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EMODnet Phase III

**Method for classifying EUSeaMap according to
the new version of EUNIS, HELCOM HUB,
and the Mediterranean habitat types**



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List of abbreviations and acronyms

EEA	European Environment Agency
ESH	EMODnet Seabed Habitats
EU	European Union
HELCOM	The Baltic Marine Environment Protection Commission is an intergovernmental organization and a regional sea convention in the Baltic Sea area
HUB	Helcom Underwater Biotope and Habitat Classification System
ICES	International Council for the Exploration of the Sea
MSFD	Marine Strategy Framework Directive
OSPAR	The mechanism by which 15 Governments and the EU cooperate to protect the marine environment of the North-East Atlantic.
TORs	Terms of reference



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Abstract

The need for maps of the seabed has become increasingly urgent in recent years for a wide range of reasons and uses, including reporting on the state of the marine environment to implement EU policies such as the MSFD. In ten years, the EMODnet Seabed Habitats initiative has produced maps for all European marine regions, where input data allowed, the resultant seabed habitat maps are known collectively as "EUSeaMap". With products such as EUSeaMap, it is assumed that mapping the broad habitat types defined in seabed habitat classifications (e.g. EUNIS) provides appropriate proxies for the occurrence of the species or communities of species that occupy them.

In addition to being released in EUNIS 2007-2011 and the MSFD Broad Benthic Habitat Types, the next version of EUSeaMap (expected in September 2021) will be released in three classifications, namely EUNIS 2019 (the new version of EUNIS), and the regional classifications HELCOM HUB and the Mediterranean habitat types.

This report proposes crosswalks between EUSeaMap modelled broad habitat types and the three classifications, and briefly discusses the opportunities/challenges entailed by the crosswalks. Our conclusion is that no major issue is expected for the translation of EUSeaMap into these classifications. We also argue that in EUNIS 2019 there are gaps at biotope levels, particularly in the Black Sea and the Arctic, and that measures should be taken to address these gaps.



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1 Introduction

The need for maps of the seabed has become increasingly urgent in recent years for a wide range of reasons and uses, including reporting on the state of the marine environment to implement EU policies such as the MSFD. In ten years, the EMODnet Seabed Habitats initiative has produced maps for all European marine regions, where input data allowed, the resultant seabed habitat maps are known collectively as "EUSeaMap". With products such as EUSeaMap, it is assumed that mapping the broad habitat types defined in seabed habitat classifications (e.g. EUNIS) provides appropriate proxies for the occurrence of the species or communities of species that occupy them. Details of how EUSeaMap is produced, and how the latest version differs from previous versions, can be found in the technical reports (Cameron and Askew, 2011, Populus et al, 2017, Vasquez et al, 2020).

EUSeaMap has been released in various classifications including the marine section of the EUNIS classification developed and maintained by the European Environment Agency (EEA). EUNIS has undergone a major restructuring whose foundations were established 4 years ago (Evans et al, 2016), and whose detailed parts were released in March 2020 in the form of an excel file under the name "EUNIS marine habitat classification 2019" (referred to as "EUNIS 2019" hereafter). In this version, the abiotic levels (i.e. 1 to 3) of EUNIS marine have been restructured to improve consistency accross marine regions. In September 2021, in addition to being released in the previous EUNIS and the MSFD Broad Benthic Habitat Types, EUSeaMap will be released in EUNIS 2019, the HELCOM HUB classification (HELCOM, 2013) and the revised classification of Mediterranean habitat types.

This report briefly describes how EUNIS 2019 differs from the previous version habitats classification and discusses the opportunities/challenges entailed by the crosswalk between EUSeaMap modelled broad habitat types and the three classifications.



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2 EUNIS 2019

EUNIS 2019 is composed of 6 hierarchical levels. The first three levels describe the habitats (i.e. the abiotic part) while the last three describe the biotopes (i.e. habitats and benthic communities that occupy them). EUSeaMap is intended to represent the abiotic levels, with a few exceptions (see section 2.3).

2.1 Level 2

Level 2 is divided by biological zone and seabed substrate as shown by Table 1.

Table 1: Level 2 habitat descriptors of the marine component EUNIS 2019, including level 2 codes (in Douglas et al, 2016)

Zone		Substrate					
		Hard/firm		Soft			
		Rock ¹	Biogenic habitat	Coarse	Mixed	Sand	Mud
Phytal/ hydrodynamic gradient	Littoral	MA1	MA2	MA3	MA4	MA5	MA6
	Infralittoral	MB1	MB2	MB3	MB4	MB5	MB6
	Circalittoral	MC1	MC2	MC3	MC4	MC5	MC6
Aphytal/ hydrodynamic gradient	Offshore circalittoral	MD1	MD2	MD3	MD4	MD5	MD6
	Upper bathyal	ME1	ME2	ME3	ME4	ME5	ME6
	Lower bathyal	MF1	MF2	MF3	MF4	MF5	MF6
	Abyssal	MG1	MG2	MG3	MG4	MG5	MG6

Seabed substrate

Soft sediment classes are defined by the relative proportions of mud, sand and gravel, based on the Folk classification (Folk, 1954). The categories are consistent with those used in EUSeaMap. Compared to the previous version of EUNIS, at level 2 the substrate is not divided in seven classes but in five classes. This difference is due to the fact that i) "sand" and "muddy sand" have been grouped in "sand", and ii) "mud" and "sandy mud" have been grouped in "mud".

Another important novelty is the inclusion at level 2 of biogenic habitats. These are habitats where animals or plants form a hard substrate for other organisms. Typical examples include mussel beds, coral reefs, coralligenous concretions and Posidonia meadows.

¹ Includes soft rock, clays, artificial hard substrata

Biological zones

The main difference with the previous version of EUNIS is the subdivision of the bathyal in 'Upper bathyal' and 'Lower bathyal'.

Energy levels

A major difference between EUNIS 2019 and the previous version is that there is no specific hierarchical level for the description of wave- and current-induced energy for rocky habitats. As a result, EUSeaMap in EUNIS 2019 will not describe the exposure of rocky seabed to wave and currents.

2.2 Level 3

Geographic division

The classification at level 3 divides level 2 by marine regions. There are five of them: Arctic, Atlantic, Baltic, Black Sea and Mediterranean. Hence, comparable habitats have different level-3 codes from one region to another. For example, Infralittoral sand has a code MB51 in the Arctic, MB52 in the Atlantic, MB53 in the Baltic, MB54 in the Black Sea, and MB55 in the Mediterranean. As a result, EUSeaMap will have to be split into these regions for each habitat to be assigned the appropriate code, which may seem straightforward but is actually not so obvious.

The *ReadMe* tab of the EUNIS 2019 excel file defines the regions as “*those of the European regional Seas and largely coincide with those of the marine conventions (HELCOM, OSPAR, Barcelona, Bucharest) and the MSFD*”. There is some ambiguity in this definition, particularly because there is no clear reference that would allow an unambiguous understanding of what is meant by “*European regional seas*”.

We assume however that by this terminology is meant the regions that are in figure 1, published by the EEA under the name “Europe’s seas”².

Assuming that the above-mentioned is correct, then comes the issue of the boundaries of the Arctic. The “Europe’s seas” geographic division comprises 4 regions, themselves divided in subregions as follows (Reker et al, 2017).

- The Baltic Sea
- The North-east Atlantic Ocean
 - The Greater North Sea, including the Kattegat and the English Channel
 - The Celtic Seas
 - The Bay of Biscay and the Iberian Coast
 - Macaronesia
- The Mediterranean Sea
 - The Western Mediterranean Sea
 - The Adriatic Sea
 - The Ionian Sea and the Central Mediterranean Sea
 - The Aegean-Levantine Sea
- The Black Sea

Hence the Arctic is not included. In the “Europe’s seas” data product that is available online in the form of a geodatabase, there are northern non-MSFD subregions, namely the Iceland Sea, the Norwegian Sea and the Barents Sea, and these are included in the North-East Atlantic Ocean.

² <https://www.eea.europa.eu/data-and-maps/data/europe-seas>

We will assume that what is referred to as “Atlantic” in EUNIS 2019 does not comprise the Iceland Sea, the Norwegian Sea and the Barents Sea, and that what is referred to as ‘Arctic’ does comprise them.



Figure 1 – Europe’s seas as pictured on the EEA’s website³. In bold: regions; In non-bold: subregions

2.3 Level 4-6

These levels are those where the biology is described. However, at level 4, in some cases the description is either fully abiotic (e.g. “MB543 Black sea infralittoral muddy sand”), or provides no detail on the biology (e.g. “MD451 Biocenosis of Mediterranean open-sea detritic bottoms on shelf-edge”).

³ <https://www.eea.europa.eu/data-and-maps/figures/regional-seas-surrounding-europe-1>

3 Regional classifications

3.1 HELCOM HUB

The HELCOM Underwater biotope and habitat classification system (HELCOM HUB) provides a framework for defining habitats and biotopes in the whole Baltic Sea. The HELCOM HUB is hierarchical and structured into six levels. It's noteworthy that Kattegat is included in HELCOM HUB as a part of the Baltic Sea area but is considered as a part of the Atlantic in EUNIS 2019. The EUSeaMap modelling process will need to take account of this discrepancy between the two classifications in order to include Kattegat in the HELCOM version.

EUNIS 2019 individualises biogenic habitats while HELCOM HUB does not, which in some cases leads to a one-to-many relationship between an EUNIS 2019 biogenic habitat and the corresponding HELCOM HUB habitats. For example, the EUNIS biogenic habitat "MB231 Baltic infralittoral bottoms dominated by epibenthic bivalves" corresponds to the HELCOM HUB "AA.A1E Baltic photic rock and boulders characterized by epibenthic bivalves", "AA.B1E Baltic photic hard clay characterized by epibenthic bivalves", "AA.H1E Baltic photic muddy sediment characterized by epibenthic bivalves", "AA.I1E Baltic photic coarse sediment characterized by epibenthic bivalves" and "AA.J1E Baltic photic sand characterized by epibenthic bivalves".

3.2 The revised classification of Mediterranean habitat types.

The list of Mediterranean benthic habitats is part of the Thematic Decision IG.24/7 adopted in December 2019 by the 21st Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (UNEP/MAP, 2019. See decision IG.24/7, annex VI).

This classification had been developed in parallel with EUNIS 2019, with the aim that the two classifications should be as close as possible to each other. As a result, at level 3 EUNIS 2019 and the revised and updated version of the Mediterranean habitat classification are identical (i.e. same code, same name). At levels 4-5 the habitats generally have the same code and similar names. There are however few habitats with different codes or names, but these are easy to crosswalk.

4 Crosswalking EUSeaMap habitat types into EUNIS 2019, HELCOM HUB and the classification of Mediterranean habitat types

Biogenic habitats

As exceptionally done so far in the Mediterranean for the Posidonia meadows, biogenic habitat polygons from survey maps will be incorporated into EUSeaMap. The metadata will make clear that these polygons reflect the best evidence for occurrence of the habitat, and that no polygon does not mean absence of the habitat. The polygons will be compiled and included in the seabed substrate data product that will be used as input to EUSeaMap. For the sake of interest, biogenic habitats will be mapped at EUNIS 2019 level 4 rather than level 3 (e.g. “MB252 Biocenosis of Posidonia oceanica” rather than “MB25 Mediterranean infralittoral biogenic habitat”).

Atlantic & Arctic

In the infralittoral, circalittoral and deep circalittoral the crosswalks are straightforward. In the deep sea, EUSeaMap divides the bathyal in three sub-zones (upper, mid and lower bathyal) while EUNIS 2019 divides in two sub-zones (upper and lower bathyal). After discussion with experts, a decision has been made that the EUSeaMap mid bathyal will be translated in the EUNIS 2019 upper bathyal. The translation of EUSeaMap into EUNIS 2019 in the Atlantic and Arctic should therefore not present any difficulties.

Baltic

EUNIS 2019 is compatible with the HELCOM underwater biotope and habitat (HUB) classification (HELCOM 2013). HELCOM HUB splits the shelf in 2 zones, namely photic and aphotic, while EUNIS splits it in 3 zones, namely infralittoral, circalittoral and offshore circalittoral. The EUNIS infralittoral fully matches the HUB photic, while the EUNIS circalittoral and offshore circalittoral are contained within the HUB aphotic. EUNIS 2019 defines the offshore circalittoral as the zone “below the halocline/pycnocline”, which is how EUSeaMap has defined the deep circalittoral. As a result, translating EUSeaMap in level 3 of EUNIS 2019 should not be challenging.

Where the EUNIS Biogenic habitat has a one-to-many match in HELCOM HUB (see section 3.1), the operator “OR” will be used in the HELCOM HUB translation. For example, for the EUNIS 2019 biogenic habitat “*MB231 Baltic infralittoral bottoms dominated by epibenthic bivalves*” the translation into HELCOM HUB will be “*AA.A1E Baltic photic rock and boulders characterized by epibenthic bivalves OR AA.B1E Baltic photic hard clay characterized by epibenthic bivalves OR AA.H1E Baltic photic muddy sediment characterized by epibenthic bivalves OR AA.I1E Baltic photic coarse sediment characterized by epibenthic bivalves OR AA.J1E Baltic photic sand characterized by epibenthic bivalves*”.

Black Sea

So far, EUNIS has not been used for EUSeaMap in the Black Sea. The reason for this is that the biotopes that were defined as important by the EMODnet Seabed Habitats’ experts were not included in EUNIS 2007-11. In EUNIS 2019, there are still substantial gaps at the biotope level. In annex 2 are listed communities that in our opinion should be included in EUNIS. For the sake of consistency with other marine regions, EUSeaMap broad habitat types will be translated into EUNIS 2019 level 3. However, the EUSeaMap technical report and metadata will make it clear that the EUNIS 2019 values assigned to polygons do not appropriately depict the biotopes

identified within the framework of EMODnet Seabed Habitats because most of them are absent from the classification. EUSeaMap will also continue to be published in the EUSeaMap Black Sea broad habitat types.

In EUNIS 2019, the Marmara Sea, which is located between the Mediterranean and the Black Sea, is included in the Black Sea region while the biotopes that occur in that sea, e.g. "Communities of coastal detritic bottoms", "Communities of infralittoral coastal terrigenous muds", or "Communities of circalittoral muddy detritic bottoms", do not occur in the Black Sea and are typical of the Mediterranean Sea. As a result, although modeled according to the rules and thresholds defined for the Mediterranean Sea, the habitats of the Marmara Sea will be assigned a Black Sea EUNIS 2019 habitat.

As the bathyal is azoic in the Black Sea, it will not be divided in lower and upper bathyal.

Mediterranean Sea

The crosswalks between EUSeaMap habitat types and EUNIS 2019 are in most cases quite simple and straightforward. So far, in the Mediterranean the circalittoral zone was not formally divided into "shallow" and "offshore" circalittoral in the modelling procedure. The use of the new EUNIS classification makes that division mandatory. However, within a same substrate a specific threshold value was used to differentiate between circalittoral biocoenosis. This threshold will be applied to subdivide the circalittoral zone. It's interesting to note that habitats like the coastal terrigenous muds, for which no differences occur through the whole circalittoral, will have to be associated to different codes (MC651 and MD651 respectively) that describe exactly the same habitat type ("Coastal terrigenous muds" *sensu* Peres and Picard).

The bathyal zone will also need to be subdivided in upper and lower bathyal, which will require a depth threshold to be determined from statistical analysis (if sufficient data available) or from the literature. As no update of the biological zones has been planned for EUSeaMap 2021, this will be left to next phase of EMODnet. As a result the "OR" statement will be used, for example where EUSeaMap's habitat is "bathyal rock", the translation into EUNIS 2019 will be "ME15: Mediterranean upper bathyal rock OR MF15: Mediterranean upper bathyal rock").

5 Conclusion

The restructuring of EUNIS achieved the main objective of bringing coherence between regions for abiotic levels 1-3. Now, at these levels, seabed habitats can be mapped consistently from one region to another. The gaps are at biotope levels. Significant progress is required in the Black Sea, where there is no consensus, and in the Arctic, where the biotopes have not been defined yet. For the Black sea, communities that in our opinion should be included are listed in annex 2. In the Atlantic, some specific biotopes of the Azores, the Iberian Peninsula and the Basque country, identified in 2013 within the framework of the MeshAtlantic project (Monteiro et al, 2013; Tempera et al, 2013), have not been integrated.

No major issue is expected for the translation of EUSeaMap into EUNIS 2019. However, until the above-mentioned gaps are not addressed, the broad habitat types covered by EUSeaMap cannot optimally reflect the biology that occupies these habitats, resulting in the introduction of biases in the assessments made for the implementation of European directives. Therefore, we recommend that urgent measures be undertaken to address this problem (see next section).

6 Recommendations for follow-up actions by the EU

The EU is invited to:

- 1) Consider the creation of EUNIS regional working groups, the TORs of which would be to review and update the EUNIS classification at biotope levels, i.e. levels 4-6. As mentioned in the conclusion, this would be needed in all regions, with the highest emergency in the Black Sea, where there is no consensus. There are also substantial gaps in the Arctic section, which currently only comprises these biotopes from the Atlantic section that are acknowledged to occur in the Arctic.
- 2) Consider the publication of a report for EUNIS 2019 that may e.g. describe how/why the recent changes were made, and provide an unequivocal definition of the regions, particularly the Arctic.



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Annex 1 Crosswalks between EUSeaMap's habitats and EUNIS 2019, HELCOM HUB and the revised classification of Mediterranean habitat types

This annex is available in the form of excel spreadsheets (same DOI).

In the Baltic and Mediterranean Sea crosswalks between EUSeaMap's habitats and regional classifications (respectively HELCOM HUB and the revised classification of Mediterranean habitat types) are also proposed.



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Annex 2 - Black Sea communities to be included in EUNIS 2019

In the table below are the communities that have been identified by Black Sea experts of EMODnet Seabed Habitats. Most of them are not in EUNIS 2019, hence would require to be included at level 4-6 in the relevant level 3 category (mentioned in column "EUNIS 2019 level 3").

EUSeaMap Habitat	EUNIS 2019 level 3	Communities
Infralittoral rock	MB14 Black Sea infralittoral rock	<p><i>Upper-infralittoral rock dominated by Cystoseira bosphorica</i></p> <p><i>Upper-infralittoral rock dominated by Cystoseira barbata</i></p> <p><i>Upper infralittoral rock with variable annual green and red macroalgae Ceramium virgatum, Gelidium spinosum, G. crinale, Corallina mediterranea, Ulva rigida, U. linza, U. intestinalis, Cladophora sericea, C. albida, Bryopsis plumosa</i></p> <p><i>Lower infralittoral rock with dominant perennial sciaphylic red and brown macroalgae (Phyllophora crispa, Zanardinia typus, Apoglossum ruscifolium) and/or widely adaptive green (Cladophora albida, C. coelothrix) and red macroalgae (Polysiphonia elongata, Gelidium spinosum, G. crinale, Anithamniom cruciatum)</i></p> <p><i>Infralittoral rock overgrown by Mytilaster lineatus and Mytilus galloprovincialis</i></p> <p><i>Infralittoral soft rock with piddocks (Pholas dactylus, Barnea candida)</i></p> <p><i>Infralittoral rock with faunal turf (bryozoans, sponges)</i></p> <p><i>Upper infralittoral rock with photophilic macroalgae (Ceramium virgatum, Corallina officinalis, Ulva rigida, U. linza, U. intestinalis, Cladophora vagabunda, C. sericea, C. albida, Bryopsis plumosa and Cystoseira barbata)</i></p> <p><i>Infralittoral soft rock with Pholadidae</i></p> <p><i>Lower infralittoral rock with faunal turf (sponges)</i></p>
Circalittoral rock	MC14 Black Sea circalittoral rock	Circalittoral rock overgrown by Mytilus galloprovincialis, hydrozoans and sponges
Infralittoral Coarse and Mixed Sediment	MB34 Black Sea infralittoral coarse sediment	<p>Infralittoral shelly gravel and sand with <i>Chamelea gallina</i> and <i>Mytilus galloprovincialis</i></p> <p>Infralittoral mixed sediments with <i>Mytilus galloprovincialis</i> biogenic reefs</p>

EUSeaMap Habitat	EUNIS 2019 level 3	Communities
		Infralittoral coarse sediments with <i>Pitar rudis</i> Infralittoral mixed sediments with <i>Anadara kagoshimensis</i> and/or <i>Molgula appendiculata</i>
Infralittoral sand and muddy sand	MB54 Black Sea infralittoral sand	Pontic <i>Zostera noltei</i> meadows Pontic mixed <i>Zostera noltei</i> - <i>Zannichellia palustris</i> - <i>Zostera marina</i> meadows Pontic <i>Zostera marina</i> meadows Pontic <i>Potamogeton pectinatus</i> - <i>Zannichellia palustris</i> meadows in man-made sheltered areas Upper-infralittoral medium and fine sand dominated by <i>Donax trunculus</i> Infralittoral shelly coarse sand and shellbed with varied infauna Infralittoral fine and medium sand, dominated by <i>Chamelea gallina</i> (<i>Lentidium mediterraneum</i> , <i>Tellina tenuis</i> , <i>Lucinella divaricata</i>) Lower infralittoral coarse and medium sand, dominated by <i>Upogebia pusilla</i> Infralittoral fine sand dominated by <i>Lentidium mediterraneum</i> (<i>Cerastoderma glaucum</i>) Lower infralittoral muddy sand with burrowing thalassinidae (<i>Upogebia pusilla</i> , <i>Gilvossius candidus</i>)
Shallow circalittoral shelly coarse sediment	MC34 Black Sea circalittoral coarse sediment	<i>Shallow circalittoral shelly coarse sediment with varied infauna</i> (<i>Modiolus adriaticus</i> , <i>Gouldia minima</i>) <i>Shallow circalittoral shelly coarse sediment with varied infauna</i> (<i>Pitar rudis</i> , <i>Nereididae</i> , <i>Diogenes pugilator</i> , <i>Polititapes aureus</i>)
Shallow circalittoral mixed sediment	MC44 Black Sea circalittoral mixed sediment	Shallow circalittoral with <i>Dipolydora quadrilobata</i>
Shallow circalittoral mud	MC64 Black Sea circalittoral mud	Shallow circalittoral muddy sand and sandy mud with <i>Upogebia pusilla</i> , <i>Heteromastus filiformis</i> , <i>Nephtys hombergii</i> , <i>Aricidea claudiae</i> , <i>Chamelea gallina</i> Shallow circalittoral mud with <i>Melinna palmata</i> Shallow circalittoral sandy mud and mud with <i>Pitar rudis</i> , <i>Spisula subtruncata</i> , <i>Polititapes aureus</i> , <i>Mytilus galloprovincialis</i> , <i>Abra</i> spp., <i>Cardiidae</i> , <i>Nephtys hombergii</i> , <i>Heteromastus filiformis</i> Shallow circalittoral mud and sandy mud with burrowing thalassinidae (<i>Upogebia pusilla</i> , <i>Gilvossius candidus</i>)

EUSeaMap Habitat	EUNIS 2019 level 3	Communities
		Shallow circalittoral mud with <i>Spisula subtruncata</i> , <i>Abra nitida</i> , <i>Pitar rudis</i> , <i>Acanthocardia paucicostata</i> , <i>Nephtys hombergii</i> and <i>Mytilus</i> beds Circalittoral mud and sandy mud with <i>Gouldia minima</i> , <i>Pitar rudis</i> , <i>Aricidea claudiae</i>
Deep circalittoral mixed sediments	MD44 Black Sea offshore circalittoral mixed sediment	Deep circalittoral shelly mud with <i>Modiolula phaseolina</i>
Deep circalittoral muddy sand	MD54 Black Sea offshore circalittoral sand	Deep circalittoral muddy sand with Molgulidae tunicates
Deep circalittoral mud	MD64 Black Sea offshore circalittoral mud	Deep circalittoral mud with <i>Terebellides stroemi</i> , <i>Amphiura stepanovi</i> , <i>Pachycerianthus solitarius</i>
Deep circalittoral suboxic calcareous muds	MD64 Black Sea offshore circalittoral mud	Deep circalittoral suboxic muds with <i>Bougainvillia muscus</i> and nematodes

Habitats occurring in river plumes

Habitat	EUNIS 2019 level 3	Communities
Infralittoral sand	MB54 Black Sea infralittoral sand	Fine sand with <i>Lentidium mediterraneum</i>
Infralittoral muddy sand	MB54 Black Sea infralittoral sand	<i>Cerastoderma glaucum</i> , <i>Mya arenaria</i> , <i>Anadara kagoshimensis</i> ,
Circalittoral coarse and mixed sediment	MC44 Black Sea circalittoral mixed sediment	Diverse faunal assemblages due to heterogenous substrate dominated by bivalves <i>Mytilus galloprovincialis</i> , <i>Spisula subtruncata</i> , <i>Acanthocardia paucicostata</i> and polichaetes <i>Nephtys hombergii</i>
Circalittoral terrigenous muds	MC64 Black Sea circalittoral mud	Danube and Dnieper plume areas (Mud with <i>Melinna palmata</i> , <i>Mya arenaria</i> , <i>Anadara kagoshimensis</i> , <i>Alitta succinea</i> , <i>Nephtys hombergii</i>)