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Litter pollution of Pomorie Lake Current situation and distribution REPORT

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1. POMORIE LAKE – PROTECTION REGIMES

1.1. Pomoriysko ezero Special Protected Area

Pomoriysko ezero Special Protected Area, with an identification code BG0000152 under the EU Bird Directive 2009/147/EC is located in the lands of towns Pomorie and Aheloy, municipality of Pomorie, Burgas region, with total area of 921.528 ha, from which 123.3 ha is marine area. This protected zone in terms of coverage includes a great deal of wetlands of Pomorie Lake, as well as the protected area and the SCI (EU Habitats Directive). The SPA fully coincides with Important Bird Area Pomoriysko ezero BG037, proposed by the Institute of Ecology at the Bulgarian Academy of Sciences during 1990s and with Ramsar site Pomorie Wetlands Complex.

It also includes some salty grasslands, arable lands, a kilometer of coast line south of the mouth of the Aheloy River, the river mouth itself, and a dam of the same name, which exceeds the coverage of the protected site by 19.8%.

According to Order by the Minister of the Environment and Water №ПД-78/3.02.2009, published in State gazette, issue 14/2009, a subject of protection within the SPA are:

- 87 species of birds as per art. 6, paragraph 1, item 3 from the Biological Diversity Act;
- 64 common migrating birds species as per art. 6, paragraph 1, item 4 from the Biological Diversity Act.

1	<i>Gavia stellata</i>	Red-throated loon
2	<i>Gavia arctica</i>	Black-throated loon
3	<i>Tachybaptus ruficollis</i>	Little grebe
4	<i>Podiceps cristatus</i>	Great crested grebe
5	<i>Podiceps grisegena</i>	Red-necked grebe
6	<i>Podiceps auritus</i>	Slavonian grebe
7	<i>Podiceps nigricollis</i>	Black-necked grebe
8	<i>Phalacrocorax carbo</i>	Great cormorant
9	<i>Phalacrocorax aristotelis</i>	European shag
10	<i>Phalacrocorax pygmeus</i>	Pygmy cormorant
11	<i>Pelecanus onocrotalus</i>	White pelican
12	<i>Pelecanus crispus</i>	Dalmatian pelican
13	<i>Botaurus stellaris</i>	Eurasian bittern
14	<i>Ixobrychus minutus</i>	Little bittern
15	<i>Nycticorax nycticorax</i>	Black-crowned night heron
16	<i>Ardeola ralloides</i>	Squacco heron
17	<i>Egretta garzetta</i>	Little egret
18	<i>Egretta alba</i>	Great egret
19	<i>Ardea cinerea</i>	Grey heron
20	<i>Ardea purpurea</i>	Purple heron
21	<i>Ciconia nigra</i>	Black stork
22	<i>Ciconia ciconia</i>	White stork

23	<i>Plegadis falcinellus</i>	Glossy ibis
24	<i>Platalea leucorodia</i>	Eurasian spoonbill
25	<i>Cygnus olor</i>	Mute swan
26	<i>Cygnus cygnus</i>	Whooper swan
27	<i>Cygnus bewickii</i>	Tundra swan
28	<i>Anser erythropus</i>	Lesser white-fronted goose
29	<i>Anser albifrons</i>	Greater white-fronted goose
30	<i>Anser anser</i>	Greylag goose
31	<i>Branta ruficollis</i>	Red-breasted goose
32	<i>Tadorna ferruginea</i>	Ruddy shelduck
33	<i>Tadorna tadorna</i>	Common shelduck
34	<i>Anas penelope</i>	Eurasian wigeon
35	<i>Anas strepera</i>	Gadwall
36	<i>Anas crecca</i>	Eurasian teal
37	<i>Anas platyrhynchos</i>	Mallard
38	<i>Anas acuta</i>	Northern pintail
39	<i>Anas querquedula</i>	Garganey
40	<i>Anas clypeata</i>	Northern shoveler
41	<i>Netta rufina</i>	Red-crested pochard
42	<i>Aythya ferina</i>	Common pochard
43	<i>Aythya nyroca</i>	Ferruginous duck
44	<i>Aythya fuligula</i>	Tufted duck
45	<i>Aythya marila</i>	Greater scaup
46	<i>Somateria mollissima</i>	Common eider
47	<i>Clangula hyemalis</i>	Long-tailed duck
48	<i>Melanitta nigra</i>	Common scoter
49	<i>Melanitta fusca</i>	Velvet scoter
50	<i>Bucephala clangula</i>	Common goldeneye
51	<i>Mergus albellus</i>	Smew
52	<i>Mergus serrator</i>	Red-breasted merganser
53	<i>Mergus merganser</i>	Common merganser
54	<i>Oxyura leucocephala</i>	White-headed duck
55	<i>Pernis apivorus</i>	European honey buzzard
56	<i>Milvus migrans</i>	Black kite
57	<i>Haliaeetus albicilla</i>	White-tailed eagle
58	<i>Neophron percnopterus</i>	Egyptian vulture
59	<i>Gyps fulvus</i>	Griffon vulture
60	<i>Circus gallicus</i>	Short-toed snake eagle
61	<i>Circus aeruginosus</i>	Western marsh harrier
62	<i>Circus cyaneus</i>	Hen harrier
63	<i>Circus macrourus</i>	Pallid harrier
64	<i>Circus pygargus</i>	Montagu's harrier
65	<i>Accipiter nisus</i>	Eurasian sparrowhawk
66	<i>Accipiter brevipes</i>	Levant sparrowhawk
67	<i>Buteo buteo</i>	Common buzzard
68	<i>Buteo rufinus</i>	Long-legged buzzard
69	<i>Aquila pomarina</i>	Lesser spotted eagle
70	<i>Aquila clanga</i>	Greater spotted eagle
71	<i>Hieraetus pennatus</i>	Booted eagle
72	<i>Pandion haliaetus</i>	Osprey
73	<i>Falco tinnunculus</i>	Common kestrel
74	<i>Falco vespertinus</i>	Red-footed falcon
75	<i>Falco subbuteo</i>	Eurasian hobby
76	<i>Falco cherrug</i>	Saker falcon
77	<i>Falco peregrinus</i>	Peregrine falcon
78	<i>Rallus aquaticus</i>	Water rail
79	<i>Porzana porzana</i>	Spotted crane
80	<i>Porzana parva</i>	Little crane
81	<i>Porzana pusilla</i>	Baillon's crane
82	<i>Crex crex</i>	Corn crane
83	<i>Gallinula chloropus</i>	Common moorhen
84	<i>Fulica atra</i>	Eurasian coot
85	<i>Grus grus</i>	Common crane
86	<i>Haematopus ostralegus</i>	Eurasian oystercatcher

87	<i>Himantopus himantopus</i>	Black-winged stilt
88	<i>Recurvirostra avosetta</i>	Pied avocet
89	<i>Glareola pratincola</i>	Collared pratincole
90	<i>Charadrius dubius</i>	Little ringed plover
91	<i>Charadrius hiaticula</i>	Common ringed plover
92	<i>Charadrius alexandrinus</i>	Kentish plover
93	<i>Burhinus oediconemus</i>	Eurasian stone-curlew
94	<i>Pluvialis apricaria</i>	European golden plover
95	<i>Pluvialis squatarola</i>	Grey plover
96	<i>Vanellus vanellus</i>	Northern lapwing
97	<i>Calidris alba</i>	Sanderling
98	<i>Calidris minuta</i>	Little stint
99	<i>Calidris temminckii</i>	Temminck's stint
100	<i>Calidris ferruginea</i>	Curlew sandpiper
101	<i>Calidris alpina</i>	Dunlin
102	<i>Limicola falcinellus</i>	Broad-billed sandpiper
103	<i>Philomachus pugnax</i>	Ruff
104	<i>Gallinago gallinago</i>	Common snipe
105	<i>Gallinago media</i>	Great snipe
106	<i>Actitis hypoleucos</i>	Common sandpiper
107	<i>Limosa limosa</i>	Black-tailed godwit
108	<i>Limosa lapponica</i>	Bar-tailed godwit
109	<i>Numenius phaeopus</i>	Eurasian whimbrel
110	<i>Numenius arquata</i>	Eurasian curlew
111	<i>Tringa erythropus</i>	Spotted redshank
112	<i>Tringa totanus</i>	Common redshank
113	<i>Tringa glareola</i>	Wood sandpiper
114	<i>Tringa stagnatilis</i>	Marsh sandpiper
115	<i>Tringa nebularia</i>	Common greenshank
116	<i>Tringa ochropus</i>	Green sandpiper
117	<i>Xenus cinereus</i>	Terek sandpiper
118	<i>Arenaria interpres</i>	Ruddy turnstone
119	<i>Phalaropus lobatus</i>	Red-necked phalarope
120	<i>Larus melanocephalus</i>	Mediterranean gull
121	<i>Larus minutus</i>	Little gull
122	<i>Larus ridibundus</i>	Black-headed gull
123	<i>Larus genei</i>	Slender-billed gull
124	<i>Larus canus</i>	Common gull
125	<i>Larus fuscus</i>	Lesser black-backed gull
126	<i>Larus cachinnans</i>	Caspian gull
127	<i>Gelochelidon nilotica</i>	Gull-billed tern
128	<i>Sterna caspia</i>	Caspian tern
129	<i>Sterna sandvicensis</i>	Sandwich tern
130	<i>Sterna hirundo</i>	Common tern
131	<i>Sterna albifrons</i>	Little tern
132	<i>Chlidonias hybridus</i>	Whiskered tern
133	<i>Chlidonias niger</i>	Black tern
134	<i>Chlidonias leucopterus</i>	White-winged tern
135	<i>Caprimulgus europaeus</i>	European nightjar
136	<i>Alcedo atthis</i>	Common kingfisher
137	<i>Merops apiaster</i>	European bee-eater
138	<i>Coracias garrulus</i>	European roller
139	<i>Dendrocopos syriacus</i>	Syrian woodpecker
140	<i>Melanocorypha calandra</i>	Calandra lark
141	<i>Calandrella brachydactyla</i>	Greater short-toed lark
142	<i>Riparia riparia</i>	Sand martin
143	<i>Anthus campestris</i>	Tawny pipit
144	<i>Acrocephalus melanopogon</i>	Moustached warbler
145	<i>Acrocephalus paludicola</i>	Aquatic warbler
146	<i>Hippolais olivetorum</i>	Olive-tree warbler
147	<i>Sylvia nisoria</i>	Barred warbler
148	<i>Ficedula semitorquata</i>	Semicollared flycatcher
149	<i>Ficedula albicollis</i>	Collared flycatcher
150	<i>Lanius collurio</i>	Red-backed shrike
151	<i>Lanius minor</i>	Lesser grey shrike

The SPA is designated for:

- Conservation and maintaining the habitats of the bird species, listed above in order to achieve their secure conservation status.
- Restoration of habitats for birds species' that need improvement of conservation status.

The number of species subject to conservation at the site is high and represents significant part of their total number in Bulgaria. This shows the great conservation importance of the lake.

Within the boundaries of the SPA following bans are imposed:

- » Building of wind turbines, ports, terminals and industrial factories, apart from facilities related to seasalt and medicinal mud extraction;
- » Mining;
- » Waste disposal;
- » Activities related to drainage, drying or changing the water regime of the marshlands and natural water bodies apart from execution of activities related to improving the status of water ecosystems and habitats and for traditional seasalt production and medicinal mud extraction;
- » Removing landscape objects (single and group of trees) during farming of arable land;
- » Tree-planting at meadows, pastures and common as well as their conversion into arable land and perennials;
- » People's access to the colonies of the nesting water birds, as well as entering the lake by boats or other vessels, practicing water tourism and sports (paddle boats, jetski, surfs, canoe), apart from the activities related to seasalt production and medicinal mud extraction;
- » Burning reedbeds and wetlands flora;
- » Reed cutting during the period from 1st March until 15th August.

1.2. Site of Community Interest Pomorie

1.1.2.1. Position and borders

SCI Pomorie with identification code BG0000620 under the EU Habitats Directive 92/43/EC is located in the lands of towns of Pomorie and Aheloy, Pomorie municipality, Burgas region and is the biggest among all four protected areas with 2085.15 ha, of which 1128.07 ha is marine area.

According to the Standard Data Form the protected area is designated for the purpose:

- Conservation of habitats' area and species' habitats and their populations – subject to conservation within the site.
- Conservation of natural status of habitats and species' habitats subject to conservation within the site including the natural for the habitats species composition, typical species and environmental conditions.
- Restoration in case of necessity of the area and natural state of priority habitats and species' habitats and populations subject to conservation within the site.

Subject to conservation are the following habitat types:

- 1110 Sandbanks which are slightly covered by sea water all the time
- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1150* Coastal lagoons
- 1160 Large shallow inlets and bays
- 1170 Reefs
- 1310 *Salicornia* and other annuals colonizing mud and sand
- 1410 Mediterranean salt meadows (*Juncetalia maritimi*)
- 1530* Pannonic salt steppes and salt marshes
- 2110 Embryonic shifting dunes
- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)
- 8330 Submerged or partially submerged sea-caves
- 92D0 Southern riparian galleries and thickets (*Nerio-Tamaricetea* и *Securinegion tinctoriae*)

As well as the following fauna species

Eurasian otter	<i>Lutra lutra</i>
Marbled polecat	<i>Vormela peregusna</i>
European fire-bellied toad	<i>Bombina bombina</i>
Blotched snake	<i>Elaphe sauromates</i>
European pond turtle	<i>Emys orbicularis</i>
Hermann's tortoise	<i>Testudo hermanni</i>
Southern crested newt	<i>Triturus karelinii</i>
Pontic shad	<i>Alosa immaculata</i>
Black Sea shad	<i>Alosa tanaica</i>

This SCI has not yet been designated with special order of Minister of Environment and Water despite a draft was published in 2020 and thus its legal status is defined by the EU Habitats Directive and Ministerial Order №122 of 2nd March, 2007, published in the State Gazette, issue 21 of 9th March, 2007, where it is listed as “BG0000620 Pomorie Directive 92/43 EC of 21st May, 1992 for conservation of the natural habitats and of the wild flora and fauna” (further on in the text “Directive 92/43 EC”).

European pond turtle (*Emys orbicularis*)



1.3. Protected site “Pomorie Lake”

The protected area Pomorie Lake covers the whole water body of Pomorie Lake and has area of 760.83 ha. It is designated by Order №RD-31 of 23rd January 2001 by the Minister of Environment and Water in order to protect Pomorie Lake, the salt pans and the adjacent coastal terrains as a wetland of international importance and as habitat for 63 endangered bird species.

According to the order for the protected site following bans are introduced:

- » Construction and any other activity that is going to change the landscape of the site and the water regime of the lake.
- » Destroying the flora in the marshlands and burning the reedbeds.
- » Pollution of lake water and adjacent areas.
- » Hunting.
- » Disturbing the birds, destroying their nests, collecting their eggs as well as ringing of chicks without permission.

The order defines and specifies the allowed activities in the lake area:

- » Sea salt production and maintenance of the sea-lake canal.
- » Extraction of medicinal mud.
- » Fish stocking with the typical for the lake fish species.
- » Fishing using special trap at special areas defined by Management plan for the site; until approval of management plan these areas should be defined by RIOEW Burgas.
- » Building of new dikes as well as reconstruction and renovation of the existing ones after consultation with the Ministry of Environment and Water.

1.4. Ramsar site “Pomorie Wetland Complex”

Pomorie Lake is Ramsar site №1229, designated on 24th September, 2002 according to the Convention on Wetlands of International Importance especially as Waterfowl Habitat. It is hyper-saline lagoon along the seashore north of Pomorie including the mouth of Aheloy River and the adjacent small dam.

The total area of the Ramsar site is 921.528 ha and completely coincides with “Pomoriysko ezero” SCI BG0000152. The aim of the Ramsar site designation is to preserve the natural character of its wetlands.

The following bird species are covering the 1% criterion of the Ramsar Convention: Sandwich tern (*Thalasseus sandvicensis*) – nesting: 2400 pairs (2013-19); Dalmatian pelican (*Pelecanus crispus*) – migrating: 150 ind. (2009); Great white pelican (*Pelecanus onocrotalus*) – migrating: 3000 ind. (2009); Black stork (*Ciconia nigra*) – migrating: 500 ind. (2009); White stork (*Ciconia ciconia*) – migrating: 50 000 ind. (2007); Mute swan (*Cygnus olor*) – wintering: 1100 ind. (2002); Common shelduck (*Tadorna tadorna*) – migrating and wintering: 1300 ind. (2009); Little gull (*Larus minutus*) – migrating: 3200 ind. (2009); Pied avocet (*Recurvirostra avosetta*) – migrating: 820 (2006) and nesting: 164 pairs (2013).

Sandwich tern (*Thalasseus sandvicensis*)



2. POMORIE LAKE – ABIOTIC COMPONENTS

2.1. Climate

Pomorie is within Continental-mediterranean climate region. The average of sunlight volume in Pomorie area is 2275 hours and its relative duration is 47%. For the period between 1961-1990 the average air temperature in Pomorie is 12.3°C. The average annual air humidity is 76% (69÷83%), the annual rainfall is 478 mm. Snowfalls in the region are rare and the snow does not stay for long. The average wind speed in the region is 4.1 m/sec. The average wind rose is characterized predominantly by the Northern winds (22.3%), followed by Northeastern (20.2%) and Western (13.4%).

2.2. Geology and morphology

In the study area are found different rocks with an age between Upper Cretaceous and Quaternary period. The present deposits are of a great importance. A great deal of the coastline in the area of the Pomorie lagoon and part of the Adata stream catchment is occupied by lake-swamp formations represented by fine sands, sandy clay, clays with black colour from burnt detritus and thin gravel layers.



2.3. Hydrology and hydrography

The catchment of Pomorie Lake is situated between the lake, Kamenar village, and Kableshkovo town covering total area of 33.55 km². The lagoon is separated from the Black Sea by a sand spit at the eastern side. Its width is around 50 m, and its length is more than 5.5 km. Through the sand spit natural water exchange exists between the sea and the lake by filtration in direction depending on the hydraulic gradient. The relation “sea-lake” is a gravity canal with length of 535 m, that crosses Pomorie town. Around the lake are built protection drainage canals whose function is to collect the surface waters from the fresh water catchment of Pomorie Lake.

2.4. Hydrochemistry

Because of the connection with the sea, Pomorie Lake has got a relative similarity with the chemical contents of the Black Sea waters. The annual dynamics of the physical-chemicals factors of the environment (salinity, pH and O₂) show that during the whole year the conditions of the biota are normal: pH (7.5 – 9.2), the oxygen saturation is between 50 and 240%. Salinity between 1 and 140‰ defines the difference in conditions of the habitats. As per the established freshwater lakes trophic classification, Pomorie Lake belongs rather to eutrophic rather than mesotrophic lakes: total phosphorus 16 – 190 µg/l (normal 16 – 386); total nitrogen 124 – 2170 µg/l (normal 393 – 6100) and Chl A 0.54 – 91 µg/l.

2.5. Soils

Typical for this region are vertisols. The reaction of the soil is from neutral to slight alkaline. The humus horizon consists of two layers with humus content in the upper layer being 3-4% that gradually diminishes in depth of the profile. Typical for the coastline is the coastal abrasion. It was found out that the abrasion processes and the related with them dynamic changes on the coastal zone are defined mainly by natural factors. In the last decades there is a trend for increase of their effect due to human activities. For the coastline zone (in our case the sand spit) most prominent is the influence of the mechanical type abrasion caused by water.

3. LAKE POMORIE – BIOLOGICAL COMPONENTS

3.1. Phytoplankton and macrophytes

63 algae taxa are recorded, most of them are oligo- and mesohaline. The values of biomass and abundance are high (average 7.01 mg/ltr 8 mln cells/ltr) and similar to the species composition show high level of eutrophication. Phytoplankton composition is defined by green algae with large share of pyrophites, blue-green, and raphidophytes. The values of structural parameters diversity, equality, dominance and species richness are in good correlation showing phytoplankton groups in the different water basins are far from favourable balanced status. From the macrophytes 8 species of green seaweed are found belonging to class Ulvophyceae of phylum Chlorophyta. The most common species in all water basins is *Ulva intestinalis*, forming densed carpets on the bottom of the water basins. On the bottom rocks, on sunked objects or among *U. intestinalis*, the species *Ulva flexuosa* – recorded are ‘Vulnerable’ in the Red List of Bulgarian macrophytes. The mass development of this euryhaline species can clearly be related to the stronger antropogenetic pressure during the last few years. With decrease of average salinity increase of coverage by widgeon grass (*Ruppia maritima*) in most of the basins is observed.

3.2. Higher plants

There are 87 species of higher plants recorded at the site, 11 of them are protected by the Biodiversity Law, seven of them are included in the Red Data Book of Bulgaria as endangered and critically endangered: Morning glory (*Calystegia soldanella*) – EN, Centaurea gracilentata – EN, Coastal hedgenettle (*Stachys maritima*) – EN, Sea holly (*Eryngium maritimum*) – EN, Sword-leaf dogbane (*Trachomitum venetum*) – EN, Petrosimonia brachiata – CR, Suaeda heterophylla – CR. Sand split separating the lake from the sea keeps dunes with their specific vegetation (*Euphorbia peplis*, *Eryngium maritimum*, *Ammophila arenaria*, *Trachomitum venetum*, etc). The saline basins and the salt pans provide good conditions for development of the Common glasswort (*Salicornia europaea*) – a specific species for the saline lakes. The dunes around the lake preserve the most significant population in Bulgaria of the threaten plant Sword-leaf dogbane (*Trachomitum venetum*).

3.3. Natural habitats in the area around lake Pomorie

12 habitat types listed in Annex 1 of the EU Habitats directive are found at SCI Pomorie Two of these are with priority status for conservation according to the same directive – 1150* Coastal lagoons and 1530* Pannonic salt steppes and salt marshes. The site holds key role at national level for the protection of the habitats 1310 *Salicornia* and other annual plants, colonizing marshlands and sand terrains and 1150*Coastal lagoons. A full list of habitat types is included in description of SCI “Pomorie”BG0000620 above.

3.4. Invertebrates

200 taxa were found at the site. The average density of the zooplankton in 2007 is 59338 ind./m³, as they vary between 68139 ind./m³ in July to 50536 ind./m³ in October. Copepod nauplius, infusoria and *Bivalvia* larvae are represented with highest relative abundance. The wetland has got also a key role for the protection of highly threatened dragonfly species Dark spreadwing (*Lestes macrostigma*). The saline lagoon is a key habitat in Bulgaria for the brine shrimps (*Artemia* sp.), and population in Pomorie Lake is dominated by *Artemia parthenogenetica*. Some of the invertebrates are main trophic source for water birds and are characterized with significant dynamics depending on the environmental factors. Other specific invertebrates are chironomids *Chironomus anchialicus* Michailova, 1974 and *Chironomus valkanovi* Michailova, 1974; benthic nematode *Syringolaimus caspersi* Gerlach, 1951; *Orthotylus (Melanotrichus) josifovi* Wagner, 1959; copepod *Nitokra fallaciosus* Klie, 1937.

3.5. Fish

The young age of the lagoon, its small size and depth without thermocline defines relatively low diversity of fish. All species are initially marine and depend on the connection with the sea. Seven species are found and all except one temporarily enter the lagoon through the artificial canal between lake and the sea – Flathead grey mullet, Leaping mullet, Golden grey mullet, Big-scale sand smelt. The only permanent species is Caucasian dwarf goby (*Knipowitschia caucasica*). In the Bulgarian Red Data Book as a vulnerable species is listed Grass goby (*Zosterisessor ophiocephalus*) – VU.

3.6. Amphibians and Reptiles

In the area of Pomorie Lake are described 20 species: 7 amphibians and 13 reptiles. Part of the species are protected and have a high conservation status at national and international level such as Spur-thighed tortoise (*Testudo graeca*), European pond turtle (*Emys*

orbicularis), European fire-bellied toad (*Bombina orientalis*), Balkan green lizard (*Lacerta trilineata*), Balkan wall lizard (*Podarcis taurica*), Southern crested newt (*Triturus karelinii*), European tree frog (*Hyla arborea*) and some others. One of the most common species is the Dice snake (*Natrix tessellata*).

3.7. Birds

This is the biggest and best studied group of animals in the region. Out of 406 bird species recorded in Bulgaria 271 are found at Pomorie Lake. In spite of the relatively small area, Pomorie Lake is ranked third in terms of total bird species and fourth in terms of water birds and species, that cover 1% of Ramsar criterion. Most of the birds are endangered such as Pygmy cormorant (*Microcarbo pygmeus*), White-headed Duck (*Oxyura leucocephala*), Red-breasted goose (*Branta ruficollis*), Dalmatian pelican (*Pelecanus crispus*), Ferruginous duck (*Aythya nyroca*) and some others. Fifty-seven species are nesting at the site, as the lagoon is the most important breeding site for the following species: Sandwich tern (*Thalasseus sandvicensis*), Pied avocet (*Recurvirostra avosetta*), Black-winged stilt (*Himantopus himantopus*), Kentish plover (*Charadrius alexandrinus*), Common tern (*Sterna hirundo*), Little tern (*Sternula albifrons*), Mute swan (*Cygnus olor*) and Shelduck (*Tadorna tadorna*). The colonies of terns and avocets are using successfully the islands and platforms created by Green Balkans NGO

Black-winged stilt (*Himantopus himantopus*) and
Pied avocet (*Recurvirostra avosetta*)

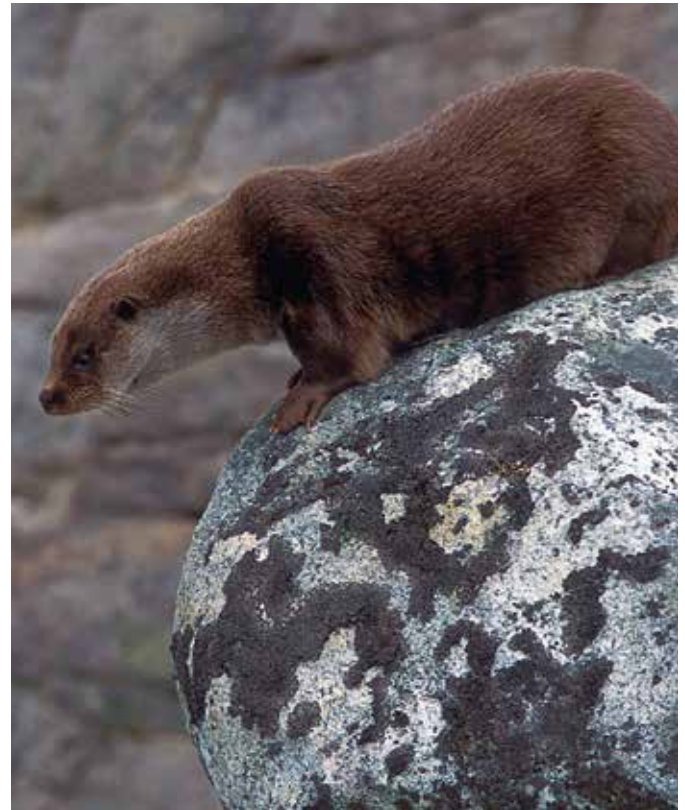


volunteers. During the migration thousands of storks, pelicans and birds of prey are flying over the lagoon along the migration flyway Via Pontica. Thousands of waders are using the site as stopover to rest and feed – Redshank (*Tringa totanus*), Greenshank (*Tringa nebularia*), Black-tailed godwit (*Limosa limosa*), Spotted redshank (*Tringa erythropus*), Ruff (*Calidris pugnax*), Curlew sandpiper (*Calidris ferruginea*), Eurasian Curlew (*Numenius arquata*), Little stint (*Calidris minuta*), Ringed plover (*Charadrius hiaticula*), Ruddy turnstone (*Arenaria interpres*) and others. The lagoon is of a great importance for the wintering birds as the hunting is forbidden in the protected site. The highest numbers of wintering birds are of Coot (*Fulica atra*), Shelduck (*Tadorna tadorna*), Wigeon (*Mareca penelope*), Teal (*Anas crecca*), Northern shoveler (*Spatula clypeata*), Mute swan (*Cygnus olor*), Northern pintail (*Anas acuta*), Tufted duck (*Aythya fuligula*), Great crested grebe (*Podiceps cristatus*), Black-necked grebe (*Podiceps nigricollis*), Red-breasted merganser (*Mergus serrator*) and Pochard (*Aythya ferina*).

3.8. Mammals

31 species of mammals belonging to 5 orders are found here. Among them are the smallest mammal in Europe – Etruscan shrew (*Suncus etruscus*), Eurasian otter (*Lutra lutra*) – a species included in the IUCN Red List (NT) and 9 species of bats.

Eurasian otter (*Lutra lutra*)



4. CONSERVATION IMPORTANCE

The lake Pomorie belongs to the **rarest type of ecosystems** in Bulgaria – the saline and hypersaline lakes.

Pomorie Lake is:

- An unique type of wetland in Bulgaria, rare at the Balkan peninsula and in Europe;
- The biggest breeding site of Sandwich tern (*Thalasseus sandvicensis*) and one of the two biggest breeding sites in Bulgaria of Kentish plover (*Charadrius alexandrinus*), Common tern (*Sterna hirundo*), Little tern (*Sternula albifrons*), Gull-billed tern (*Gelochelidon nilotica*), Pied avocet (*Recurvirostra avosetta*) and Black-winged stilt (*Himantopus himantopus*) in Bulgaria;
- One of the most important sites in the country and along our coast as a resting and feeding site during migration for birds from the class Charadriiformes: Redshank (*Tringa totanus*), Greenshank (*Tringa nebularia*), Black-tailed godwit (*Limosa limosa*), Spotted redshank (*Tringa erythropus*), Ruff (*Calidris pugnax*), Curlew sandpiper (*Calidris ferruginea*), Curlew (*Numenius arquata*), Little stint (*Calidris minuta*), Ringed plover (*Charadrius hiaticula*), Ruddy turnstone (*Arenaria interpres*) and others.
- The international importance of Pomorie Lake for migrating birds is studied through colour ringing scheme for Sandwich terns from the colony in the lagoon and recoveries during autumn-winter period from the Canary Islands (Lanzarote), Tunisia, Italy, France, Spain, Montenegro and Israel. Observations of Common terns from Poland, Hungary, and Mediterranean gulls from Italy and Hungary, Black-headed gulls from Serbia, Lesser black-backed gulls from Finland and Sandwich terns from Italy and Holland have been registered.
- Important site for conservation of Caucasian dwarf goby (*Knipowitschia caucasica*) population in Bulgaria;
- It is the biggest locality for Sword-leaf dogbane (*Trichomitum venetum*) and one of the two biggest locations of European glasswort (*Salicornia europaea*) in Bulgaria;
- The only one and the most important habitats of the Dark spreadwings (*Lestes macrostigma*) dragonfly;
- One of the two sources of medicinal mud in Bulgaria;
- One of the two salinas in Bulgaria;

- The site is important in Bulgaria for conservation of habitat that holds priority status on European level – Coastal lagoons;
- The status of the dune habitats at the sand spit separating the lagoon from the Black Sea is good, mostly due to the fact that the beach is not intensively used through concession like other beaches along the Bulgarian coastline.

Vulnerability of the lake is high because of the fact its water level is under the sea level and all polluted water from the catchment theoretically flows into the lagoon. The hydrological balance is vulnerable to drying up, flooding and other extreme events. The natural habitats and rare plants are vulnerable to human pressure (such as trembling, pulling out, litter pollution, building and others). Most of the invertebrates that live in the lake are stenobionts and they are very sensitive even to very small changes in their habitats. Vertebrates and especially birds are directly dependent to changes in the hydrological regime, salinity, abundance of plankton and benthos and anthropological pressure from land and water use.

The naturalness of the lake is relatively small because of the fact that the lagoon is changed into salinas with basins, dikes and canals. This process has started in antiquity. In the last few years it is accelerated because of the territory's urbanisation (including the south part of the sand spit between the lake and the sea). The region of the Pomorie Lake is a complex combination of natural and anthropogenically modified habitats. While the marine zone, the sand spit and the dunes are mostly in a natural state the group of wetlands are artificially modified and maintained system that at the same time is a natural habitat for flora and fauna communities.

Ecosystems stability in the protected areas complex is dynamic and it is based on periodical seasoned events: exchange of water through sea-lake canal and the sandspit; evaporation of water and increase of salinity; water circulation according defined scheme defined by seasalt production; salt crystalization and return of lye and used waters back to the lake; land use of salt pans and lands around them. Disruption of this stability is going to lead to unpredictable changes in the habitats and communities with resulting biodiversity loss. Though more important is going to be the change in diversity and distribution of the rare and protected species. Main concerns are related to eventual abandoning of sea salt production; bad maintenance of the canal sea-lake; building or urbanization of the territories included in the protected areas, extreme weather conditions (dry weather and floods) related to expected global climate changes; bad maintenance of the drainage system and changing land and water bodies use.

5. SOCIO-ECONOMIC IMPORTANCE

As an addition to the high natural values, Pomorie Lake has significant social-economical importance due to the traditional sea salt production through evaporation of sea water. In Bulgaria there are only two active salt pans using this method – in Pomorie and Burgas. There are many publications describing that sea salt production in Bulgaria, Black Sea coast in the region of Anhyalo (present Pomorie) is known and practiced for thousands of years. According to some written chronicles, sea salt has been harvested in Anhyalo since 892 AD when it was sought and sold in Moravia. In 2002 a Salt museum was established where at present the last of the so-called urban salt pans are preserved while remaining parts of these were destroyed after restitution of ownership and converting these into urbanized regulated land plots. In the museum the traditional “Anhyalo method” for sea salt production is demonstrated, where smaller salt pans are used and salt is manually collected. In the rest of the salt pans in Pomorie the so called “Fochenian method” is used where bigger pans are used.

The sea salt and lye are used for various cosmetic products. The key substance of the popular toothpaste Pomorin is the lye from the salt pans of Pomorie. In the last few years new cosmetic series have been developed

using sea salt and lye. Other important product from the lake is medicinal mud that is extracted from the bottom of the lake. It is a specific product that is formed from the disintegration of the dead biota in an environment poor in oxygen and high salinity. In Pomorie there are a couple of specialized hospital in medicinal mud treatment as well as several hotels that are offering some procedures with lye and medicinal mud from the lake. These products and services are of a great importance in the region where they provide lots of jobs and define the image of Pomorie.

In the last few years, more interest is paid to the lagoon’s recreation values – birdwatching and wildlife photography are gaining popularity and the lake is used for ecotourism.

The lake is a source of significant ecosystem services from various kind. This requires systematical approach by applying the imperatives of the sustainable development – equality of the three goals – nature conservation – including biodiversity, economical development and social development. Leading role at the present conditions should be given to ecosystems’ and unique biodiversity conservation at Pomorie Lake that are at the basis of the medicinal mud development. However, at the same time rational use of the other resources should be considered.

The activities of medicinal mud treatment and rehabilitation is closely related to the status, functioning of the medicinal mud extraction site, use of medicinal mud and its return back into the lake for regeneration. The medicinal mud source in the lake is extremely sensitive to some external unfavourable natural factors – strong winds, storms, damage of dikes or a negative influence of continuous summer drying, etc. generally disrupting the functioning of the ecosystem and thus forming and keeping of medicinal mud.

Negative impact on condition of medicinal mud production and disrupting natural processes of forming and maturing of the mud is caused by antropogenic pressures to lake such as: pollution with domestic waste and others, especially during the tourism’s high season, drastic changes in content and structure of salts in the lake waters during sea salt production, formation of illegal dumping sites very close to the lake or in the lake itself and others.



6. LITTER POLLUTION

In the period between 2007-2009 an Integrated management plan of SCI “Pomorie“, SPA “Pomoriysko ezero“, PS “Pomorie Lake“ and Ramsar site “Pomorie Wetlands Complex“. Among the described threats is pollution with domestic waste and used building materials on illegal depots described and evaluated as follows:

“In the northern part of the roma quarter named North is formed a depot with a surface around 10-15 decares.

Very close to the western part of the lake also in the roma quarter a depot is formed that is on three levels (stretches):

- *A depot with length around 1000 m and wide 20-30 m, in some areas up to 50 m;*
- *There it is formed a second stretch between the lake and this depot that is going down to the lake;*
- *The third waste stretch is formed in the water body of the lake.*

In the area around the Salt museum and Specialized hospital for rehabilitation – National Complex (east of it) waste is dumped and piled chaotically – mainly used building materials. They are used to cover the old salt pans in this part of the town. At present in this zone the land is used for building. Medium level of threat.”

In 2011 within project “Urgent measures for restoration and coservation of species and habitats with European importance in the protected area complex of Pomorie Lake”, funded by the European Fund for Regional development of the European Community and the state Budget of Republic of Bulgaria through operative program “Environment 2007-2013” priority Axis 3 “Conservation and restoration of biodiversity in Republic of Bulgaria” implemented by Green Balkans NGO actions have been made to solve the problem, described in the Integrated management plan of Pomorie Lake.

A specialized company has been hired in order to fulfill the contract with a task “Cleaning the natural habitats in SCI “Pomorie“ from solid domestic waste and used building materials, in relation to conservation of coastal habitats and dunes in the area of Pomorie Lake. In the period 19th April to 18th May, 2011 the company mobilized the following resources for completion of contract: loader – 1, trucks – 3 pcs, workers – 30 persons, waste sacks – 1000 pcs, rakes – 20 pcs, shovels – 20 pcs, metal spits – 25 pcs.

The following activities have been completed:

- Collection of solid domestic waste and used building materials on a surface of 600 decares;
- Loading and transporting the collected waste by trucks – 112 trips;
- Cleaning the land and loading with a loader – 9 machine-shifts;
- The collected 762 m3 solid domestic waste and used building materials are transported up to the waste depot of Pomorie, where these are deposited.

Accordint to information from Pomorie Municipality during 2019, around 20 recommendations have been given to land-owners of polluted plots in and around Protected site “Pomorie Lake“ to clean these. Every year the Municipality takes actions to clean the waste from municipality-owned land plots that are very costly.

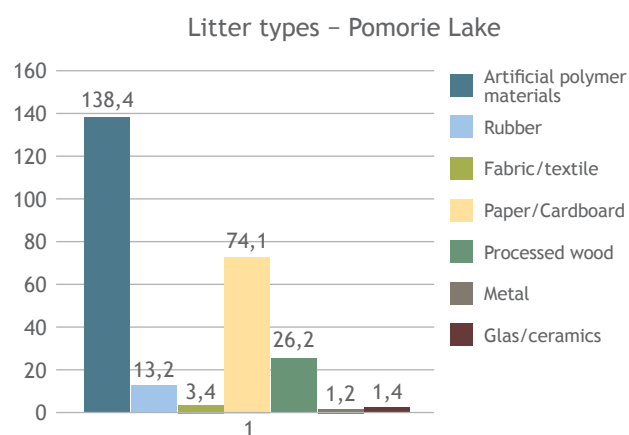
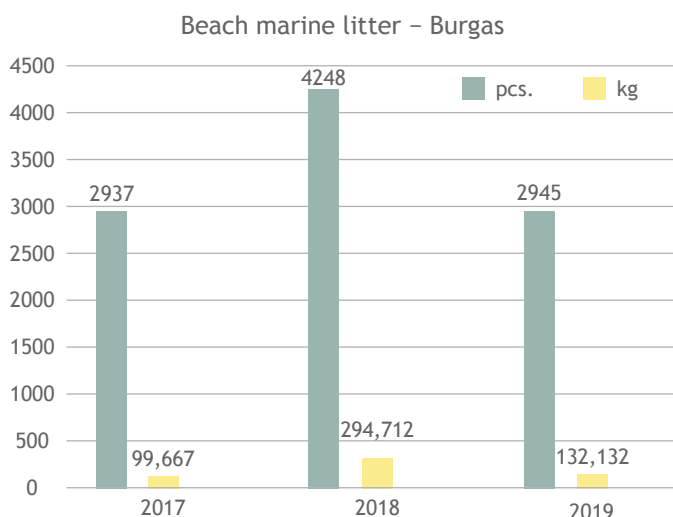
In fulfilment of the requirements of the Marine Strategy Framework Directive 2008/56/EC (MSFD), Bulgarian Government with Resolution 1111/29.12.2016 has accepted the Marine Strategy of Republic of Bulgaria and a program of measures in order to achieve and maintain the good environmental status of the marine environment. Descriptor 10 is Marine litter, including three indicators: quantity of beach/coastal litter > 2.5 cm upon categories of pcs and weight for 100 m stretch; quantity of marine litter > 2.5 cm, floating on the sea surface in pcs/km² and litter quantity > 2.5 cm, desposited on the bottom of the sea in pcs/km². Upon the first criteria the monitoring places are 10: beach Durankulak- North 1; beach Krapets, canal 2 – Lake Varna – Black Sea; beach Shkorpilovtsi north; beach Byala – Karadere; beach Obzor – summer children camps; beach Irakli; beach near to the Black Sea salt pans – Burgas; beach Alepu and beach – Veleka River mouth. Black sea Basin Directorate, Varna is in charge of the monitoring. Database for the following 3 years is available – 2017, 2018 and 2019 collected by the association “Our world”.

Because the beaches around Pomorie (including the sand spit that separates Pomorie Lake from the Black Sea) are not included in the main monitoring sites, here we represent the data of the closest site where the monitoring has taken place – a beach close to the salt pans of the Black Sea – Burgas. It may be considered that the oceanographic characteristics – exposures, predominant drafts and winds are identical or close and because of this the displayed results are relevant for the sand spit of the Pomorie Lake. The generlized results are shown in the following table:

Year	2017		2018		2019	
Missions	3 pcs.		4 pcs.		4 pcs.	
Categories	pcs.	kg	pcs.	kg	pcs.	kg
Artificial polymer materials	2021	23.87	2513	73.369	1799	28.471
Rubber	51	3.35	105	34.418	59	3.976
Fabric/textile	42	6.45	122	39.89	93	16.145
Paper/Cardboard	509	16.66	559	19.804	376	15.36
Processed wood	104	35.612	397	65.337	424	46.938
Metal	105	1.6	340	27.516	124	3.402
Glas/ceramics	95	11.565	184	30.326	53	15.85
Unidentified	10	0.56	28	4.052	17	1.99
TOTAL	2937	99.667	4248	294.712	2945	132.132

From the data it is clear that the biggest waste quantity along the beach Black Sea salt pans – Burgas is in 2018. The biggest amount of waste during the three years is in the category “Artificial polymer materials”, but as weight their share is the biggest in 2018, while during the other two years the biggest share takes the waste from the category “Processed wood”.

A few places with very high concentration of pollution are marked – they are mainly the area around the gipsy quarter (North) of town Pomorie, close to its inner dike (dike 1) and the sand spit/shore that separates Pomorie Lake from the Black Sea. The total volumes of the waste is estimated to approximately 257.9 cm³. The results from the study by types are shown in the following graph:



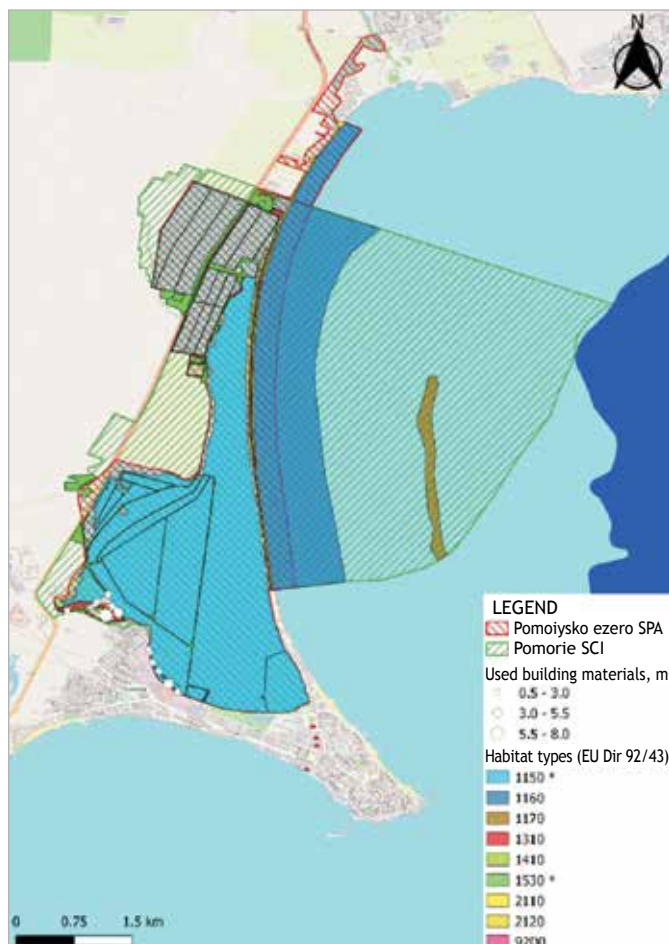
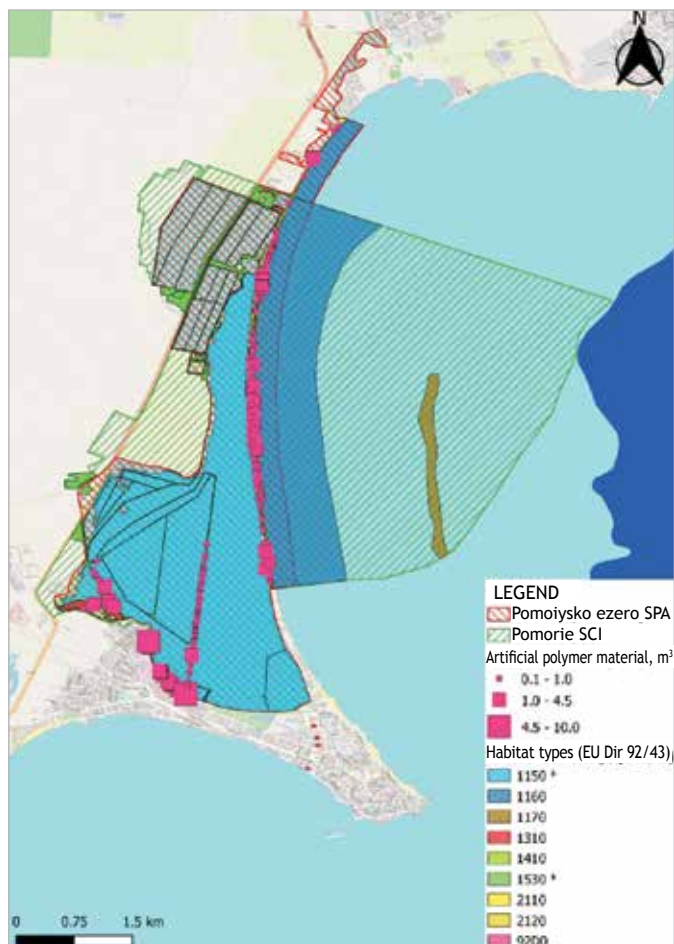
Within the frame of the present project BSB142 BioLearn a detailed mapping and a description of the waste in the region of Pomorie Lake is made. The types of litter are described according to the classification accepted by Marine Strategy Framework Directive with a little modification – one type is added – used building materials. The quantity is described as cubic meters as precise measurements are not made of each registered litter but the quantity data are aiming to show the ratio between the different types of litter and their approximate volume. For this purpose a field form for data collection is made where litter type, quantity, geographical coordinates recorded with GPS, affected habitat type in SCI “Pomorie”, its status in Standard Data Form and the level of pollution are recorded. Experts walked the shores of the lake including the inner dikes.

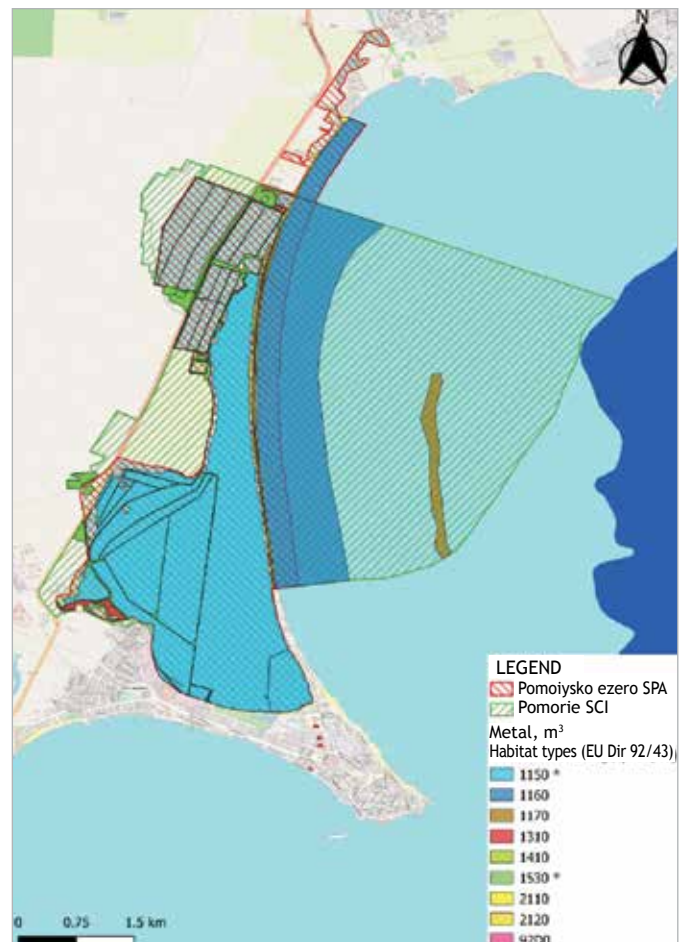
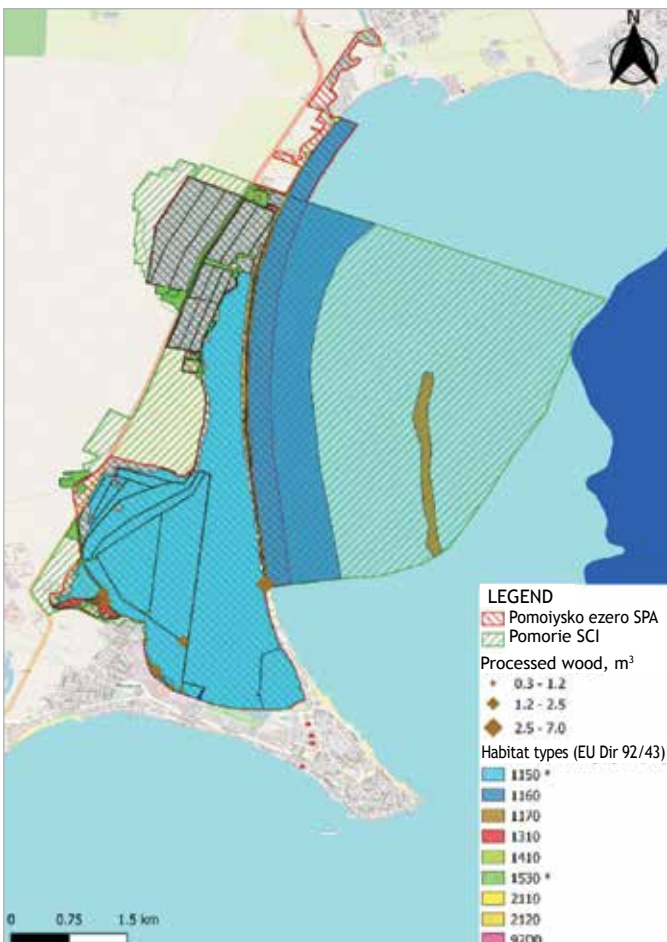
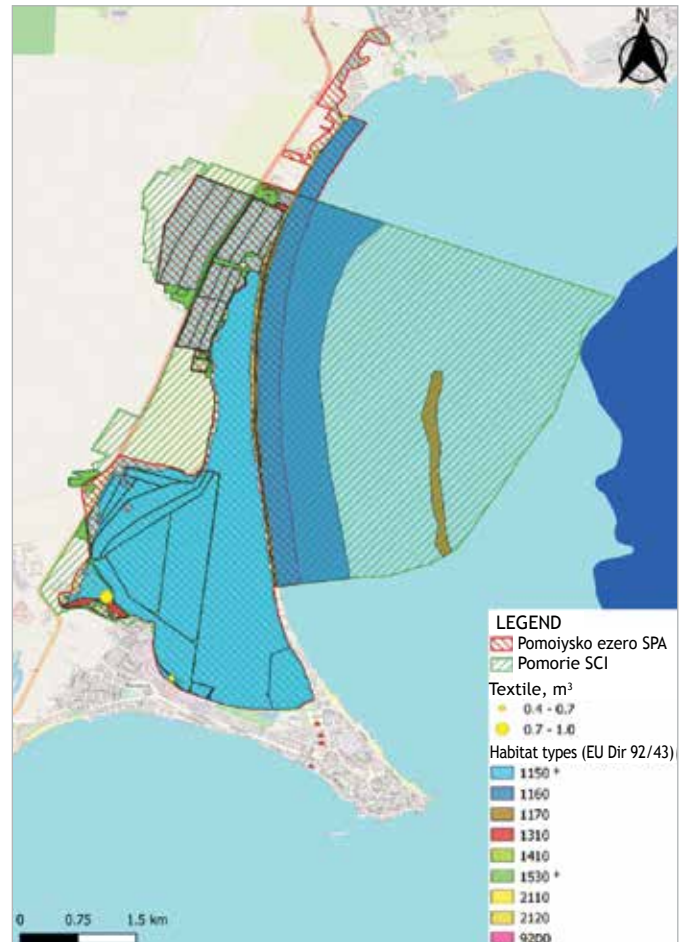
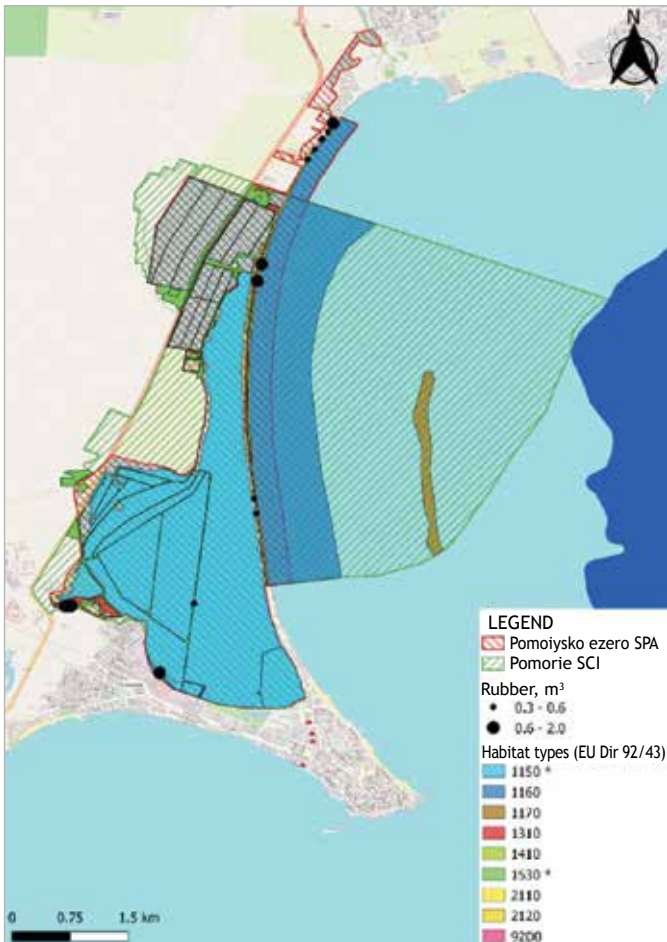
The biggest share is of artificial polymer materials – 138.4 m³ – that are distributed in all polluted areas including the following natural habitats: 1150* Coastal lagoons, 1310 Salicornia and other annual annuals colonizing mud and sand, 1530* Panonian salt steppes and salt marshes and 2120 White dunes with *Ammophila arenaria*. The next type of litter with serious share are used building materials (74.1 m³), that are spread in stretches along the roma quarter in the southwestern side of the lagoon. Third in terms of volume is ranked processed wood with total quantity 26.2 m³, these being mainly old furniture. The type of litter rubber (13.2 m³) is represented mainly by old tires concentrated nearby a garage that is most likely the source of this waste. The other types of litter – fabrics/textiles, glass and metal – are less in volume compared to those types already described.

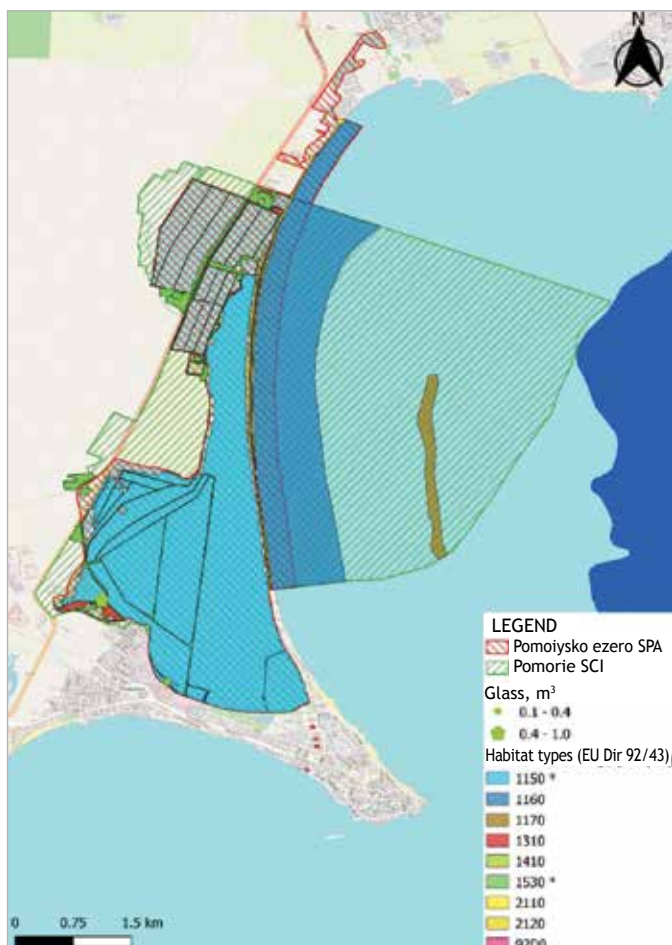
During the mapping various kinds of litter were encountered- from children toys, bottles, tires, shoes, clothes up to kitchen and home appliances such as fridges, TV sets and others. In the area of the sand spit that separates the lagoon from the sea concentration of aquaculture waste was registered – buoys from mussels farms and stiropore boxes used by fishing vessels.



The various types of litter are shown on the maps below:

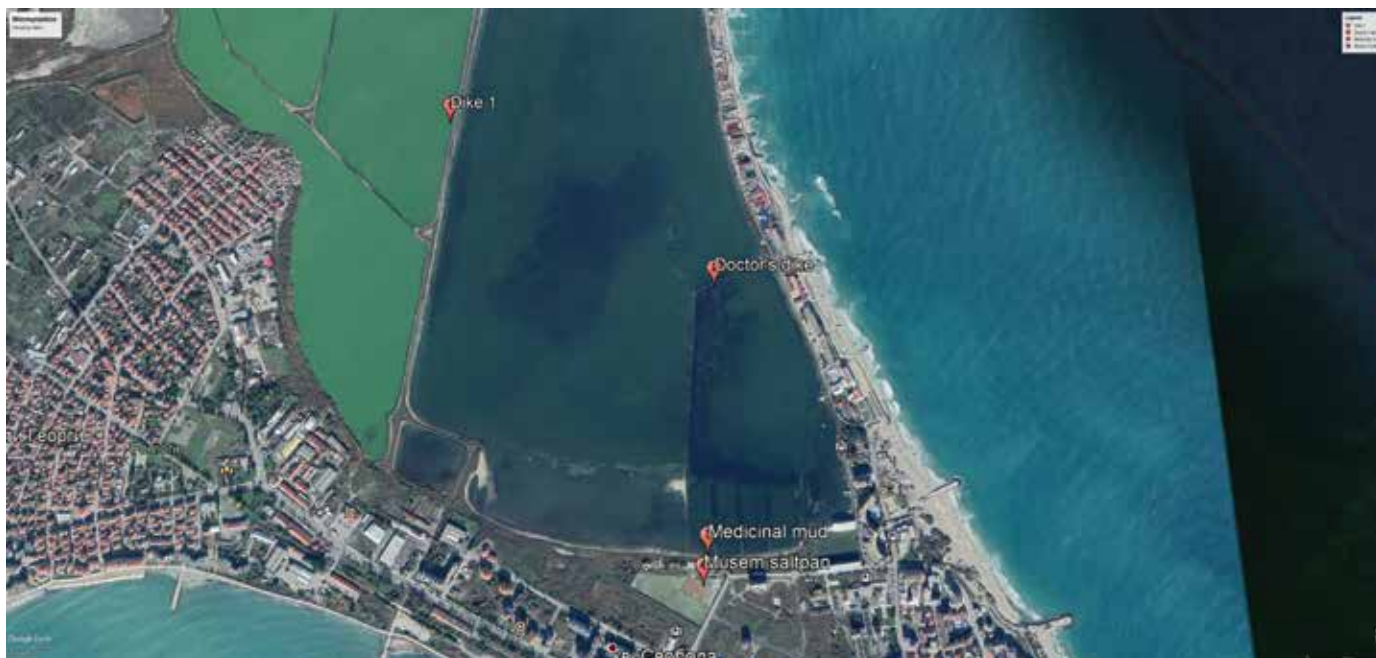






As an addition to the mapping and description of the macrolitter, samples have been collected from 4 sites in Pomorie Lake in order to study the levels of microplastics pollution in the water column and sediment. The research has been done in the laboratory of the Institute of Oceanology – Bulgarian Academy of Sciences by Associated Professor K. Stefanova and PhD candidate S. Mihova. The locations where the samples have been collected include:

- 1 – Dike 1
- 2 – Doctor's dike
- 3 – Medicinal mud
- 4 – Museum salt pan

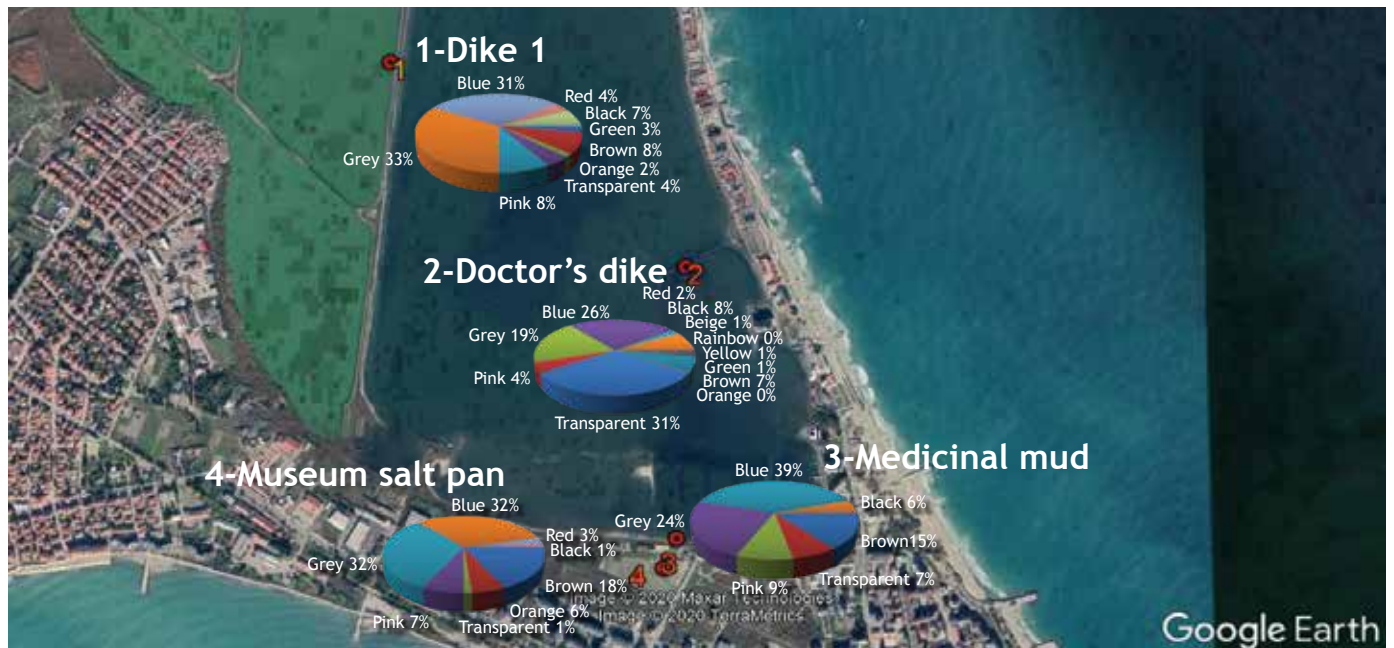


Microplastics were found in all four samples. The dominant type is fibers/threads and at station 4 (Museum saltpan) they are 100%. In the other samples the ratio between fibres/threads and other artificial particles is as follows:

Station 1 (Dike 1) – 92% threads and 8% other particles;

Station 2 (Doctor's dike) – 98.2% threads and 1.80% other particles;

Station 3 (Medicinal mud) – 97.12% threads and 2.88% other particles.

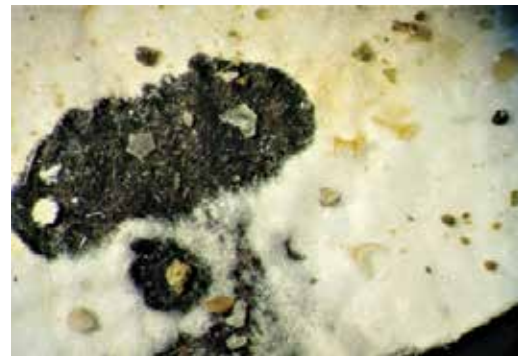


All identified elements are secondary microplastics (product of disintegration from bigger plastic parts) with the exception of one microgranule at station 3 (Medicinal mud).

The distribution of the fiber types by colours are shown in the table below:

Fiber pcs	Dike 1	Doctor's dike	Medicinal mud (sediment)	Museum salt pan (seasalt)
Beige	0	5	0	0
Rainbow	0	1	0	0
Yellow	0	2	0	0
Green	2	4	0	0
Brown	6	31	16	13
Orange	1	1	0	4
Transparent	3	149	8	1
Pink	6	21	10	5
Grey	24	91	26	23
Blue	22	123	43	23
Red	3	9	0	2
Black	5	39	6	1
Total	69	327	101	71

As a conclusion of this pilot study it can be stated that the dominant type of microplastics is fibre/thread. The majority are grey and blue fibres/threads. The discovered microplastics are secondary (with one exception).





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