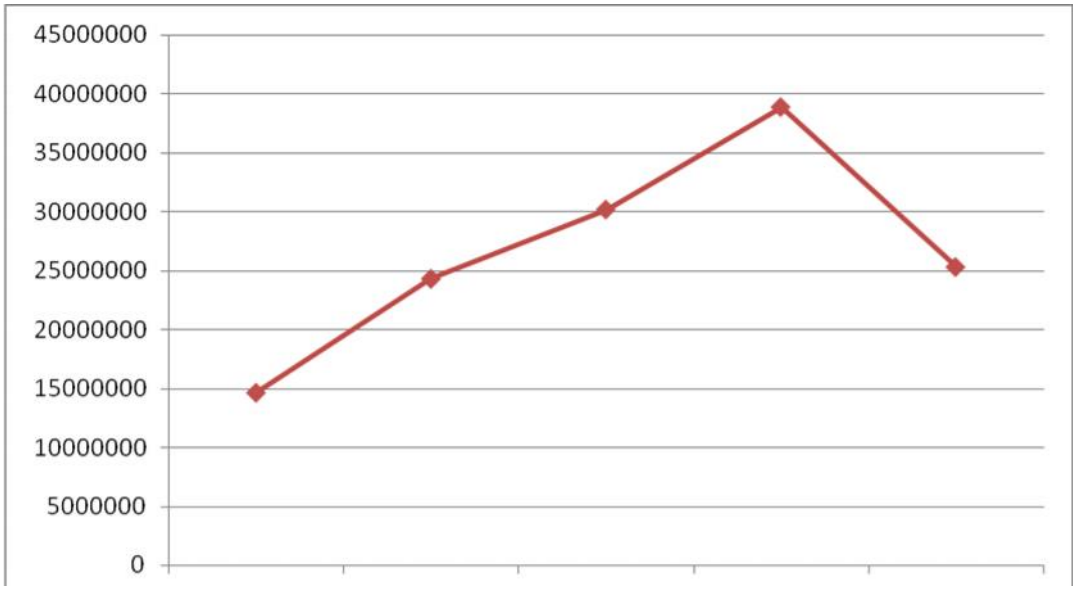


Chart.#3.the amount of anchovy caught in 2006-2011 (in kg)

The catch of mackerel was highest in 2008-2009. As is seen from Chart 4, later its

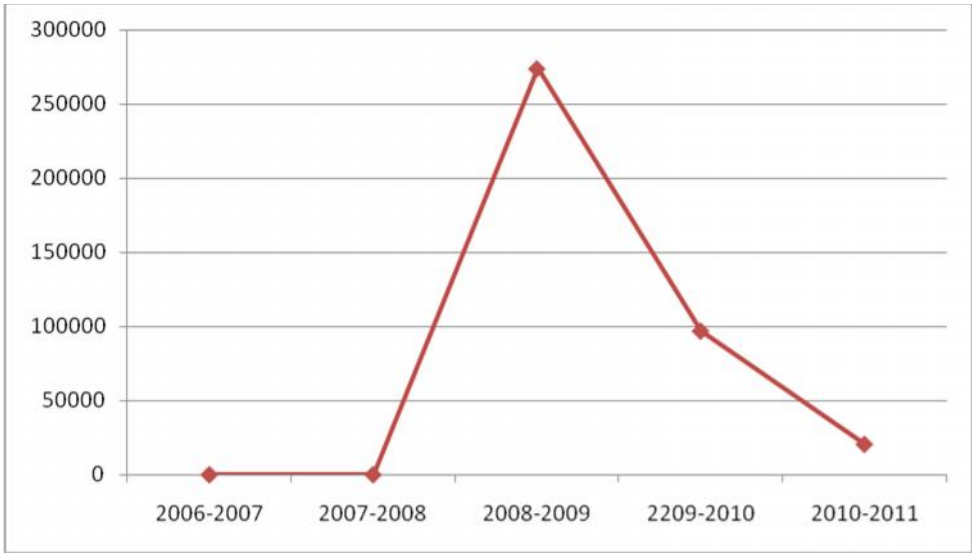


Chart.#4.the amount of mackerel obtained in 2006-2011 (in kg)

decreased according to the information provided by fishermen.

The catch of mullet was limited in 2006 -2009, whereas in 2010-2011, 15 000 kg were obtained (Chart #5)

The catching of whiting also increased rapidly in 2010-2011 (Chart.#6)

The amount of fish caught annually by the same companies reveals the tendency of decrease in the number of fish. Every following year proves decrease in the number of the specie of fish which was caught in large amount the previous year. This has a negative impact on fishermen, especially those who own a license. They pay taxes but are unable to

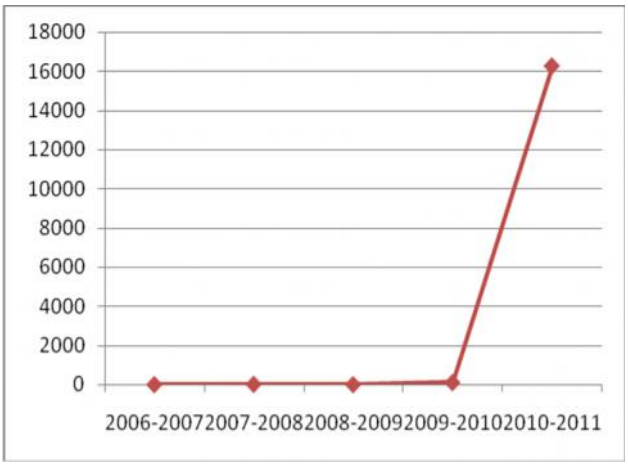


Chart 5. The amount of mullet caught in 2006-2011 (in kg)

meet the quotas. e.g. one licensed fisherman whose license envisaged 20 000 tons of anchovy had caught only 7000 tons by February. In March the obtaining season ends. Thus,

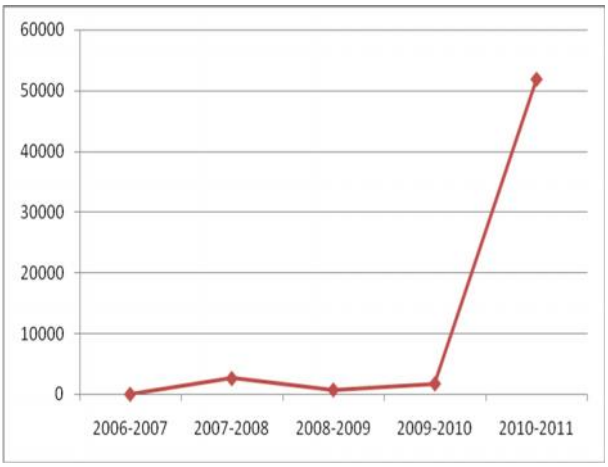


Chart 6. The amount of whiting caught in 2006-2011 (in kg)

it is likely that the owner of the license will not meet the quota.

Owners of smaller fishing boats also mention decrease in the number of fish: earlier (5–7 years ago) **half a ton of fish was caught within one kilometer. This year only 50 kg are caught within one km.**

Decrease in the anchovy, herring and shi drum catch caused increase in prices. This, in its turn, affected the consumer. Therefore, protection of fish species is important not only for the preservation of biodiversity but also for the development of fishing. For this purpose, it is necessary to establish quotas on the scientific basis, using modern methodology. It is necessary to implement permanent monitoring of the status of populations of commercial fish species.

Pressure on commercial and occasionally obtained species, benthic and pelagic communities was caused by amendments in the decree of April 6, 2011 on "The List of Objects of Fauna, Obtaining of Species, Terms and Allowed Weapons and Tools". The amendments involve a permission to use bottom trawls and decrease in the size of net loops. Especially dangerous for benthic communities is a form of trawl called bottom trawl.

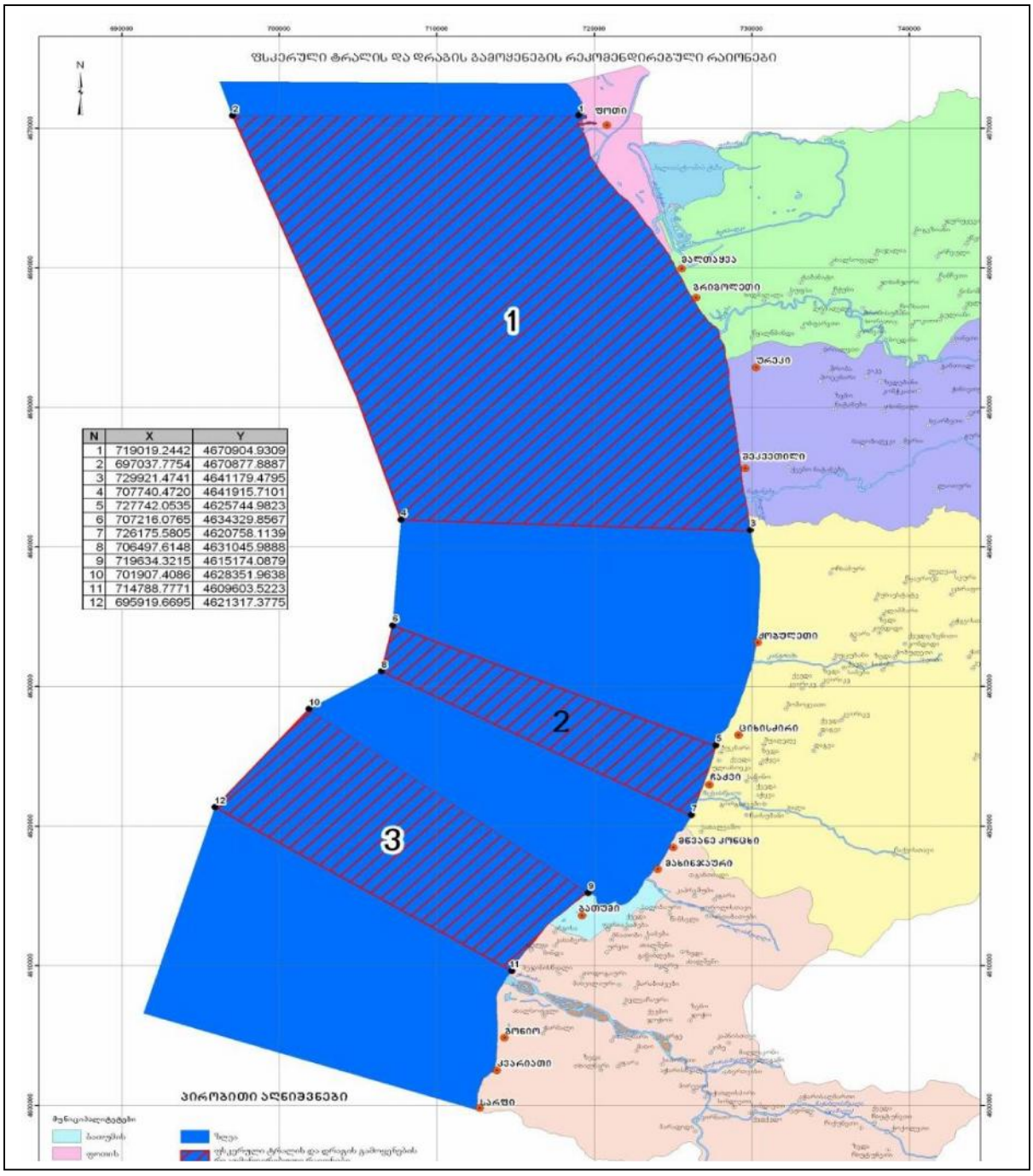
According to the legislation, bottom trawl is a trawl in which the total share of typical bottom fish and other hydrobionts like scates, flounders, gobies, bullfish, scorpionfish, weever, stargazer, mullet, ophidian, crowner, crabs mollusks and other benthic species exceeds 5%. Disturbance caused by the use of bottom trawl affects benthos habitats and the structure of the communities. Earlier there was a widespread opinion that trawl is favourable for the propagation of minor benthos organisms with short life cycle, as trawl frees them from the pressure of predation and competition. Numerous research proved that trawls cause significant decrease in the biomass of species of benthos communities. There is inversely proportional relationship between the size of animals and the frequency of trawl. Frequent use of trawl leads to a degraded ecosystem consisting of minor organisms and poor in the content of species. Increase in the productivity of some organisms does not compensate significant decrease in total productivity, because there is rapid decrease in the number of large-size animals (Jennings et al. 2001; Cryer, Hartill, O'Shea 2002). The use of bottom trawl annihilates filterer mollusks that represent food for numerous benthos fish, including sturgeon. Sites suitable for feeding and spawning are also destroyed. Apart from affecting cenoses of live organisms, long-term use of bottom trawls (for several subsequent days) affects water turbidity and bottom structure.

Corpuscles rising from the bottom spread over several kilometers and reduce the transparency of water. The bottom remains a “ploughland” for a long time. (Palanquet al. 2001). These traces are visible even on photos taken from the satellite. The width of the “ploughlands” is about 30 meters, while the depth is 50 cm. Reduction of water transparency affects the process of photosynthesis. Therefore, the content of oxygen is reduced in the thin layer of the Black Sea inhabited by live organisms. Research implemented in 2011 proved that bottom trawl affects the quality of benthos fish (quality means the ratio of weight to length) (Hiddink, Johnson, Kingham, Hinzam; 2011). Bottom trawl also affects top predators – dolphins. Due to the availability of food, dolphins often follow seiners in groups and are entangled in trawls, i.e. the probability of bycatching increases (Rayment, 2009).

In the Georgian part of the Black Sea the use of bottom trawl is permitted almost on the entire territory (See Map N5.). This territory embraces the estuaries of large rivers, spawning sites for numerous fish species, rich benthos cenoses and feeding territories for all the three dolphin species. Bottom trawls may cause additional problems in Georgian territorial waters. The depth of water rich in hydrogen sulfide, its spatial and seasonal change is not yet studied. Therefore, trawls may lead to the mixing of this water with the aerobic layer. This will deteriorate the quality of water.

One of the threats affecting numerous species is using dynamite. Despite prohibition, dynamite is often used by the estuaries of the rivers Kintrishi and Dekhva and other rivers too. Sometimes about a hundred kg of fish is obtained per one shot. Poachers select only large fish, leaving the smaller dead ones in the river. Dynamite is used even in fish reproduction season.

According to the IUCN Threats Classification Scheme (Version 3.0) the above-mentioned threats are categorized as follows: 5: 5.4; 5.4.2., 5.4.4 (5 – ***Biological resource use*** , sub-paragraphs for forms of use).



N	X	Y
1	719019.2442	4670904.9309
2	697037.7754	4670877.8887
3	729921.4741	4641179.4795
4	707740.4720	4641915.7101
5	727742.0535	4625744.9823
6	707216.0765	4634329.8567
7	726175.5805	4620758.1139
8	706497.6148	4631045.9888
9	719634.3215	4615174.0879
10	701907.4086	4628351.9638
11	714788.7771	4609603.5223
12	695919.6695	4621317.3775

V.4. Invasion

Anthropogenic introduction of alien species in the Black Sea, whether intentional or occasional, started in the 19th century. The impact of introduction of alien species on the ecosystem was highest in the 20th century. The Black Sea was characterized until the mid 1970s as a highly productive ecosystem at all trophic levels, which by the 1990s had degraded to an ecosystem with a low biodiversity dominated by a `dead-end'gelatinous food web. A number of factors, such as climate change, interannualnatural biological uctuations, anthropogenic impacts, including changes in river discharge quality resulting in a rise in eutrophication and pollution, overfishing of selective species together with the accidental introduction of exotic species from aquaculture projects, have resulted in great structural changes in the food web of the Black Sea.

Out of 26 invasive species of the Black Sea, 6 affected its ecosystem to a great extent. These species are: *Mnemiopsis leidyi, Rhithopanopeus harrisi, Rapana thomasiana, or Rapana venosa, mollusks Mya arenaria* and *Cunearca cornea* and fish *Mugil soiuy (Liza haematocheilus)*. The highestnegative impact is caused by *Mnemiopsis leidyi*. It was introduced into the Black Sea in the early 1980s, possibly in ballast water of ships from the north-western Atlantic coastal region. Being a rapidlyreproducing, self-fertilizing hermaphrodite, it possessed the ideal reproductive strategy for rapid colonization. As a generalized feeder, it is not prey specific and occursover a broad range of inshore, hydrographic conditions. This enabled *Mnemiopsis leidyi* to fast invade the new habitat. In the Black Sea it was first found in 1982. By 1989 its density reached its peak. The following year its number started to decrease until 1993. Then it increased again. The second peak was registered in 1994. The number decreased again until 1995. The seasonal changes in the population of *Mnemiopsis leidyi* are given in the table below.

February-June	*June-beginning of July*	*Second half of July-August*	*October-November*	*December-February*
Middle-sized individuals are found chiefly in the open sea. **Due to somatic growth, the size of wintered individuals increases.**	The population consists solely of adult individuals. The number and biomass are low. Chiefly found at the coastline.	Reproduction starts ($t \geq 23^0C$) first at the coastline, later in the open sea. There is a large number of small individuals.	The number of the population reaches its peak. Beginning from the middle of November there is only somatic growth.	Only middle-sized individuals are found in the open sea, below the surface layer, in comparatively warm water $t \geq 4^0C$

Table N4. Seasonal change of the population of Mnemiopsis leidyi according to Shiganova (Shiganova, 1998)

Degradation of the ecosystem had started before the invasion of *Mnemiopsis leidyi* in the Black Sea. Degradation was due to the following reasons: strong eutrophication, changes in the hydrological regime of adjoining rivers caused by the construction of irrigation systems and hydroelectric power stations, overfishing. As a result of excessive fishing, the density of numerous commercial fish species decreased. Eutrophication led to the change in the structure of zooplankton and phytoplankton. The change in the hydrological logical regime weakened the surface currents of the Black Sea. The greatest effects occurred in the north, where the infuence of rivers such as the Danube, Dnieper, Dniester, Don and Cuban determined the hydrochemical regime. The surface currents in the
Black Sea are generated by inflow from these rivers and inflow through the Strait of Kerch from the Sea of
Azov. These inflows also affect the velocity of the rim current in the west (Rumelian current) and central
Black Sea, which is directed towards the Bosphorus, particularly during the spring flood. These currents
determine the extent of migration of pelagic species (Scomber scomber, Sarda sarda, Pomatomus saltatrix andTrachurus trachurus) in the spring from the Sea of Marmara to the northern Black Sea .

A decrease in current velocity resulted in a limitation of the extent of migration of these species to the north and a decrease in the number of migrating fish. A simultaneous input of nutrients and toxic substances from a large catchment basin caused changes in the hydrochemical regime with consequent eutrophication.
The changes in benthic communities caused by eutrophication decreased the number of the following species: *Psetta maxima, Solea lascaris nasuta, Platichthys flesus, Arnoglossus kessleri*. In the beginning of the 1980s the number of jellyfish *Aurelia aurita* increased, chiefly due to eutrophicaiton. Accumulation of nutrients created a favourable environment for this specie.

All the above-mentioned was added by the appearance of *Mnemiopsis leidyi.* Increase of its number decreased the number of ichtyoplankton and mesozooplankton and reduced the diversity of species. Some crustaceans disappered altogether from zooplankton. Comb jelly (*Mnemiopsis leidyi)* most affected the fish spawning in summer e.g. anchovy. There was negative correlation between the density of fish spawning in winter and the density of *Mnemiopsis leidyi. Mnemiopsis leidyi* also affected the density of sprats.

Since 1999 the biomass of comb jelly (*Mnemiopsis leidyi)* has decreased due to the appearance of a new invasive specie - *Beroe ovata* which feeds almost exclusively on *Mnemiopsis*. Since this time, it appears that the trend of decreasing numbers of phytoplankton-eating zooplankton has begun to reverse, possibly as a consequence of *Beroe*'s appearence, but the data are so variable that this is not possible to say with any certainty. The highly seasonal reproductive pattern of *Beroe ovata* means that long-term *Mnemiopsis* eradication due to the introduction of *Beroe ovata* is unlikely. Assessment of the comb jelly situation over the past decade is also complicated by the natural 3-4 year cycle of *Mnemiopsis* abundance/biomass, which occurs in both the NE Atlantic (from where *Mnemiopsis* originates) and the Black Sea.
Besides, severe winter also affects the number of *M. leidyi*. In the years when winter temperature was extremely low, the number of *Mnemiopsis leidyi* decreased significantly in spring. However, in conditions of higher temperature and abundance of nutrients, the biomass of *M. leidyi* increases rapidly.

It should be mentioned that in Georgian territorial waters *Mnemiopsis leidyi* was found in autumn 2009 in the open sea. In spring 2010 about ten individuals were found near Poti port. In spring 2011 6 individuals were found near Grigoleti. The size of the latter

individuals was about 8 centimeters. In the same period middle-sized and large *Mnemiopsis leidyi* were found in a shallow water near a sandy coast. This was a period of spawning of various fish species. The existence of *Mnemiopsis leidyi* in the spawning places is a significant threat for larvae and spawns.

Another invasive specie affecting the Black Sea ecosystems is veined rapa whelk (*Rapana thomasiana, or Rapana venosa*). It decreased the number of bivalve populations. As these mollusks filter the water, decrease in their number leads to the deterioration of the quality of water. Besides, bivalves and mussels are significant food for fish, including rare species (e.g. sturgeon). Thus, decrease in the food resources naturally leads to the decrease in the number of fish.

The invasive species of the Black Sea are divided into three groups: I. North Eureopan (NEU); II - Atlantic (AT); III - Pacific (PC). The main sources of invasion are ships, ballast waters, aquaculture. The list of invasive species of the Black Sea is given in Table # 7 in the Appendix.

The above-given threat corresponds to the following IUCN categories: 8 (8 Invasive & other problematic species & genes): 8.1 – „Invasive non-native/alien species".

V.5. Natural system modifications

According to the information provided by mass media, it is planned to build a new city with half-million population – Lazika, which will be located on the Black Sea coast. This will be the second largest city in Georgia after Tbilisi and the economic center of Western Georgia. The construction process will involve reclamation of relict bogs. Protection of humid territories, including these marshes, is the obligation of Georgia under RAMSAR Convention[2]. The territory is also protected under Georgian legislation as part of Kolkheti National Park. Bog reclamation will lead to annihilation of numerous plant and animal species.

This territory is a migration site for thousands of water birds. About 900 000 migrating raptors of 34 species and 84 species of 16000 passerine birds are counted annually.Such an amazing number of migrating raptors makes East Black Sea bottleneck

[2] In 1997 Kolkheti National Park and Kobuleti Protected Area were attached the status of humid territories of international significance.

the most important raptor migration site of Western palearctic and third largest (4-6 mln. raptors at Veracruz, Mexico; 2 mln. raptors at Eilat, Israel) raptor migration site on the planet. Therefore, destruction of this already affected natural ecosystem may be considered a threat of global scale.

Information is also spread regarding the consutruction of a new port in Anaklia. This is the location of one of the deepest canyons on the Black Sea coast; hence, it is convenient for the construction of a sea port. Numerous fish species spawn on this territory. The place is also favourable for the representatives of sturgeon family on IUCN and Georgian Red Lists. Anaklia is a feeding territory for all the three dolphin species (bottlenose, white-sided dolphin and herring hog). Therefore, these mammals on the IUCN Red List are also endangered.

Besides the above-mentioned, the process of active urbanization will increase the amount of sewage and other types of pollution. This will enhance eutrophication and decrease oxygen in the Black Sea layers. Eutrophication will be aggravated by the change in the hydrological regime caused by bog reclamation. As a result, instead of tourism development zone, this place will turn into an environment unsuitable for life.

The given threat corresponds to IUCN categories: **1**(1.1; 1.2; 1.3) ; **6** (6.1); 7 (7.3); **9** (9.1; 9.4).

VI. Protected Area

Kolkheti National Park is located in western Georgia. It covers the eastern zone of the Black Sea coast and the basin of the Paliastomi Lake. The Park is established with the purpose of protection and maintenance of wetland ecosystems. The Kolkheti lowland became the subject of international interest first in 1996, when Georgia joined the Ramsar Convention on “Wetlands of International Importance Especially as Waterfowl Habitat”. In 2000 Kolkheti National Park began full-scale functioning. The park consists of separate territories – districts. The Park is divided into the following natural geographical districts: Anaklia-Churia (between the coastline sections of gorges of the Churia River and the Khobistskali River), Nabada (between the western sections of the gorges of the Khobistskali River and the Rioni River) and Imnati (between the western sections of the gorges of the Rioni River and the Supsa River). These are the places where the ecosystems of wetlands are best preserved. Besides, the National Park includes the sea water area located between the estuaries of the rivers Rioni and Churia. The area of

Anaklia-Churia embraces 13713 hectares; Nabada district covers 10697 hectare area, and Imnati district area embraces 19903 hectares. In total, the land area of the National Park is 28571 hectares, and the sea water area is 15 742 hectares.

The marine mammals are represented by 3 species of dolphins, such as: the bottle-nose olphin (Tursiops truncatus), common dolphin (Lagenorhynchus acutus) and harbor porpoise (Phocoena phocoena).

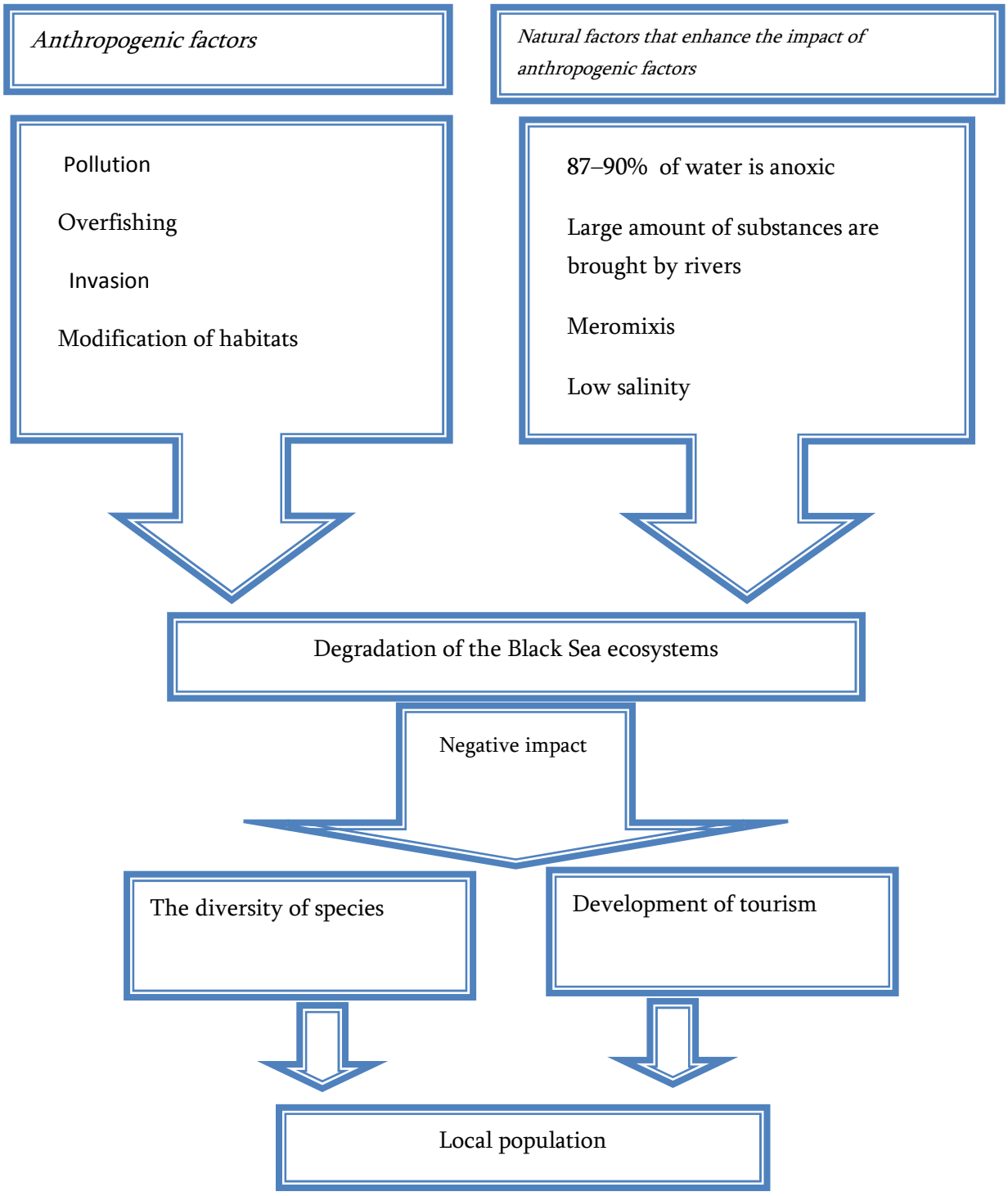
Ichtyofauna of the National Park is represented by 88 species, out of which 23 species are transiting, 21 species live in fresh water and 44 species live in the Black Sea. Among the cartilaginous fish the Atlantic sturgeon and beluga can be distinguished, and among the bony fish – the Black Sea salmon, herring, striped mullet, pike, bonito etc.

6 species of fish of the Red List of Georgia are widespread in the water ecosystems of Kolkheti National Park, such as: beluga (Huso huso), sea sturgeon (Acipenser sturio), Sevruga sturgeon (Acipenser stelatus), sea trout (Salmo fario (truta) morpha), Sand goby (Gobius (Neogobius) fluvatilis), roach (Rutilus frisii).

Kolkheti National Park, kingfisher

Kolkheti National Park, common dolphin

Below is given a summary scheme N1, reflecting the threats to the Black Sea biodiversity. Anthropogenic pressure is added by natural conditions characteristic of the Black Sea. Degradation of ecosystems affects not only the number and diversity of wildlife species, but also hampers the development of tourism. All this is a threat to the welfare of the local population.



Scheme N1. Factors affecting the Black Sea biodiversity and the welfare of the population

Key political instruments of protection of the Black Sea; Georgian legislation

VII.1. International conventions, agreements and organisations

Since 1993 Georgia is member of the **Internatrional Marine Organisation (**IMO). The regulations of this organization refer to ballast waters, as they are an important source of invasion of alien species. In 2002 a joint decree of Georgian Minister of Environmental Protection and Natural Resources and Georgian Minister of Transport and Communications №83-№53 was issued concerning „The Procedures of Ballast Water Management in Georgia“. This decree regulates the management of ballast waters in Georgia. Spilling of ballast waters in the open sea is prohibited. The ships in Georgian ports should change ballast waters before entering the second sanitary district (50-mile zone), at least at 25 nautical miles from the nearest shore, on the territory of 100 meters' depth.

On July 20-22, 2011 a training was held in Batumi aimed at preparation of the employees of the marine administration and the port for elementary biological research in the port. The training was held within a joint program GloBallast (GEF/UNDP/IMO). The aim of the program is to assist the developing countries in the reduction of the invasion of pathogenic water organisms and elaboration of a convention on the management of ballast waters.

In 1993 Georgia joined **MARPOL Convention on the Prevention of Pollution from Ships** (London, 1973). MARPOL Convention is aimed at the prevention of pollution from ships, which in its turn reduces the threats caused by pollution.

Georgia joined **Bucharest Convention on the Protection of the BLack Sea Against Pollution** in 1992. According to the Convention, the Sides are obliged to pay special attention to the protection of living marine resources, change of their habitat due to fishing and other legal use of the sea. Georgia is obliged to fulfill the following protocols of the Convention: “PROTOCOL ON PROTECTION OF THE BLACK SEA MARINE ENVIRONMENT AGAINST POLLUTION FROM LAND BASED SOURCES ”; “PROTOCOL ON COOPERATION IN COMBATING POLLUTION OF THE BLACK SEA MARINE ENVIRONMENT BY OIL AND OTHER HARMFUL SUBSTANCES IN

EMERGENCY SITUATIONS"*;* "PROTOCOL ON THE PROTECTION OF THE BLACK SEA MARINE ENVIRONMENT AGAINST POLLUTION BY DUMPING".

On September 24, 2009 **The Black Sea Biodiversity and Landscape Conservation Protocol** to the Convention on the Protection of the Black Sea Against Pollution was signed in Sofia, Bulgaria 2002 was ratified. Georgia also signed this protocol, according to which all members of the protocol should join their efforts to protect the biological and landscape diversity of the Black Sea, preserve and, where possible, improve its ecological health, historical, cultural and aesthetic values.

Protection of the Black Sea is also an issue of **the Convention on the conservation of European wildlife and natural habitats (Bern Convention)**, joined by Georgia in 2008.

This Convention regulates the protection of European species and habitats. Common dolphin (*Delphinus delphis*), bottlenose dolphin (*Tursiops truncatus*), harbor porpoise (*Phocoena phocoena*), Atlantic sturgeon (*Acipenser sturio*) and beluga (*Huso huso*) are listed on the Appendix 2 of Bern Convention. These species are found on the Georgian coast of the Black Sea.

Appendix 2 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora) (CITES) protects Black Sea bottlenose dolphin (*Tursiops truncatus*), all sturgeon species except Atlantic sturgeon (*Acipenser sturio*), which is included in Appendix 1. Georgia became part of this Convention in 1996.

The Convention on Biological Diversity was signed by Georgia in 1994. It regulates the protection of biodiversity on the entire Georgian territory, including the Black Sea.

The Convention on Migratory Species of Wild Animals (CMS; Bonn Convention) was joined by Georgia in 2000. It underlines the protection of Black Sea bottlenose (*Tursiops truncatus*) and Atlantic sturgeon (*Acipenser sturio*) (Appendix 1). Harbour porpoise (*Phocoena phocoena*) and other species of sturgeon are listed in Appendix 2.

T**he Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS).** Agreement under the Bonn Convention on the Conservation of Migratory Species of Wild Animals . Georgia signed this Agreement in 2001. The Agreement envisages the protection of all the three species of Black Sea dolphins and their habitats.

National Environmental Action Plan

According to the Decree 127 of the Government of Georgia, issued on January 24, 2012, the second National Environmental Actions Plan (2012–2016) (NEAP-2) was approved. Chapter 5 embraces the problems of the Black Sea: eutrophication, decline in commercial marine living resources, degradation of the Black Sea marine and coastal biodiversity and habitats and poor water quality . The activities mentioned in the program are important, yet too general. More concrete activities should be outlined in the Biodiversity Protection Action Plan. The plan has been adopted recently, but actions aimed at certain objectives are already launched (e.g. elaboration of indicators for the Black Sea biodiversity).

The Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea

On April 17, 2009, in Sofia (Bulgaria) an updated plan of strategic actions for the protection and rehabilitation of the Black Sea was adopted. The TDA 2007 reconfirmed four priority transboundary environmental problems, described above, requiring coordinated efforts by all Black Sea coastal States. It was determined that these areas of concern, and their causes, could be most effectively and appropriately addressed through the aims of four Ecosystem Quality Objectives (EcoQOs). The four EcoQOs and associated Sub EcoQOs are:In this regard, four key objectives were outlined in order to improve of four Ecosystem Quality Objectives (EcoQOs)the quality of the ecosystem (EcoQO):

- **EcoQO 1: Preserve commercial marine living resources**

  EcoQO 1a: Sustainable use of commercial fish stocks and other marine living resources.

  EcoQO 1b: Restore/rehabilitate stocks of commercial marine living resources.

- EcoQO 2: **Conservation of Black Sea Biodiversity and Habitats.**

  EcoQO 2a: Reduce the risk of extinction of threatened species.

  EcoQO 2b: Conserve coastal and marine habitats and landscapes.

- **EcoQO 3 – Reduce eutrophication**

- **EcoQO 4 - Ensure Good Water Quality for Human Health, Recreational Use and Aquatic Biota.**

EcoQO 4a: Reduce pollutants originating from land based sources, including atmospheric emissions.

EcoQO 4b: Reduce pollutants originating from shipping activities and offshore installations

Georgia, as part of the document, is obliged to fulfill and implement the recommendations given in the document. However, recent amendments in the Georgian legislation are contrary to the objectives of **The Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea.** According to activity EcoQO 1b (4), non-preventive methods of fishing, including the use of dredges and bottom trawls, was prohibited. The activity also embraced reduction of bycatching and obtaining of juvenile (not adult) fish (EcoQO 1b activities (7,8)). The Decree of April **6,** 2011 on the amendments to the list of weapons and equipment permitted for obtaining objects and species of wildlife, envisages permission for the use of dredges and bottom trawls, reduction of the size of net loops and obtaining of non-adult fish. All this contradicts the recommendations given in the above-mentioned document.

VII.2. Georgian legislation.

Below are given the amendments that contradict Georgia's obligations toward the international community with regard to the protection of the Black Sea biodiversity and habitats.

There were several amendments in the Decree of April 6, 2011 on the rules and terms of use of wildlife resources, the list of tools and equipment permitted for catching wildspecies:

Sub-Paragraph (b) of paragraph 3, article 7:

Fishing is prohibited „b) all the year round at the estuaries of rivers suitable for sturgeon and salmon and at the estuary space of the Black Sea – at the distance of 300 meters around the estuary". – As compared to the earlier permitted 500 meters, the distance was reduced by 200 meters. This is a threat to the already endangered fish species.

The terms of prohibition of obtaining certain fish species also changed:

Sub-paragraph (e) of Article 8

Turbot – „e) european turbot –From may 1 to July 1, instead of earlier defined February 15-July 1; which means that prohibition terms were reduced by 2.5 months. This increases pressure on one of the most important representatives of benthos communities. Reproduction of this specie starts in April and reaches its peak in May, lasting until the middle of July.

Sub-Paragraphs (g) and (h), concerning prohibitions, were withdrawn.

g) By means of dredges of all constructions, including Khizhnyak construction;

h) Bottom trawls (bottom trawl is a trawl in which the total share of typical bottom fish and other hydrobionts, scats, flounders, gobies, scorpionfish, stargazer, mullet, ophidion, crowner, crabs, mullusks and other inhabitants of the bottom, exceeds 5% (when counted).

sub-paragraph (d) of Article 10 was also withdrawn. This sub-paragraph prohibited ***the use of nets the length of which exceeded 300 meters in the sea and 120 meters in internal waters, whereas the length of pulling ropes exceeded 20 meters;*** THUS, CURRENTLY THE PARAMETERS OF NETS ARE NOT REGULATED.

Besides, Paragraph 5 was added to Article 10, which says: Fishing is prohibited using dredges of all constructions and bottom trawls **outside the limits of certain zones defined by geographical coordinates** (these „limits“ embrace a huge territory; see the Map 5). It should be stressed that before the adoption of this amendment, the above-mentioned types of equipment were prohibited altogether.

As a result of updating paragraph 12, the size of anchovy, permitted for obtaining, was reduced. At the same time, according to Paragraph 2 of Article 13, the permitted number of fish with minimum length was increased to 40%. This has increased pressure on anchovy and affected its number. According to the same amendment (APPENDIX #1) the size of loops of fishing nets was reduced**:** ***the size of loops of casting nets used for catching mullet-like fishes was reduced from 20 mm to 12 mm, the size of loops in tangling nets was reduced from 28 mm to 18 mm.*** THEREFORE, A GREATER AMOUNT OF JUVENILE FISH IS FOUND IS NETS, WHICH AFFECTS THE TOTAL NUMBER OF FISH.

The fees (determined by the Georgian legislation) for the catching of sturgeon species equals 3000 GEL, for the catching of salmon species equals 525 GEL. This law contradicts other laws. The fee Meanwhile, according to Article 8 of the regulations, terms and the list of weapons and equipment permitted for obtaining objects and species of wildlife, catching of the following species is prohibited:

a) sturgeon species – all the year round;

c) Black Sea salmon – all the year round.

Thus, the two above-mentioned laws contradict each other.

The Ministry of Environmental Protection explained the above-mentioned contradiction as follows: fee is envisaged for sturgeon and salmon species in order to define the amount of fine in case of illegal fishing.

VIII. Projects Implemented in Georgia in the Field of Protection of the Black Sea

Title: Restoration of the Black Sea ecosystems II Phase – Pilot monitoring on the Black Sea 2006-2007

Donor Organization: United Nations Development Programme, Global Environmental Facility

Project Goal: Participation of laboratories/organizations in pilot exercises concerning the analysis and control of sediments (organic and inorganic), water column (nutrients), zooplankton, benthos and phytoplankton.

Title: A Supporting Programme for Capacity Building in the Black Sea Region towards operational status of Oceanographic Services- ASCABOS. 2005-2008.

Donor Organization: EU Sixth Framework Programme

Project Goal: Improvement of Black Sea forecasting and operative observation systems for all basin countries. Development of oceanographic services in order to ensure transport security on the Black Sea

Title: Black Sea Scientific Network, SCENE 2005-2008

Donor Organization: EU Sixth Framework Programme

Project Goal: Creation of scientific network in the Black Sea and coastal zones of Black Sea countries. Integration and harmonization with relevant EU networks.

Title: Control of pollutants, regarding rehabilitation of the Black Sea ecosystem 2005-2007

Donor Organization:UNDP - GEF

Title: Study of Vibrio physiological group in the Black Sea coastal zone in Georgia

Donor Organization: US Defence Threat Reduction Agency (DTRA)

Appendices










Table N1. PLants by Habitats

1110 Sandy coast thinly covered with sea water

Green algae of the sea	*Green algae.: Chaetomorpha linum*, *Ch. aerea, Ch.crassa, Cladophora cristallina*, *C. dalmatica, C. laetevirens, Enteromorpha intestinalis*, *E.linza, E. prolifera, Ulva rigida, Urospora penicilliformis* etc.; Brown algae: *Cystoseira barbata*; Red alage: *Bangia fuscopurpurea*, *Ceramium rubrum* da *Callithamnion corymbosum* Phytoplankton: The moast widespread diatoms are *(Nitzschia longissima, N. seriata, Rhizosoleniaalata, Rh. calcar-avis, Thalassiosira parva)*
Sea plants	*Bangia fuscopurpurea*, *Callithamnion corymbosum*, *Ceramium rubrum, Chaetomorpha linum*, *Ch. aerea, Ch. crassa, Cladophora cristallina*, *C. dalmatica, C. laetevirens,* *Cystoseira barbata*, *Enteromorpha intestinalis*, *E. linza, E. prolifera, Nitzschia* *longissima, N. seriata, Rhizosolenia alata, Rh. calcar-avis, Thalassiosira parva, Ulva* *rigida, Urospora penicilliformis*,

1130 Delta (Estuary)

Sea plants
Lemna minor, Spirodela polyrhiza, Salvinia natans, Hydrocharis morsus- ranae, *Myriophyllum spicatum, Potamogeton pusillus, P. natans, P. crispus, P. perfoliatus,* *Nymphaea candida, Nuphar luteum, Trapa colchica*, *Zostera* spp., *Chara* spp., *Eleocharis* spp., *Euphorbia peplis, Cakile maritima, Salsola tragus, Eringium maritimum.*

21150 Coastal lagoon

Sea algae	*Chaetomorpha linum*, *Ch. aerea, Ch. crassa, Cladophora cristallina*, *C. dalmatica, C.laetevirens, Enteromorpha intestinalis*, *E. linza, E. prolifera, Ulva rigida, Urospora penicilliformis* etc. Brown algae - *Cystoseira barbata*; Red algae - *Bangia fuscopurpurea*, *Ceramium rubrum* da *Callithamnion corymbosum.* FPhytoplankton: diatoms (*Thalassiosira parva, Nitzschia seriata, Nitzschia longissima, Rhizosolenia alata, Rhizosolenia calcar-avis)*
Still water algae	LBlue-green algae Cyanophyta : *Anabaena flos-awuae, Anabaena variabilia, Gloeocapsa turgida,* *Merismopedia glauca, Microcystis grevillei, Microcystis pulverea, Oscillatoria brevis, Oscillatoria limosa, Oscillatoria tenuis, Spirulina subtilissima.* flint algae – Cillariophyta - diatoms: *Cyclotella kuetzingiana, Cyclotella meneghiniana, Caloneis bacillum, Cocconeis placentula, Cymbella ventricosa,* *Gomphonema acuminatum, Navicula cryptocephala, Nitzschia amphibia, Nitzschia dissipata, Pinuularia viridis, Synedra ulna.* green algae: Chlorophyta *Cladophora glomerata, Oedogonium* sp., *Pediastrum boryanum, Scenedesmus acuminatus, Scenedesmus obliquus, Scenedesmus quadricauda, Spirogyra* sp., *Ulotrix zonata*
Caliciform plants	*Euphorbia peplis, E. paralias,* *Cakile maritima, Salsola tragus, Silene euxina, Digitaria ciliaris, Polygonum littorale, Calystegia soldanella, Satchys maritima, Eringium maritimum,* etc. On the coast of Guria there is *Convolvulus persicus.* Near Grigoleti there is - *Trapa colchica,* *Lemna minor, Salvinia natans, Utricularia vulgaris, Myriophyllum spicatum, Potamogeton pectinatus, etc.*

1160. Shallow water and bay

Algae	Green algae of the sea: *Enteromorpha intestinalis*, *Urospora penicilliformis*, *Ulva rigida, Enteromorpha linza, E.prolifera, Cladophora laetevirens, Chaetomorpha linum*, *Ch. aerea, Ch. crassa, Cladophora cristallina*, *C. dalmatica,* etc. Brown algae - *Cystoseira barbata*; Red algae - *Bangia fuscopurpurea*, *Ceramium rubrum* and *Callithamnion corymbosum*. FPhytoplankton is broadly represented by diatoms: *Thalassiosira parva, Nitzschia seriata, Nitzschia longissima, Rhizosolenia alata, Rhizosolenia calcar-avis.*
Plant species	*Enteromorpha intestinalis*, *Urospora penicilliformis*, *Ulva rigida, Enteromorpha linza, E.prolifera, Cladophora laetevirens, Chaetomorpha linum*, *Ch. aerea, Ch. crassa, Cladophora cristallina*, *C. dalmatica, Bangia fuscopurpurea*, *Ceramium rubrum, Callithamnion corymbosum*. *Thalassiosira parva, Nitzschia seriata, Nitzschia longissima, Rhizosolenia alata, Rhizosolenia calcar-avis.*

Table N2. Seasonal change of phytoplankton

Season	Dominant species and genera	Average portion of total number 0-10-25m per layer	Biomass
Spring	*Rhizosolenia alata* *Rhizosolenia calcar avis* *Exuviella* *Peridinium* *Amphydinium* *Goniaulax* *Prorocentrum*	0-10-25 m in layers comprises $115*10^6$ $kl.m^{-3}$	648 $mg.m^{-3}$.
Summer	*Chaetoceros affinis* *Chaetoceros borgei* *Chaetoceros compressus* *Chaetoceros curvisetus* *Chaetoceros danicus* *Chaetoceros gracillis* *Rhizosolenia calcar* *Cyclotella caspia* *Exuviella cordata* *Exuviella compressa* *Goniaulax cochlea* *Amphydinium lanceolatum* *Peridinium subinerme* *Peridinium trochoideum* *Peridinium decipiens* *Prorocentrum micans* *Prorocentrum scutelum*	For dinoflagellates- $93*10^6$ $kl.m^{-3}$ For diatoms- $381*10^6$ $kl.m^{-3}$ For the entire phytoplankton- $282*10^6$ $kl.m^{-3}$	For dinoflagellates - 833 $mg.m^{-3}$ For diatoms- 294$mg.m^{-3}$ For the entire phytoplankton - 1,832 $mg.m^3$.
Autumn	*Chaetoceros socialis* *Chaetoceros curvisetus* *Chaetoceros affinis* *Chaetoceros borgei* *Coscinodiscus jonesianus* *Cyclotella caspia*	For diatoms- $429*10^6$ $kl.m^{-3}$ For peridium- $38.6*10^6$ $kl.m^{-3}$	For diatoms - 4,043 $mg.m^{-3}$ For peridium- 312$mg.m^{-3}$

Table N3. Zoobenthos species, based on research of the 1990s

Animal groups	Species	Animal groups	Species
CNIDARIA	Actinothoe clavata	**Phoronidea**	Actinotrocha metschnikoffi
	Actinia equina		Phoronie euxinicola
Polychaeta	Aricidea jeffreysii	**Crustacea**	
	Ancistrosyllis tentaculata	**Cirripodia**	Balanus improvisus
	Aonides paucibranchiata		Balanus eburneus
	Aonides sp.	**Decapoda**	Athanas nitescens
	Amphitrite gracilis		Brachynotus sexdentatus
	Capitella capitata		Grangon grangon
	Capitomastus minimus		Diogenus pugilator
	Eteone picta		Hippolyte longirostris
	Eteone siphonodonta		Callianassa truncate
	Exogone gemmifera		Callianassa pestai
	Fabricia sabella		Clibanarius erythropus
	Glycera alba		Palaemon elegans
	Glycera capitata		Palaemon adspersus
	Glycera tridactula		Pilumnus hirtellus
	Heteromastus filiformis		Potamon potamios
	Harmothoe imbricata	**Castropoda**	Bela nebula
	Harmothoe reticulata		Calyptraea chinensis
	Laonice cirrata		Cerithidium pusillum
	Mellinna palmata		Cerithium vulgatum
	Magolona resea		Clathrus turtonin
	Magelona papillicornis		Cyclope donovani
	Mystides limbata		Cylichnina strigella
	Nephthys longicornis		Cylichnina variabilis
	Nephthys cirrosa		Cylichnina robagliana
	Nephthys hombergii		Gibbulla albida
	Nereis succinea		Hydrobia sp.
	Nereis diversicolor		Mohrensternia parva

	Nereis longissima		*Nana donovani*
	Nereis zonata		*Nana neritea*
	Nainereis laevigata		*Ostrea edulis*
	Nerine cirratulus		*Proneritula westerlundi*
	Nerinides tridentata		*Rapana thomasiana*
	Oridia armandi		*Retuca truncatella*
	Prionospio cirrifere		*Tritia reticulata*
	Prionospio malmgreni	***Bivalvia***	*Abra nitida milachewichi*
	Paraonis fulgens		*Chamelea gallina*
	Paraonis gracilis		*Donacilla cornea*
	Paraonis sp		*Donax semisstriatus*
	Phyllodoce lineate		*Donax trunculus*
	Phyllodoce mucosa		*Fabula fabula*
	Phyllodoce maculata		*Couldia minima*
	Pholoe synophthalmica		*Hypanis anqusticostata anqusticostata*
	Phyllodoce nana		*Hypanis pontica*
	Polydora ciliaata		*Hypanis colorata*
	Polycirrus sp.		*Lucinella divaricata*
			Moerella donacina
			Moerella tenuis
			Modiolus phaseolinus
			Mytilus galloprovincialis
			Mytilaster lineatus
			Pitar rudis
			Pitar mediterranea
			Polititapes aurea
			Plagiocardium simili
			Spisula trianqula

Table N 4.Certain fish species of the Black Sea and their conservation status

Latin name	Habitat	Conservation status	Document
Sprattus sprattus sprattus (Linnaeus, 1758)	*Pelagic*	*LR*	*FB*
Sardinella aurita (Valenciennes 1847)	*Pelagic*	*LR*	*FB*
Sardina pilchardus (Walbaum 1792)	*Pelagic*	*VU*	*FB*
Engraulis encrasicolus ponticus (Alesandrov, 1927)	*Pelagic*	*LR*	*FB*
Trachurus mediterraneus ponticus (Aleev, 1956	*Pelagic*	*LR*	*FB*
Salmo labrax (Pallas, 1814) (Salmo trutta labrax Pallas, 1814)	*Demersal-anadromous*	*EN*	*FB*
Mugil cephalus (Linnaeus, 1758)	*Pelagic –neritic*	*LR*	*FB*
Liza aurata (Risso,1810)	*Pelagic –neritic*	*LR*	*FB*
Liza saliens (Risso, 1810)	*Pelagic -neritic*	*LR*	*FB*
Atherina boyeri (Risso, 1810) (Atherina mochon pontica Eichwald, 1831)	*Demersal, Pelagic –neritic*	*LR*	*FB*
Mullus barbatus (linnaeus 1758)	*Denersal, bentho- Pelagic*	*LR*	*RBS*
Sarda sarda (Bloch, 1793)	*Pelagic*	*LR*	*RBS*
Scomber scombrus Linnaeus, 1758	*Pelagic*	*LR*	*FB*
Platichthys flesus (Linnaeus, 1758) (=Platichthys flesus lussus (Pallas, 1814)	*Demersal, Benthos*	*LR*	*FB*
Merlangius merlangus (Linnaeus 1758)	*Demersal,bentho- Pelagic*	*LR*	*FB*
Raja clavata (Linnaeus, 1758)	*Demersal, bentho- Pelagic*	*LR*	*IUCN*
Belone belone (Linnaeus, 1761) (Belone belone euxini Gunther, 1866)	*Pelagic*	*LR*	*RBC*
Umbrina cirrosa (Linnaeus, 1758)	*Demersal, bentho- Pelagic*	*LR*	*FB*
Alosa immaculata (Bennett 1835)	*Pelagic,Neritic*	LR	*IUCN*
Sciaena umbra (Linnaeus, 1758)	*Demersal, bentho- Pelagic*	*LR*	*FB*
Diplodus annularis (Linnaeus, 1758)	*Demersal, bentho- Pelagic*	*VU*	*RBS*
Spicara smaris (Linnaeus, 1758)	*Demersal, Pelagic –neritic*	*LR*	RBS
Symphodus tinca (Linnaeus, 1758)	*Demersal, bentho-pelagic*	*LR*	*RBS*
Acipenser nudiventris (Lovetsky 1828)	*Demersal, anadromous*	*CR*	*IUCN*
Symphodus ocellatus (Linnaeus, 1758)	*Demersal, bentho- Pelagic*	*VU*	RBS
Acipenser gueldenstaedtii (Brandt & Ratzeburg, 1833)	*Demersal*, anadromous	*CR*	*IUCN RBS*
Acipenser stellatus (Pallas, 1771)	*Demersal, anadromous*	*EN*	*IUCN RBS*
Acipenser sturio (Linnaeus, 1758)	*Demersal, anadromous*		*IUCN*
Huso huso (Linnaeus, 1758)	*Demersal, anadromous*	*EN*	*IUCN*

Acipenser persicus (Borodin, 1897)	*Demersal, anadromous*	*EN*	*FB*
Acipenser persicus colchicus (Marti, 1940)	*Demersal, anadromous*	*EN*	*FB*
Acipenser ruthenus (Linnaeus, 1758)	*Demersal, potamodromous*	*CR*	*IUCN*
Squalus acanthias (Linnaeus, 1758)	*Bentho- Pelagic*	*LR*	*IUCN*
Uranoscopus scaber (Linnaeus, 1758)	*Demersal –Benthos*	LR	RBS
Neogobius melanostomus (Pallas, 1814)	*Demersal –benthos*	*LR*	IUCN
Knipowitschia caucasica (Berg, 1916) (Pomatoschistus caucasicus)	*Demersal –benthos*	*EN*	*FB*
Mesogobius batrachocephalus (Pallas, 1814)	*Demersal –benthos*	*LR*	*IUCN RBS*
Thunnus thynnus (Linnaeus, 1758)	*Pelagic*	*DD*	*RBS*
Hippocampus guttulatus (Cuvier, 1829)	*Demersal –bentho Pelagic*	*VU*	*IUCNRBS*
Scorpaena porcus (Linnaeus, 1758)	*Demersal –benthos*	*LR*	*RBS*
Eutrigla gurnardus Linnaeus, 1758 (Trigla gurnardus Linne)	*Demersal –benthos*		
Pegusa nasuta Pallas, 1814 (Solea lascaris nasuta (pallas, 1814)	*Demersal –benthos*	*LR*	*RBS*
Conger conger (Linnaeus, 1758)	*Demersal, bentho- Pelagic*	*EN*	*RBS*
Chromogobius quadrivittatus (Steindachner,1863)	*Demersal, benthos*		*RBS*
Liza ramada (Risso, 1827)	*Pelagic-neritic*		*RBS*
Arnoglossus kessleri (Schmidt, 1915)	*Demersal, Benthos*	*CR*	FB
Scophthalmus maeoticus (Pallas, 1814)(Psetta maxima maeotica)	*Demersal, benthos*	*LR*	*FB*
Pomatomus saltatrix (Linnaeus, 1766)	*Pelagic*		

Definitions

IUCN- The Red List of the International Union of Conservation of Nature

FB - fish database
CR-critically endangered **EN**-endangered **VU**-vulnerable **LR** – at low risk

Table N5. Place of origin and period of propagation of certain Black Sea fish

latin name	*Origin*	Propagation period
Sprattus sprattus sprattus (Linnaeus, 1758)	*A*	November – middle of May
Sardinella aurita (Valenciennes 1847)	*A*	June-September
Sardina pilchardus (Walbaum 1792)	*A*	July-August
Engraulis encrasicolus ponticus (Alesandrov, 1927)	*E(B)*	May – end of September
Trachurus mediterraneus ponticus (Aleev, 1956	*A*	June-August
Salmo labrax (Pallas, 1814) (Salmo trutta labrax Pallas, 1814)	*E(M)*	October-January
Mugil cephalus (Linnaeus, 1758)	*A*	June-middle of August (June 15 – July 15)
Liza aurata (Risso,1810)	*A*	June-October
Liza saliens (Risso, 1810)	*A*	July-end of September
Atherina boyeri (Risso, 1810) (Atherina mochon pontica Eichwald, 1831)	*A*	March-September
Mullus barbatus (linnaeus 1758)	*A*	End of May-end of July
Sarda sarda (Bloch, 1793)	*A*	End of May-end of August (chiefly June)
Scomber scombrus Linnaeus, 1758		January-May in the Seaof Marmara
Platichthys flesus (Linnaeus, 1758) (=Platichthys flesus lussus (Pallas, 1814)	*A*	January-March (January-April)
Merlangius merlangus (Linnaeus 1758)	*E(M)*	September-May
Raja clavata (Linnaeus, 1758)	*C*	March-end of July
Belone belone (Linnaeus, 1761) (Belone belone euxini Gunther, 1866)	*E(M)*	End of April-middle of October
Umbrina cirrosa (Linnaeus, 1758)	*A*	March-April (March-September)
Alosa immaculata (Bennett 1835)	E(B)	May-middle of August
Sciaena umbra (Linnaeus, 1758)	*A*	May-September
Diplodus annularis (Linnaeus, 1758)	*A*	June-middle of September
Spicara smaris (Linnaeus, 1758)	*A*	June-September
Symphodus tinca (Linnaeus, 1758)	*A*	May-June
Acipenser nudiventris (Lovetsky 1828)	*E(B)*	May-June
Symphodus ocellatus (Linnaeus, 1758)	*E(M)*	April-beginning of July
Acipenser gueldenstaedtii (Brandt & Ratzeburg, 1833)	*E(B)*	March-April (for spawning moves to the Rioni river)
Acipenser stellatus (Pallas, 1771)	*E(B)*	May-September
Acipenser sturio (Linnaeus, 1758)	*A*	May-July

Huso huso (Linnaeus, 1758)	*E(B)*	spring or summer
Acipenser persicus (Borodin, 1897)		July-August
Acipenser persicus colchicus (Marti, 1940)		July-September
Acipenser ruthenus (Linnaeus, 1758)	*Eu W*	April-June
Squalus acanthias (Linnaeus, 1758)	*C*	winter or spring
Uranoscopus scaber (Linnaeus, 1758)	A	June-September
Neogobius melanostomus (Pallas, 1814)	*E(B)*	April-May (sometimes end of June)
Knipowitschia caucasica (Berg, 1916) (Pomatoschistus caucasicus)	*E(B)*	April
Mesogobius batrachocephalus (Pallas, 1814)	*E(B)*	March-June
Thunnus thynnus (Linnaeus, 1758)	*A*	July-August
Hippocampus guttulatus (Cuvier, 1829)	*A*	Middle of June-middle of September
Scorpaena porcus (Linnaeus, 1758)	*A*	May-August
Eutrigla gurnardus Linnaeus, 1758 (Trigla gurnardus Linne)	*A*	All summer
Pegusa nasuta Pallas, 1814 (Solea lascaris nasuta (pallas, 1814)	*E(M)*	April-June
Conger conger (Linnaeus, 1758)	*A*	Not defined
Chromogobius quadrivittatus (Steindachner,1863)	*A*	May-June
Liza ramada (Risso, 1827)	*A*	Autumn
Arnoglossus kessleri (Schmidt, 1915)	*E(M)*	May-August
Scophthalmus maeoticus (Pallas, 1814)(Psetta maxima maeotica)	*A*	End of March-end of July
Pomatomus saltatrix (Linnaeus, 1766)	*C*	Summer

A-Atlantic

E(B)- Black Sea endemic specie
E(M)- Mediterranean endemic specie

The Minutes of the Meeting with Fishermen

February 9

Small entrepreneurs: ten fishermen from Poti, five from Batumi, three from Kobuleti

Summary

Fishing is the key source of their income. They own mostly rowing boats. Some own outboard motorboats.

Key obtained species are: anchovy, herring, mullet, seasonally grey mullet, mackerel (in less quantity).

1. Sprats are obtained in very little quantity. Usually they are mixed with other fish. There is no special fishing on this specie.
2. Anchovy is mostly obtained in winter. It used to be obtained in large quantity, but this year its number has decreased significantly. Groups of anchovy are not always found at the Georgian coast. Its number is highest in winter and spring.
3. Grey mullet is mostly obtained in May, June and July. Its number has not changed. It is mostly caught in the Paliastomi lake and river estuaries.
4. Mullet is mostly obtained in spring, although it is possible to obtain this specie all the year round. Earlier it was obtained in large quantity. Currently there is a decreasing tendency (The problem is the size of net loops: they say the allowed size is more than 28 mm. Therefore, it is difficult to catch fish with such nets. Mullet is best caught with a net, the loop size of which is 16 mm).
5. Bonito is rare and is seldom found in the net.
6. Mackerel rarely gets into the net.
7. Flounder is rare. Owners of boats are not allowed to reach the distance at which is would be possible to obtain it.
8. Whiting is rarely obtained. Fishers are not allowed to reach the distance at which is would be possible to obtain whiting. Therefore, they cannot give any information concerning the number and tendencies of this specie.
9. Pickerel (pike) – The limits in the loop size hamper obtaining of this specie. It is obtained in little quantity. There is no data concerning the number of this fish.
10. Shi drum – this specie likes rocky places. It is rarely found at Poti coast and is chiefly spread near Tsikhisdziri. Its number decreased in the past years.

11. Herring – is obtained in large quantity in winter. This year its number has decreased considerably; hence, less quantity is obtained.
12. Sturgeon is very rare.
13. Spurdog is very rare. Its number has recently decreased. It can be caught at a long distance from the shore, which is prohibited.

Key challenges hampering the activities of the fishermen:

1) Fishing is permitted at 100–300 meters' distance from the shore. This line of 200 meters is very small. Therefore, it is impossible to obtain certain fish species. Thus, the income of the fishermen has decreased. They understand that this problem is due to safety measures, but they think these measures are too strict. Before going to sea, they listen to the weather forecast. They agree to wear life jackets and take water and mobile phones (which fulfill the function of radio phones).

   They demand to have the right to go as far as 2 km. Despite prohibition, they go farther than the allowed distance, because otherwise they are unable to obtain fish, which has decreased in number. Coastguards often stop them and make them pay fines. The first fine is 50 GEL (coastguards, Convention service). In case of several violations, the fine increases to 2000 GEL.
2) They demand reduction of the size of net loops.
3) They protest against the allowed periods of fishing.
4) They say they obtain mullet in the depth, which is prohibited. Therefore, the amount of obtained mullet is very little.
5) Every year they have to certify their boats and pay 85 GEL. For this purpose, the fishermen of Poti have to travel to Batumi.
6) They note decrease in the amount of fish: earlier (5–7 years ago) **they would catch half a ton of fish per one km. This year they obtain only 50 kg per 1 km.**
7) They mention rapid decrease in the amount of herring. This fish is obtained in winter, starting from December. This year there was little amount of this specie. The size of the fishes has also decreased.
8) They consider the penetration of Turkish seiners as one of the main reasons for the decrease in the amount of fish. To their knowledge, 20–30 Turkish seiners enter the Black Sea. This is added by Georgian and Ukrainian seiners. They have 3 km nets, 200 meters

in height. They obtain a huge amount of fish. They also use bottom trawls, allowed in 2011. This trawl ploughs the entire bottom and destroys live organisms. It is very dangerous for fish larvae.

9) The decrease in the amount of fish has led to increase in its price: earlier one box of anchovy (28 kg) cost 5 GEL. Now its price is 60 GEL.

February 10.

Meeting with amateur fishermen (5 people)

Summary

1. Sprats are rare and are obtained occasionally with other fish. Mainly in November. They used to be extremely rare and have been found only in the past 6 years.
2. Anchovy is more frequent. The catching season lasts from November till March. In this period anchovy of all sizes are found. Groups of anchovy do not stay at the Georgian coast during the entire year or remain in small quantity. Large groups are found at the end of autumn, in winter and the beginning of spring. This year the number of anchovy has decreased, causing the increase in price.
3. Black Sea mackerel is found in average quantity in all seasons, but periodically. Sometimes groups of mackerel appear at the coast, sometimes they disappear. All sizes of the fish are found. No changes have been observed recently.
4. Black-eyed mullet is more frequent in summer. Its amount is not large.
5. Common mullet is widespread is spring, summer and autumn. The obtaining season is May-August. The fishermen consider that the number of this specie has increased, with the exception of mullet specie - haarder.
6. Bonito follows herring and anchovy. The obtaining season lasts from the end of autumn to winter. This year it is rare. To the information of the fishermen, in October 2011 there were 100 thousand tons near Sochi and they moved southward to Batumi. Thus, it was expected to appear in large quantity. However, small groups appeared near Batumi for a short while.
7. Mackerel is not found.

8. Flounder is rare. The fishing season is March-April. In this period this fish is obtained at 35–40 meters' depth. The period of propagation is May. It is obtained in small quantity near the Canyon of Supsa.
9. Merlang is obtained in average quantity. The net has to be placed at 60–70 meters' depth. The obtaining season lasts all the year round. The amount has decreased.
10. Parrotfish is of no commercial value.
11. Garfish is obtained in average quantity. The obtaining season lasts from October till December. In this period groups of fish appear comprised of fishes of all sizes.
12. Light drum is obtained in average quantity, chiefly in May-July, although the season lasts all the year round. Recently its number has decreased.
13. Dark drum is rare. Its size reaches 20 kg. The obtaining period is May-July. The number has decreased considerably.
14. Seabream – is occasionally found in the net. It is obtained in average quantity.
15. Pickarel is obtained in small quantity. The largest fish weigh about 100 grams. Its number had always been small and it still is.
16. Peacock wrasse – is mostly found near Sarpi. It prefers rocky places. Its amount is small near Poti. It is chiefly obtained in May, June, July and August.
17. Sturgeon is extremely rare. It (*Acipenser nudiventris)* was occasionally caught only twice.
18. Spurdog follows anchovy. This year its number has decreased considerably.
19. Red-eyed mullet is found in May, June and July. Its number has decreased in the past years.

Interesting information: Near Kintrishi, Kobuleti, at 900-1000 meters' distance from the shore, a net was cast at 45–50 meters' depth. When withdrawn, it was full of slime and had a terrible sulphur smell, which stayed for a long time. The colour of the net had also changed.

Dynamite is used in the Dekhva river, Kintrishi and other rivers too. 20-30 kg fish is obtained per one shot. Only large-size fish are selected. Smaller dead fish remain in the water. The Dekhva is often penetrated by fish larvae (the river is warm and its depth is small). The fish larvae perish as a result of dynamite explosion.

The key markets for fish: Batumi fish market, Poti market, Maltakva fish store, Tskaltsminda (here fish is sold in less quantity).

Key fishing places: Gonio, Sarpi, Adlia (near Kvariati), Tsikhisdziri, Shekvetili, Grigoleti, Kulevi (khobistskali).

Fish is widespread near Supsa Canyon. The most abundant in fish are the rivers: Supsa, Khobitskali, Korolis Tskali, Chorokhi, Chakvis Tskali.

The estuaries of rivers abound in mullet. In spring, trout is frequent.

Nets: loop size: 16–18–20 mm for obtaining red mullet

24–30 mm for mullet (diagonal)

Dragnet – optimal size is 100 meters, one wall,

or 75–100 meters three-wall tangling net.

Crowners of 3 kg and 5 kg weight have appeared.

Mullet is widespread.

Red mullet, herring and anchovy have decreased in number.

Plaice, sturgeon and salmon are very rare.

Plaice is mostly found near Anaklia and Tsikhisdziri Canyon. In spring it moves to 25–40 meters. Sometimes beluga also appears in these places.

In 1987 Asov bullfish appeared in Georgian territorial waters.

In the closed zone of Supsa, at 2 miles radius from the buoy, fishing is prohibited. Fishermen are unable to approach 500 meters (if there is a tanker, small vessels can travel near the shore, whereas seiners have to pass at 2 miles from the shore). This zone abounds in fish. Besides, Supsa Canyon is located here.

Experienced fishermen (with 30–40 years' experience) say they used to obtain fish at a distance from the shore. Now they have moved closer to the shore.

They assume that the increase in the level of hydrogen sulfide, fishing from seiners and bottom trawls are the main reasons for the decrease in the number of fish.

February 11

Meeting with the owners of seiners (Madai ships)

Currently 19 seiners including Madai go to sea from Poti port. There are additional 7 seiners.

1. Sprats are rare and mixed with other fish. There is no special commercial fishing on sprats. It appears in the period between spring and autumn.
2. There are no sardines.
3. Anchovy is obtained in large quantity during three seasons, chiefly in winter.
4. Black Sea mackerel was average this year, about 400 tons. It is abundant at the Abkhazian border and near Supsa.
5. Black Sea salmon is not obtained.
6. Mullet is not specially obtained.
7. Red mullet is the key commercial specie. This year it is more widespread near Abkhazia. Its number has decreased. It is easily obtained by means of bottom trawl, the use of which is allowed from Poti to Kubuleti.
8. Bonito is obtained in September and October near Kobuleti.
9. Mackerel is not found.
10. Black Sea whiting is obtained in large quantity all the year round.
11. Garfish is of no commercial value.
12. Shi drum– is obtained in small amount, when occasionally found in the net.

Anchovy is abundant near Supsa Canyon (outside the prohibited zone), Batumi and Kobuleti outskirts.

Sometimes Asov anchovy also enters the territory.

Anchovy is obtained from December till April. Small size fish are processed as fish flour. There is a leased factory in Poti which processes fish oil and fish flour. Large-size anchovy are exported.

Bonito is found in large groups.

The amount of anchovy has decreased. Earlier, in this period about 100 tons used to be obtained. It has been rare for the past 2 years.

Flounder – about 20 fishes are obtained per year. The weight of one fish is about 8 kg.

Spurdog is mostly found in May and June.

Sturgeon is mostly found near Anaklia.

Seabass is extremely rare.

This year the quota is 20 000 tons. The tax on resource is 25% i.e. 800 000 (whether the quota is met or not).

Nets–1.5 km at the Georgian coast and near Abkhazian shore. The season lasts 4 months.

Reasons for the decrease in the number of fish: spilling of pyrolysis tar near Poti port 2 months ago, climatic conditions. Spilling of oil near Kulevi terminal (detected by the strong smell of oil).

Anchovy and red mullet are sold at fish market.

4000 tons are sold at Georgian market. The rest is sold in Turkey.

TABLE N6. Results of the Chemical Analysis of the Black Sea Samples

Parameters mg/l	I	II	III	IV	V	VI	VII
Hydrogen index PH	8,35	8,25	8,11	8,34	8,39	8,29	6,82
dissolved oxygen O_2	4,99	5,38	4,80	5,38	5,57	4,99	4,16
Carbonates CO_3^{2-}	20,40	9,60	6,00	14,40	21,60	9,60	
Hydro carbonates HCO_3^-	178,12	158,60	151,28	136,64	187,88	164,70	200,08
Chlorides Cl^-	8510,0	5200,0	4820,0	3760,0	8720,0	6230,0	8010,0
Sulphates SO_4^{2-}	1850,0	1100,0	900,0	650,0	1900,0	1250,0	1800,0
Nitrites NO_2^-	0,045	0,040	0,027	0,045	0,020	0,040	0,020
Nitrates NO_3^-	0,01	0,025	0,015	0,018	0,025	0,01	0,015
Ammonium NH_4^+	2,50	1,70	1,60	0,88	2,70	1,66	2,50
Magnesium Mg^{2+}	740,54	528,09	327,79	284,94	691,98	485,60	619,14
Calcium Ca^{2+}	220,0	170,0	160,0	120,0	220,0	160,0	180,0
Natrium Na^+	5290,0	3370,0	3130,0	2440,0	5660,0	4040,0	5200,0
Potassium K^+	150,0	200,0	205,0	190,0	155,0	201,0	170,5
Phosphorus P mineral	0,22	0,50	0,60	0,45	0,006	0,04	0,05
Silicium Si	3,30	3,60	6,08	6,08	3,60	2,80	2,70
Salinity g/l	16,96	10,74	9,70	5,16	17,56	12,54	16,18
Permanganate oxidation	6,72	8,16	4,16	5,12	2,88	2,88	11,60
BOD_5	4,99	5,38	4,80	5,38	5,57	4,99	4,16
TOC	6,30	7,65	3,90	4,80	2,70	2,70	10,88

Table N7. The Invasive Species in the Black Sea

	Latin name	Origin	Intentional occasional introduction	Probable time of introduction
1.	*Balanus improvisus*	AT	Occasional	19th century
2.	*Balanus eburneus*	AT	Occasional	19 th century
3.	*Blackfordia virginica*	AT	Occasional	1925
4.	*Mercierella enigmatica*	NEU	Occasional	1929
5.	*Bourgainvillia megas*	AT	Occasional	1933
6.	*Rhithropanopeus harrisi tridentata*	NEU	Occasional	1937
7.	*Rapana venosa (thomasiana)*	PC	Occasional	1946
8.	*Mia arenaria*	AT	Occasional	1966
9.	Callinectes sapidus	NEU	Occasional	1967
10.	Doridella obscura	AT	Occasional	1980
11.	Cunearca cornea	PC	Occasional	1982
12.	*Mnemiopsis leidyi*	AT	Occasional	1982
13.	*Desmarestia viridis*	NEU	Occasional	1990
14.	*Gambusia affinis*	AT	Intentional	1925
15.	*Lepomis gibbosum*	Still water (North America)	Intentional	1930
16.	*Pandallus kessleri*	PC	Intentional	1959
17.	*Plecoglossus altivellis*	PC also still water	Intentional	1963
18.	*Roccus saxatilis*	AT	Intentional	1965
19.	*Salmo gairdneri*	PC	Intentional	1965
20.	*Oryzias latipes*	Still water South-Eastern Asia	Intentional	1970
21.	*Penaeus japonicus*	PC	Intentional	1970
22.	*Oncorhynchus keta*	PC	Intentional	1972
23.	*Mugil soiuy (Liza haematocheilus)*	PC	Intentional	1972
24.	*Dicentrarchus labrax*	EU	Intentional	1977
25.	*Lateolabrax japonicus*	PC	Intentional	1978
26.	*Crassostrea gigas*	PC	Intentional	1980

NEU- North European

AT - Atlantic

PC - Pacific

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