

Seabed Habitats Lot



Generating Essential Ocean Variables

The purpose of this document is to explain the methodology used in creating Essential Ocean Variables for the Atlas of Marine Life.

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This document gives an overview of the procedure used to create spatial data layers displaying seagrass, macroalgae and live coral from the existing library of habitat maps on the EMODnet Seabed Habitats map viewer. These layers present the first attempt to map areal extent of three Essential Ocean Variables (EOVs) in Europe. Together with the EOV data products developed by EMODnet Biology, they contribute to the growing <u>Atlas of Marine Life in Europe</u>.

Essential Ocean Variables

The Global Ocean Observing System (GOOS) aims to promote common standards for data collection around the world. As part of this it has identified a series of variables that it hopes will lead to consistency and cost-effective marine monitoring, globally; these are known as 'Essential Ocean Variables' (EOVs).

Of the ten EOVs in the 'Biology and Ecosystems' category there are three that relate to European seabed habitats, and within each EOV there are several sub-variables (specific variables that may be measured), one of which can be directly informed by habitat maps (Table 1).

EOV	Relevant sub-variable
Hard coral cover and composition	Live hard coral cover and extent
Seagrass cover and composition	Areal extent of seagrass meadows
Macroalgal canopy cover and composition	Areal extent

Table 1. EOV variables and their sub-variables which can be mapped using data from the EMODnet Seabed Habitats portal.

At the time of writing, the specification sheets for these habitats were still under development; therefore, the 3 EOV layers produced should also be seen as a "work in progress".

EMODnet Seabed Habitats Map Viewer

EMODnet Seabed Habitats (ESBH) collates habitat maps, habitat models and habitat point data (Figure 1). It also produces a broadscale predictive map – EUSeaMap – which displays EUNIS marine habitats in European waters. A library of over 750 habitat maps have been collated to date. These maps span the extent of the Northeast Atlantic Ocean, Baltic Sea, Mediterranean Sea and Black Sea. The maps are in themed categories: EUNIS, Habitats Directive Annex 1, Composite Data Products and broad-scale predictive maps. (The maps are fully INSPIRE compliant. All maps can be freely downloaded from the <u>ESBH portal</u> along with metadata and confidence scores for each map).



Figure 1. Categories of maps available for download from the EBSH map viewer.

The resources on this web viewer were used in the compilation of composite layers displaying the areal extent of the three EOVs listed above.

Generating EOV layers

A list of habitats was prepared for each EOV with input from all ESBH project partners. These are presented in Appendix 1. After agreeing on the habitat lists, the relevant data for each EOV were extracted from the library of habitat maps on the portal. An R script was used to extract the data from all EUNIS habitat maps. Data from other maps types were extracted manually. The data were merged into standardised, non-overlapping polygon shapefiles and published as web mapping service (WMS) layers from the ESBH viewer.

1. Seagrass cover

Seagrasses provide essential habitat and nursery areas for many marine fauna. There are approximately 72 seagrass species that belong to four major groups: Zosteraceae, Hydrocharitaceae, Posidoniaceae and Cymodoceaceae. *Zostera* beds and *Cymodecea* meadows are named on the OSPAR Threatened or Declining Habitats list (Appendix 2). *Posidonia* beds are protected under Annex I of the EU Habitats Directive (Appendix 3).

Seagrass habitat data have been collated from the following map categories from the ESBH portal (order reflects the priority):

- (i) OSPAR threatened and/or declining habitats shapefile
- (ii) Library of EUNIS habitat maps
- (iii) non-EUNIS habitat maps
- (iv) Annex I habitat maps
- (iv) EUSeaMap (broad-scale predictive map)

Decision rules when dealing with overlaps

Layers (i), (ii) and (iii) are high resolution vector data. The EUSeaMap layer is a vectorised polygon layer converted from a 250 m model of predicted habitats. It was given the least priority on account of its course resolution (Figure 2a).

OSPAR data was given priority over any overlapping data from EUNIS or non-EUNIS maps. In areas where 2 EUNIS maps overlapped, the map with the highest confidence was given priority (Figure 2b). In areas where there was a mosaic of live *Posidonia* and dead *Posidonia*, the polygons displaying live *Posidonia* were selected for input into the final layer.



Figure 2. (a) Overlap between EUNIS habitat maps and EUSeaMap. (b) Overlaps between 2 EUNIS habitat maps with difference confidence assessment scores.

The final layer shows extent of seagrass collated by ESBH in European waters (Figure 3).



Figure 3. Collated seagrass polygon data from the ESBH map viewer used in the generation of the Seagrass EOV layer.

2. Macroalgal canopy cover

Kelp and fucoid brown algae are the dominant species that comprise macroalgal forests. Although not on any list of protected habitats, they provide many important functions including provision of nursery areas and protection from coastal erosion.

Macroalgal forest data have been collated from the following map categories from the ESBH portal (order reflects the priority):

- (i) Library of EUNIS habitat maps
- (ii) non-EUNIS habitat maps

In areas where 2 EUNIS maps overlapped, the map with the highest confidence score was given priority.

The final layer shows extent of macroalgal forests collated by ESBH in European waters (Figure 4).



Figure 4. Collated kelp and fucoid polygon data from the ESBH map viewer used in the generation of the Macroalgal Canopy Cover EOV layer.

3. Live coral

The health and areal extent of the hard coral community within a reef are direct indicators of the ability of a system to sustain the diversity of associated species. *Lophelia pertusa* and Coral gardens are both on the OSPAR List of threatened and/or declining species and habitats.

Live coral habitat data have been collated from the following map categories from the ESBH portal (order reflects the priority):

- (i) OSPAR threatened and/or declining habitats shapefile
- (ii) Library of EUNIS habitat maps

The final layer shows extent of hard coral collated by ESBH in European waters (Figure 5).



Figure 5. Collated coral polygon data from the ESBH map viewer used in the generation of the Live Coral EOV layer.

Limitations and future improvements

There are a few key limitations with these products that are important to highlight.

1. Incompleteness

The composite maps are the most comprehensive collection of maps related to these EOVs in Europe. However, they cannot be assumed to show the true extent of the habitats, and likewise areas that are not mapped do not necessarily imply that the habitat is absent.

This is due to multiple reasons including:

- i. We cannot guarantee that the collection of maps contains all the European seabed habitat maps in existence.
- ii. Much of the seabed has never been surveyed for these habitat types.
- iii. Whilst some surveys may have targeted these habitat types, the data may not facilitate the mapping of areal extents. For example, the Live coral layer produced is missing a lot of data, particularly in the Irish EEZ. One likely reason for the absence is that the output from Remotely Operated Vehicle (ROV) Surveys – the preferred survey technique for deep water corals – is a series of photos and a point dataset indicating the presence of a species or habitat. The format makes it difficult to translate into a polygon shapefile measuring extent. Advances in photogrammetric techniques may change this in the future but for now the best data will most likely be from a model or a point dataset.

2. Change over time is not explicit

Using the current method, if a single site has been mapped repeatedly over time, all instances of the habitat will be included from all the maps. This would lead to an overestimate of the extent of the habitat within the site if the extent had decreased over time.

3. There is no distinction between 'absent habitat' and 'no data'

It may be useful for a user to know whether a habitat is not mapped somewhere because the area hasn't been surveyed, or because it was surveyed and another habitat was present.

For future versions of these composite products we recommend to:

- i. Continue to collate individual habitat maps from surveys to provide the most comprehensive product possible.
- ii. Amend the method to make a distinction between 'absent habitat' and 'no data'.

- iii. Include a layer of point data although points do not give an areal extent, they will help to indicate additional areas where the habitats have been observed but not necessarily mapped.
- iv. Make the time element more prominent. The current products show data from many different years presented together; however in reality the extent of the habitats may change over time as a result of natural variability or human activities.

Appendix 1: Habitat lists for EOVs

Table 2 displays a list of habitat types from the EUNIS habitat classification system that the ESBH partners determined relate to the seagrass EOV. These were used to extract the relevant polygons from the individual EUNIS habitats maps and EUSeaMap. Also included are columns indicating with which Annex I and OSPAR habitats these habitat types might correspond.

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Association with [Zostera notiki] on superficial muddy sands in sheltered stociation with [Zostera notiki] on superficial muddy sands in sheltered sociation with [Zostera notiki] on stociation with [Zostera notiki] on marina]. Association with [Zostera notiki] on marina]. Mediteranean (Zostera horemanniana], vicarian of [Zostera notiki] on stociation of the Mediteranean endemic [Zostera horemanniana], vicarian of [Zostera notiki] on marina]. Beds de stargens [Zostera horemanniana], vicarian of [Zostera notiki] stociation [Sostera hore], stociation [Sostera horemanniana], vicarian of [Zostera horemanniana], vicar	eurybaline and eurythermal environment	A5 53321	7	substrata, from sand to mud, either at the entrances to the Jagoons (graus) or even within the Jagoons, where it	Zostera heds		Zostera beds
superficial modely sands in sheftered Ass322 7 area where there is an active deposit of fine matter. The epifauna of the vascular plants is poor. The population can Association with [Zostera marina] in euclythine and euclythermal environment AS.5333 6 Zostera beds Zostera beds Association with [Zostera marina] in euclythermal environment in AS.5333 6 mating]. This association is found in eurlythermal environment marina], divident of [Zostera marina], often confined to beds Zostera beds	Association with [Zostera poltii] on			Association with the [Zostera politii] on muddy sands in sheltered waters. The [Zostera politii] constitutes a hed in			
Association with [Zostera marina] and explained and explained and explained out explained out explained and paints provide and paints provide and prov	suporficial muddy cands in sheltared	AE 52222	7	and where there is an active denoting of made y sense in the entities where the exception of the exception of the entities of the entits of the entities of the entities of th	Zortora bodr		Zortora hodr
Association with (costern annih) in eurynamia and eurynemai wates and its characterised by the eer grass (zostern a best evaluation and eurynamia and eurynemai wates and its characterised by the eer grass (zostern a best evaluation and eurynamia and eury	superioral modely salids in shere red	A3.33322	,	areas where there is an active deposit of the matter. The epiradua of the vascular plants is point the population can	20stera Deus		20stera beus
euryntermie and euryntermie a	Association with [Zostera marina] in			inis association is found in eurynaline and eurythermai waters and it is characterised by the eei-grass [zostera			
Mediterranean locater a hormannianal, vicariant of IZoster hormanninanal, vicariant of IZOSTER hormannianal, vicariant of	euryhaline and eurythermal environment	A5.5333	6	marina].	Zostera beds		Zostera beds
beds A5.334 6 coastal lagoons, recorded also from the lstrio-Dainmatian archipelago. Zostera beds Zostera beds [Ruppia] and [Zannichellia] communities A5.344 5 generally found in extremely sheltered embayments, maine inelles, setuaries and lagoons, with very weak tidal Ruppia ladds Augusta beds Augusta beds [Ruppia] and [Zannichellia] communities A5.344 6 of backish seas, sea inlets, estuaries, permanent goods propia priorbaj. [Zannichellia] enderolitati. [Lotand appic.] Tokaj and (Chang) a	Mediterranean [Zostera hornemanniana]			Formations of the Mediterranean endemic [Zostera hornemanniana], vicariant of [Zostera marina], often confined to			
Beds of segress [Zostera marnia] or [Roppia] spp] in analysments, marine index, staturais and algoons, with very weak and stature and algoons of Attature, North Sea & Walpia beds Medde tarrepean (Ruppia) and (Ruppia) a	beds	A5.5334	6	coastal lagoons, recorded also from the Istrio-Dalmatian archipelago.	Zostera beds		Zostera beds
Integrate and Zamichellia Jommanties AS34 S generally found in extremely sheltered embayments, main einlets, estuaries and lagoons, with vey weak tidal Ruppia lades Rup				Beds of seagrass ([Zostera marina] or [Ruppia] spp.) in shallow sublittoral sediments. These communities are			
Niddle European (Ruppi)a) Submerged beds of (Ruppi andrinal), (Ruppi andrinal), [Ruppi andrinal),	[Ruppia] and [Zannichellia] communities	A5.534	5	generally found in extremely sheltered embayments, marine inlets, estuaries and lagoons, with very weak tidal	Ruppia beds		
Zamichelia (communities A5.5341 6 of brackity seas, sea indics, estuaries, permanent pools form dur or sand flats, and coastal lagoons of Atlantic, North Sea Ruppia beds Image: Communities A5.5342 Communities A5.5343 Communities A5.5353 Communities A5.5343 Communities A5.5353 Communities A5.5353 Communities A5.5364 Communities A5.5364 Communities A5.5364 Communities A5.5364 Communities A5.5374 Communities A5.5	Middle European (Ruppia) and			Submerged beds of [Runnia maritima] [Runnia circhosa] [Zannichellia nedicellata] [Chara] spn. [Tolynella nidifica]			
Laminotine (Jointanics) A.S.342 O O bink and seg, set inters, permittering (Jointanics) and of Chanal spo. of sain induces and appoint on training (Ruppin acritina) (Ruppin	(Zannichallia) communities	AE 5241	6	of brackich core, conjugate activities permanent pools of mudiar and fate and constal property of Atlantic North Soc	Ruppia bode		
Tethyan marine [Ruppia] communities A5.5342 6 positor frad or set of ruppia among or (ruppia) among or ruppia) among or ruppia among	[Zaninchenia] communities	A3.3341	0	of blacksh seas, sea milets, escuaries, permanent poors of mud of saint hats, and cuastar ragoons of Atlantic, North sea	Nuppia Deus		
lettyamanne (typpa)a communities A5.542 6 pools of mud or sand tats, and coastal lagoons of the Meditermean, the Black sea and the subtropical Atlantic, north Nuppa anatting in reduced salities (Ruppi)a narrating in reduced salities A5.5352 6 These beds may be populated by fish such as (Casteropical Atlantic, north, Nuppa abeds) Ruppi a narrating in reduced salities (Infailting muddy sand A5.5352 5 These beds may be populated by fish such as (Casteropica sucleatus) which is less common on filamentous algal Ruppi a narrating in reduced salities Posidonia beds (Posidonia) beds A5.5352 5 species is endemic to the Meditermaean and constitutes characteristic formations called Posidonia meadows, located Posidonia beds Posidonia beds Comorphosis of "barrier-reef" (Posidonia) The steppe and constitutes characteristic formations calles if source and calles is four addited by the presence of the marine segarated by stretches of dead mat colonised by Posidonia beds Posidonia beds Comorphosis of "barrier-reef" (Posidonia) The steppe and constitutes in the intered bars. The vertical growth of the constitutes of dead mat colonised by Posidonia beds Posidonia beds Coancial dead/source Posidonia beds Fosidonia beds Fosidonia beds Posidonia beds Coancial dead/source Posidonia beds Posidonia beds Posidonia beds Posidonia beds Coancial dead/source A5.5352 6 <td></td> <td></td> <td></td> <td>submerged beds of [Ruppia maritima] or [Ruppia cirriosa] and of [Chara] spp. of sea inlets, estuaries, permanent</td> <td></td> <td></td> <td></td>				submerged beds of [Ruppia maritima] or [Ruppia cirriosa] and of [Chara] spp. of sea inlets, estuaries, permanent			
[Rupping in reduced salinity in sheltered brackish muddy sand and mud, beds of [Rupping inartitinal] and more rarely [Rupping inartitinal] Image: Rupping inartitinal inartition in the rupping inartitinal and more rarely [Rupping inartitinal] may occur. Image: Rupping inartitinal inartition in the rupping inartitinal inartitinal rupping inarinartitinal inartition in the rupping inartitinal i	Tethyan marine [Ruppia] communities	A5.5342	6	pools of mud or sand flats, and coastal lagoons of the Mediterranean, the Black Sea and the subtropical Atlantic, north	Ruppia beds		
infallitional muddy sand A5.333 6 These beds may be populated by fish such as [Gaterorous sculentus] which is less common on finamentous algal- Ruppia beds Nuppia beds Image: State	[Ruppia maritima] in reduced salinity			In sheltered brackish muddy sand and mud, beds of [Ruppia maritima] and more rarely [Ruppia spiralis] may occur.			
Postdonia beds A5.333 Section is seemblage is characterised by the presence of the marine seagrass (phanoregam) (Posidonia oceanica). This Posidonia beds Posidonia beds Ecomorphosis of striped (Posidonia A5.333 Section is seemblage in the Mediterranean and constitutes characteristic formations called Posidonia nacedwas, located Posidonia bedwas Posidonia beds Posidonia beds Ecomorphosis of striped (Posidonia) A5.331 Gotta is betwased locate in the Mediterranean and constitutes characteristic formations called by stretches of dead matcoloniste dby posidonia beds Posidonia beds Posidonia beds Ecomorphosis of "harrier-reef" (Posidonia) K This ecomorphosis can be found in (Posidonia oceanica) headous to stretches of dead matcoloniste dby stretches of dead matco	infralittoral muddy sand	A5.5343	6	These beds may be populated by fish such as [Gasterosteus aculeatus] which is less common on filamentous algal-	Ruppia beds		
Ipostdomaip beds A.S.33 5 species is endemic to the Mediterranean and constitutes characteristic formations called Posidonia meadows, located Posidonia beds Posido				This assemblage is characterised by the presence of the marine seagrass (phanerogam) [Posidonia oceanica]. This			
Ecomorphosis of striped [Posidonia occanical] meadows AS.532 6 This result of that can be several dozen metres long. These ribboss are separated by stretches of dead mat coloniaed by Bosidonia beds Posidonia beds Pos	[Posidonia] beds	A5.535	5	species is endemic to the Mediterranean and constitutes characteristic formations called Posidonia meadows, located	Posidonia beds	Posidonia beds	
occanical meadows A5.333 6 that can be several dozen metres long. These fibbos are separated by stretches of dead mat colonised by Posidonia beds Posidonia beds <thp< td=""><td>Ecomorphosis of striped (Posidonia</td><td></td><td></td><td>The strined [Posidonia oceanica] meadows facies is found at denth 0 - 5 metres. It appears as fairly narrow ribbons</td><td></td><td></td><td></td></thp<>	Ecomorphosis of striped (Posidonia			The strined [Posidonia oceanica] meadows facies is found at denth 0 - 5 metres. It appears as fairly narrow ribbons			
Ecomorphois of "barrier-cef" [Posidonia Instrument of the mathematical provides of the mathe	oceanical meadows	A5 5351	6	that can be several dozen metres long. These ribbons are separated by stretches of dead met colonised by	Posidonia beds	Posidonia beds	
Insectionary insection provides an insection provide in the insection provide insect	Ecomorphonic of "barrier mof" [Desidence	.0.001		This comparabasis can be found in [Posidonia ocoanica] bads procent in shaltered have. The contract and the	- condonia deus	r ostaorina beus	
uccentral preductions rescalars	comorphosis or partier-reer (Posidonia	45 5353	c .	This econorphosis can be round in prostoonia oceanical beds present in shertered bays. The Vertical growth of the	Desidenia h - t-	Desidenia hada	
praces or beas mattes or (prositional decail Positionia decail Positionia decail oceanical jubition uncher pillora A5.533 6 This facies is characterised by a dead mat of [Positionia oceanical] without macro-epillora. "mattes" Positionia beds Association with (Caulerap arolifera) n This facies is characterised by a dead mat of [Positionia oceanical] without macro-epillora. "mattes" Positionia beds (Positionia beds) A5.533 6 oceanical jubition terms of the green alga [Caulerap arolifera] in association with the [Positionia beds Positionia beds (Positionia beds) A5.534 6 oceanical jubition Positionia beds (Positionia beds) A5.545 Sociania beds Positionia beds (Positionia beds) A5.545 Sociania beds Positionia beds	oceanicaj meadows	MD.5352	0	mizomes reads to the raising of the mat, thus enabling the meadow to reach the surrace.	Posicionia peds	Posidonia Deds	
occentral without much epilfora A5.333 6 This fade's is characterised by a dead mat of [Posidonia oceanica] without macro-epilfora. "mattes" Posidonia beds Association with [Caulerpa prolifera] on Image: Caulerpa prolifera] Image: Caulerpa prolifera] Posidonia beds Posidonial beds A5.333 6 oceanica] bed. Posidonia beds Posidonial beds A5.334 6 oceanica] bed. Posidonia beds Posidonial beds A5.335 6 oceanica] bed. Posidonia beds Posidonial beds Posidonia beds Posidonia beds Posidonia beds	Facies of dead "mattes" of [Posidonia	1			Posidonia dead		
Association with (Caulerap prolifera) and the presence of the green alga (Caulerap arolifera) in association with the [Posidonia [Posidonia] beds in reduced salinity in the presence of the green alga (Caulerap arolifera) in association with the [Posidonia] Posidonia beds po	oceanica] without much epiflora	A5.5353	6	This facies is characterised by a dead mat of [Posidonia oceanica] without macro-epiflora.	"mattes"	Posidonia beds	
Posidonial beds A5.333 6 oceanical bed. Posidonial beds Posidonia beds Posidonia beds [Zostera] beds in reduced salivity infalltitoral sediments A5.595 5 Total sediments A5.595 Total sediments A5.595 Total sediments	Association with [Caulerpa prolifera] on			This facies is characterised by the presence of the green alga [Caulerpa prolifera] in association with the [Posidonia			
Zosteral beds in reduced salinity Infallitoral sediments AS.545 5 Zosteral beds Zosteral beds	[Posidonia] beds	A5.5354	6	oceanica) bed.	Posidonia beds	Posidonia beds	
Infallitoral sediments A5.545 5 Zostera beds Zostera beds Zostera beds	[Zostera] beds in reduced salinity						
	infralittoral sediments	A5.545	5		Zostera beds		Zostera beds

Table 2: List of habitats in Seagrass Cover EOV.

Table 3 displays a list of habitat types from the EUNIS habitat classification system that the ESBH partners determined relate to macroalgal cover EOV. These were used to extract the relevant polygons from the individual EUNIS habitat maps and EUSeaMap. Also included is a column entitled "Other Habitat Maps" which lists two habitat types identified from non-EUNIS habitat maps.

EUNIS Name	EUNIS Code	EUNIS Level	Generic name	Other Habitat Maps
Kelp with suching found and or foliose and sequends	42.11		Kolp Forest or Kolp park	
keip with cushion radia and/or onose red seaweeds	A3.11	*		
[Alaria esculenta] on exposed sublittoral fringe bedrock [Alaria esculenta], [Mytilus edulis] and coralline crusts on very exposed	A3.111	5	Kelp Forest	
sublittoral fringe bedrock [Alaria esculenta] and [Laminaria digitata] on exposed sublittoral fringe	A3.1111	6		
bedrock	A3.1112	6		
extremely exposed infralittoral bedrock	A3.112	5	Kelp Forest	
[Laminaria hyperborea] forest with a faunal cushion (sponges and polyclinids) and foliose red seaweeds on very exposed infralittoral rock	A3.113	5	Kelp Forest	
[Laminaria hyperborea] with dense foliose red seaweeds on exposed	42.115		Koln Forart	
[Laminaria hyperborea] forest with dense foliose red seaweeds on	A3.115	5	Reip Porest	
exposed upper infralittoral rock Mixed [Laminaria hyperborea] and [Laminaria ochroleuca] forest on	A3.1151	6	Kelp Forest	
exposed infralittoral rock	A3.1153	6	Kelp Forest	
[Laminaria hyperborea] and red seaweeds on exposed vertical rock	A3.117	5	Kelp Forest	
Association with [Cystoseira amentacea] (var. [amentacea], var. [stricta], var. [spicata])	A3.132	5		
Kelp and red seaweeds (moderate energy infralittoral rock)	A3.21	4		
II aminaria digitatal an moderately average cublitheral fringe mek	42 211		Koln canony and furnide	
Lammana digitataj on moderatery exposed subrittoral milge rock	A3.211	5	Kerp canopy and fuccios	
[Laminaria digitata] on moderately exposed sublittoral fringe bedrock	A3.2111	6	Kelp canopy and fucoids	
[Laminaria digitata] and under-boulder fauna on sublittoral fringe boulders	A3.2112	6	Kelp canopy and fucoids	
[Laminaria digitata] and piddocks on sublittoral fringe soft rock	A3.2113	6	Kelp canopy and fucoids	
[Laminaria hyperborea] on tide-swept, infralittoral rock	A3.212	5		
[Laminaria hyperborea] forest, foliose red seaweeds and a diverse fauna on tide-swent upper infralitoral rock	A3 2121	6	Kelp Forest	
Second Strept appendituation rock		_		
[Laminaria hyperborea] on tide-swept infralittoral mixed substrata [Laminaria hyperborea] forest and foliose red seaweeds on tide-swept	A3.213	5		
upper infralittoral mixed substrata	A3.2131	6	Kelp Forest	
infralittoral rock	A3.214	5		
[Laminaria hyperborea] forest and foliose red seaweeds on moderately exposed upper infralittoral rock	A3.2141	6	Kelp Forest	
[Sabellaria spinulosa] with kelp and red seaweeds on sand-influenced	A3 21//5	6	Keln forest	
	A3.2143	-	Reprofest	
[Laminaria hyperborea] on moderately exposed vertical rock	A3.216	5		
Kelp and seaweed communities in tide-swept sheltered conditions	A3.22	4	Kelp forest	
fringe rock	A3.221	5	Kelp forest	
Mixed kelp with foliose red seaweeds, sponges and ascidians on sheltered tide-swept infralittoral rock	A3.222	5	Kelp forest	
Mixed kelp and red seaweeds on infralittoral boulders, cobbles and gravel in tidal rapids	A3.223	5	Kelp forest	
	42.224			
Association with [Cystoserra tamanscriptia] and [Saccomiza polyscribes]	A3.234	5		
Association with [Cystoseira brachycarpa]	A3.239	5		
Mediterranean and Pontic Association with [Cystoseira crinita]	A3.23A	5		
Association with [Cystoseira crinitophylla]	A3.23B	5		
Association with [Cystoseira sauvageauana]	A3.23C	5		
Association with [Cystoseira spinosa]	A3.23D	5		
Cilead halo an Investment of stillen and suith full satisfies	42.21		Kala farant ashala asal	
Mixed [Laminaria hyperborea] and [Laminaria ochroleuca] forest on	A3.31	4	Kelp forest or kelp park	
moderately exposed or sheltered infralittoral rock Mixed [Laminaria hyperborea] and [Laminaria saccharina] on sheltered	A3.311	5	Kelp Forest	
infralittoral rock	A3.312	5	Kelp forest or kelp park	
sheltered upper infralittoral rock	A3.3121	6	Kelp Forest	
[Laminaria saccharina] on very sheltered infralittoral rock	A3.313	5	Kelp forest or kelp park	
[Laminaria saccharina] and [Laminaria digitata] on sheltered sublittoral	42 2121	6	Kolo canony	
Silted cape-form [Laminaria hyperborea] on very sheltered infraittoral rock	A3.3132	ь	Kelp Forest	
rock	A3.314	5	Kelp Forest	
Kelp in variable salinity on low energy infralittoral rock	A3.32	4		
grazed infralittoral rock	A3.322	5	Kelp Forest	
[Laminaria saccharina] with [Phyllophora] spp. and filamentous green seaweeds on variable or reduced salinity infralittoral rock	A3.323	5	Kelp Forest	
Association with [Cystoseira compressa]	A3 333	5		
Association with [cystoscilla compressa]	13.333	3		
Association with [Cystoseira zosteroides]	A4.261	5		
Association with [Cystoseira usneoides]	A4.262	5		
Association with [Cystoseira dubia]	A4.263	5		
Association with [Cystoseira corniculata]	A4.264	5		
Kelp and seaweed communities on sublittoral sediment	A5.52	4		
[Laminaria saccharina] and [Chorda filum] on sheltered upper infralittoral muddy sediment	A5 522	5		
[Laminaria saccharina] with [Psammechinus miliaris] and/or [Modiolus				
modioiusj on variable salinity infralittoral sediment [Laminaria saccharina], [Gracilaria gracilis] and brown seaweeds on full	A5.523	5	Keip Forest	
salinity infralittoral sediment	A5.524	5		
Association with [Cystoseira barbata]	A5.52E	5		
N/A	N/A	N/A	Kelp Forest	Large Laminaria hyperborea kelp forests
N/A	N/A	N/A		Infralittoral rock with fucoids

Table 3: List of habitats in Macroalgal Canopy Cover EOV.

EMODnet Seabed Habitats 11 Generating Essential Ocean Variables

Table 4 displays a list of habitat types from the EUNIS habitat classification system that the ESBH partners determined relate to the live coral EOV. These were used to extract the relevant polygons from the individual EUNIS habitats maps and EUSeaMap. Also included are columns indicating with which Annex I and OSPAR habitats these habitat types might correspond.

EUNIS Name	EUNIS Code	EUNIS Level	Generic name	Annex 1 Habitat	Subtype	OSPAR
				_		
Circalittoral coral reef	A5.63	4	Coral reef	Reefs	Biogenic	
Circalittoral Lonhelia pertusa reefs	45 631	5	Cold-water coral	Reefs	Biogenic	Ionhelia pertusa reefs
	A3.031	5	cold water coldi	neers	Diogenie	Lophena pertasa reers
Communities of deep-sea corals	A6.61	4	Deep-sea coral	Reefs	Biogenic	
Deep-sea Lophelia pertusa reefs	A6.611	5	Cold-water coral	Reefs	Biogenic	Lophelia pertusa reefs
			Coral carbonate			
Carbonate mounds	A6.75	4	mounds	Reefs	Biogenic	Carbonate mounds
N/A	N/A	N/A	Coral Gardens			Coral Gardens

Table 4: List of habitats in Live Coral EOV.

Habitat type	EOV	EOV layer
Carbonate mounds	Yes	Live coral
Coral gardens	Yes	Live coral
Cymodocea meadows	Yes	Seagrass cover
Deep-Sea Sponge Aggregations		
Intertidal <i>Mytilus edulis</i> Beds on Mixed and Sandy Sediments		
Intertidal mudflats		
Littoral chalk communities		
Lophelia pertusa reefs	Yes	Live coral
Maerl beds		
Modiolus modiolus beds		
Oceanic ridges with hydrothermal vents		
Ostrea edulis beds		
Sabellaria spinulosa reefs		
Seamounts		
Sea-pen & burrowing megafauna communities		
Zostera beds	Yes	Seagrass cover

Appendix 2: OSPAR List of Threatened and/or Declining Habitats

Table 5: Habitats selected from the OSPAR List for inclusion in the EOV layers.

Habitat type	Code	EOV	EOV layer
Sandbanks	1110		
Posidonia Beds	1120	Yes	Seagrass cover
Estuaries	1130		
Mudflats and sandflats not covered by sea water at low tide	1140		
Coastal lagoons	1150		
Large shallow inlets and bays	1160		
Reefs	1170		
Submarine structures made by leaking gases	1180		
Submerged or partially submerged caves	8330		

Appendix 3: Marine habitats listed in Annex I of the EU Habitats Directive.

Table 6: Habitats selected from the Annex I List for inclusion in the EOV layers.