A5.51 Rhodolith beds in the Mediterranean

Summary

Rhodolith beds are formed by the accumulation of various species of unattached red calcareous algae (Rhodophyta). They are composed of living and dead thalli, and although they have a patchy distribution, they occur throughout the Mediterranean Sea where they are particularly abundant. Mediterranean rhodolith beds are known to be hot-spots of biodiversity, hosting a high diverse invertebrate community. Moreover, they are amongst the Mediterranean communities with the highest amounts and production rates of carbonates, and they provide nursery grounds for commercial fish and shellfish species.

Commercial dredging, trawling fisheries, chemical pollution by organic matter and excess nutrients are the major threats identified for these habitats. Rhodolith-forming algae are likely to be also affected by the ongoing global warming and ocean acidification. The need to grant protection to the characteristic species of this Mediterranean assemblage should also be considered along with a moratoria on the issue of further permits for the siting of aquaculture units above rhodolith grounds; monitoring programmes: designation of 'no-take' reserves and MPAs where these habitats occur; and establishing measures to limit the impacts that might affect water quality above rhodolith beds.

Synthesis

There are no published data on trends of this habitat and very little available information about its extent of occurrence or its area of occupancy. There have been no quantitative analyses examining the probability of extinction of Mediterranean rhodolith beds. As a result, there is insufficient data to properly assess the habitat against any of the red list criteria, and it is listed as Data Deficient for both EU 28 and EU +28.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Data Deficient	-	Data Deficient	-

Sub-habitat types that may require further examination

Maerl beds

Habitat Type

Code and name

A5.51 Rhodolith beds in the Mediterranean

Scorpion fish and maërl bed. Oceana expedition to the Balearic seamounts onboard the SOCIB R/V. Fort d'en Moreu, Cabrera, Balearic Islands, Spain (© OCEANA_Scorpionfish).

Rhodolith beds in the Aegean Sea (© Y.Issaris).

Habitat description

Mediterranean rhodolith beds could be found between 20-150 m depth in normal marine conditions. The most common species is *Lithothamnion corallioides* and *Phymatolithon calcareum* is recorded less frequently. Different dominant species characterize the Mediterranean rhodolith beds, probably on the basis of biogeography and local environmental conditions.Characteristic associations include: Association with rhodoliths in coarse sands and fine gravels under the influence of bottom currents; and Association with rhodoliths on coastal detritic bottoms.

Rhodolith beds are defined by those sedimentary bottoms characterised by any morphology and species of unattached nongeniculate calcareous red algae (incompletely-coated grains excluded) with >10% of live cover. They occur in coarse clean sediments of gravels, clean sands and coastal detritic areas under the influence of bottom currents, which occur either on the open coast or in tide-swept channels of marine inlets (the latter often stony).

In general, fluent unidirectional hydrodynamism and laminar currents affect the seafloor. In the Mediterranean, the most favourable environment for this habitat to occur in biotopes with laminar bottom currents with a regular course. Changes in hydrodynamic conditions and intensity of light differentiate the presence of different associations, particularly in the community of the coastal detritic bottoms (circalittoral). The most frequent species of epiflora are *Arthrocladia villosa* and *Sporochnus pedunculatus*. Differences in intensity and typology of hydrodynamism and in species composition are able to determine differences in the growth form, structure and shape of the rhodoliths that can be summarized into three main morphologies: small and compact pralines, unattached branches, and large, irregular, boxwork rhodoliths. In the lower infralittoral zone this assemblage forms patches of organogenous pebbles of branched rhodoliths in various development stages. In the circalittoral zone the free calcareous algae formation can cover up to several square kilometres. Rhodolith beds can be considered as authentic carbonate factories, since they are among the highest producers of biogenic particles in European seas. The living part of the association is limited only to the surface of some centimetres of thickness. Subhabitat scomposed of non-nucleated, unattached growths of branching, twig-like coralline can be distinguished as maerl beds.

Classification

EUNIS (v1405):

Level 4. A sub-habitat of ‘Mediterranean shallow/infralittoral coarse sediment’ (A5.5).

Annex 1:

1110 Sandbanks slightly covered all the time

1170 Reefs

MAES:

Marine- Marine inlets and transitional waters

Marine- Coastal

MSFD:

Shallow sublittoral sediment (coarse, sand, mud, mixed)

EUSeaMap:

Shallow coarse or mixed sediments

IUCN:

9.5 Subtidal sandy-mud

Other relationships:

INFRALITTORAL Barcelona code:

III.3.1. (lower infralittoral) Habitat of coarse sands small pebbles stirred by waves (CSSW)

III.3.1.a. Association with rhodoliths on CSSW (*Lithophyllum dentatum, Lithophyllum racemus, Lithophyllum incrustans*)

III.3.2. Habitat of sands and gravels under influence of bottom currents (SGBC - SGCF) (present both in Infralittoral and Circalittoral)

III.3.2.a. Association of maërl on SGBC (*Lithothamnion corallioides* and *Phymatolithon calcareum*)

III.3.2.b. Association with rhodoliths on SGBC (*Lithophyllum racemus* and *Lithothamnion* spp.)

III.3.2.c. Facies with *Ophelia neglecta*

CIRCALITTORAL

IV.2.2.a. Maërl Association on coastal detritic (*Lithothamnion corallioides* and *Phymatolithon calcareum*)

IV.2.2.b. Association with rhodoliths on coastal detritic (*Lithothamnion spp., Neogoniolithon mamillosum, Spongites fruticulosus*)

IV.2.2.1, IV.2.2.2., IV.2.2.4 (circalittoral)

Does the habitat type present an outstanding example of typical characteristics of one or more biogeographic regions?

Yes

Regions

Mediterranean

Justification

The Mediterranean rhodolith habitat appears to have a higher calcareous algae biodiversity than North East Atlantic beds and to be distributed to greater depths. Some rhodolith-forming coralline algae such as *Lithophyllum racemus, Lithothamnion minervae* and *Lithothamnion valens* are believed to be Mediterranean endemic species.

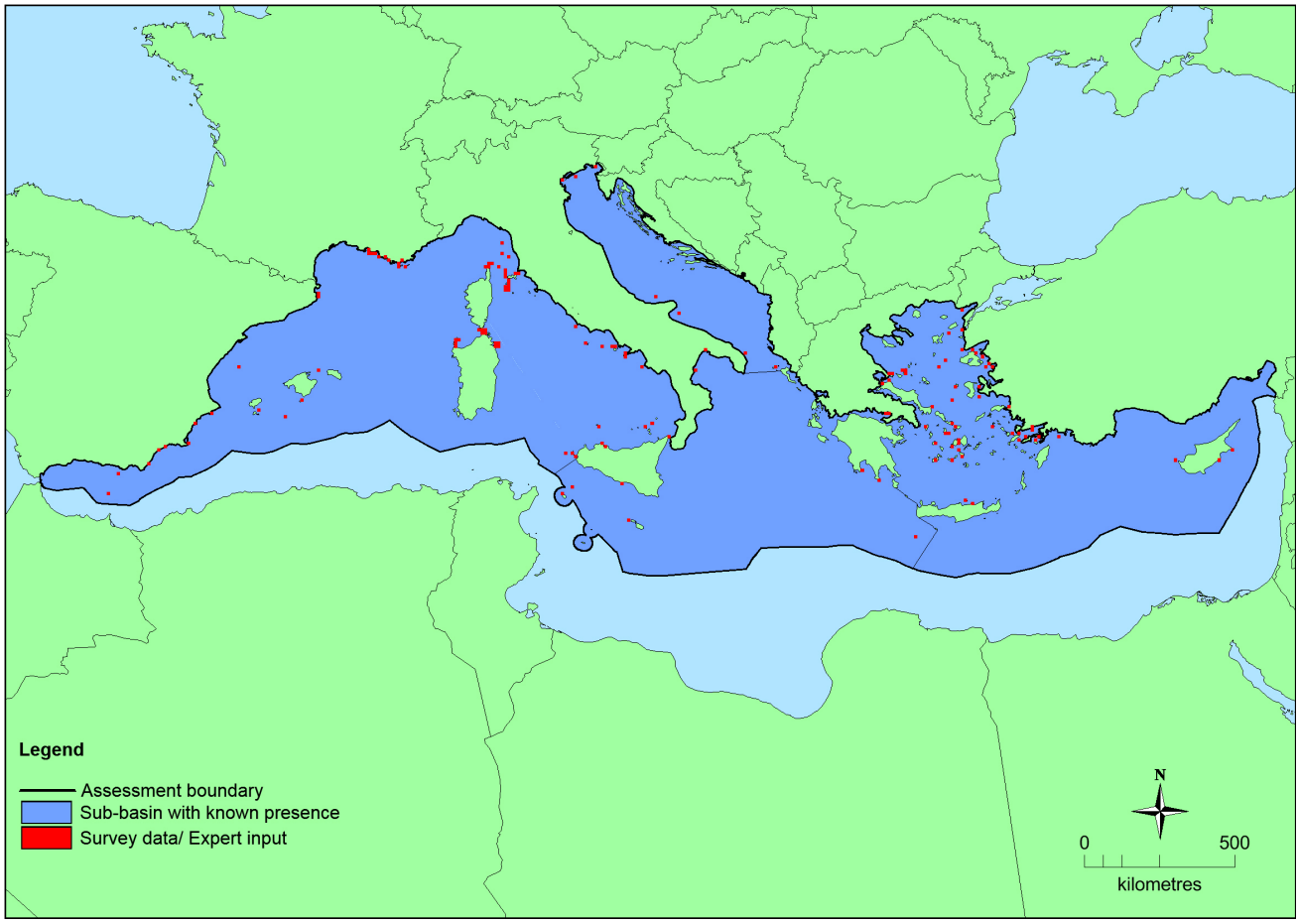
Geographic occurrence and trends

Region	Present or Presence Uncertain	Current area of habitat	Recent trend in quantity (last 50 yrs)	Recent trend in quality (last 50 yrs)
Mediterranean Sea	Adriatic Sea: Present Aegian-Levantine Sea: Present Ionian Sea and the Central Mediterranean Sea: Present Western Mediterranean Sea: Present	Unknown Km^2	Unknown	Unknown

Extent of Occurrence, Area of Occupancy and habitat area

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
EU 28	2,182,108 Km^2	136	Unknown Km^2	EOO and AOO have been calculated on the available data. Although this data set is known to be incomplete the figures exceed the thresholds for threatened status.
EU 28+	2,244,540 Km^2	146	Unknown Km^2	EOO and AOO have been calculated on the available data. Although this data set is known to be incomplete the figures exceed the thresholds for threatened status.

Distribution map



This map has been generated using data from Basso et al., *in press*; Coconet Project, 2015 and MEDISEH project, within the MAREA framework, and supplemented with expert opinion. EOO and AOO have been calculated on the available data presented in this map however these should be treated with caution as expert opinion is that this may not indicate the full distribution of the habitat

How much of the current distribution of the habitat type lies within the EU 28?

Unknown.

Trends in quantity

The first broad distribution map reported for Mediterranean rhodolith beds has been recently documented with a surface area of more than 1,654 km^2. However this valuation is probably well under-estimated as it only reflects areas from small-scale studies, limited to the 0 to 200 m depth band. In Italy, the habitat cover is reported approximately 1,547km^2 while in other countries such as Malta and Spanish Balearic Islands, the observed distribution is already higher than 555 km^2.

The degree to which rhodolith beds are exploited for fishing is unknown in most areas, preventing estimations of the magnitude of losses of the habitat and its key species.

- Average current trend in quantity (extent)
  EU 28: Unknown
  EU 28+: Unknown
- Does the habitat type have a small natural range following regression?
  No
  Justification
  This habitat has a large natural range extending throughout the Mediterranean Sea, with important beds in Marseille and Corsica (France), Sardinia (Italy), and in the Aegean Sea.

- Does the habitat have a small natural range by reason of its intrinsically restricted area?
  No
  Justification
  The EOO exceeds 50,000km^2 therefore this habitat does not show a small natural range although it is likely that a complex of different calcareous algal associations with a limited distribution are presently included in a single habitat.

Trends in quality

To date, the primary focus of research on rhodoliths has been compositional, ecological and distribution studies. There is limited information regarding the trends on the quality of this habitat. In Spain, for example,studies comparing MPA of Tabarca with low trawling pressure with another site with a high frequency of trawling, revealed that the cover of rhodoliths, was four times greater at the MPA, with also a greater number and biomass of macrofaunal species. Studies on the effects of fish farming also showed how the waste load can modify the rhodolith beds in a physico-chemical (increasing sedimentation rates of particulate organic carbon, particulate organic nitrogen and total phosphorus) and biological way as well as lowering the number of trophic groups (mainly grazers) and the balance among groups in affected sites.

Rhodolith- associated assemblages have been shown to be significant less diverse and abundant in areas with higher fishing pressure than others. In Alicante (Spain), the cover of coralline algae was found around 50% of total algal cover in less impacted areas (Tabarca MPA) in comparison to 90% of the cover due to non-calcareous algae, mainly species from the genus *Peyssonnelia*, in areas of higher impact.

Overall trends in quality are unknown.

- Average current trend in quality
  EU 28: Unknown
  EU 28+: Unknown

Pressures and threats

The major anthropogenic impact on Mediterranean rhodolith beds is due to otter trawling which is the most important fishing activity that is illegally carried out in some inshore waters. Otter trawling can cause physical and biological degradation of benthic habitats. Other pressures such as land reclamation for coastal structures, effluent discharges (e.g. domestic and/or industrial wastes); offshore dumping (e.g. domestic and/or sewage sludge and industrial waste); extraction (direct exploitation of rhodoliths for use as a soil conditioner; extraction of sand for artificial beaches); aquaculture waste; mooring of boats, and alien species can produce diverse kind of impacts on the habitat.

Ocean warming and acidification can decrease net calcification, decrease growth and reproduction, as well as reduce abundance and diversity, leading to death and ecological shift to dominant non-calcifying algae.

List of pressures and threats

Biological resource use other than agriculture & forestry

Suspension culture
Benthic or demersal trawling
Benthic dredging

Human intrusions and disturbances

Shallow surface abrasion/ Mechanical damage to seabed surface
Penetration/ Disturbance below surface of the seabed

Pollution

Pollution to surface waters by industrial plants
Pollution to surface waters by storm overflows
Other point source pollution to surface water
Toxic chemical discharge from material dumped at sea

Natural System modifications

Landfill, land reclamation and drying out, general
Removal of sediments (mud...)

Climate change

Temperature changes (e.g. rise of temperature & extremes)

Conservation and management

A special Action Plan for the protection of Mediterranean coralligenous and maerl assemblages has been recently adopted within the framework of the United Nations Environment Programme's Mediterranean Action Plan (UNEP-MAP). Besides, the European Commission's 'Habitats Directive' mandates the conservation management of two of the main European maerl-forming species, *Phymatolithon calcareum* and *Lithothamnion corallioides* and under European law (No 1967/2006) and destructive fishing is prohibited over Mediterranean maerl beds.

Marine reserves and MPAs have worked well in protecting local rhodolith beds from the effects of towed fishing gear as in the case of Tabarca Island. Rhodolith beds are considered as being vulnerable habitats by France and have been included within a proposed network of conservation areas termed 'Natura 2000' sites.

However, the lack of relevant geospatial data of the distribution of this habitat in the Mediterranean countries, significantly hinders the effective implementation of these policies. Among key conservation and management measures proposed are:

- Change the term "maerl" in the legal EU and Barcelona policy documents to "rhodoliths" as to conform the origin of the terms and their international scientific use, and to cover also the calcareous *Peyssonnelia* beds;

- Development of a moratoria on the issue of further permits for the siting of aquaculture units above rhodolith grounds;

- Setting up monitoring programmes of the health of rhodolith beds; including the collection of quantitative data about community composition;

- Designation of 'no-take' reserves and MPAs where these habitats occur;

- Establishing measures to limit the impacts that might affect water quality above rhodolith beds;

- Other Mediterranean endemics should be considered for protection (i.e.: *Lithophyllum racemus, Lithothamnion minervae, Lithothamnion valens*)

- Given its importance and current threats, should be evaluated as priority habitats for the Annex I of Habitat Directive

List of conservation and management needs

Measures related to wetland, freshwater and coastal habitats

Restoring/Improving water quality

Measures related to marine habitats

Other marine-related measures

Measures related to spatial planning

Establish protected areas/sites

Measures related to hunting, taking and fishing and species management

Regulation/Management of fishery in marine and brackish systems

Measures related to special resouce use

Regulating/Managing exploitation of natural resources on sea

Conservation status

Annex 1:

1110: MMED XX

1170: MMED XX

Two rhodolith-composing Mediterranean species, *Lithothamnion corallioides* and *Phymatolithon calcareum*, are included in Annex V of the Habitats Directive.

When severely damaged, does the habitat retain the capacity to recover its typical character and functionality?

Being among the slowest-growing organisms (up to a few mm per year), rhodolith algae are exceptionally vulnerable to any mechanical disturbance or those impacts that increase sedimentation and turbidity making the habitat less resilient to disturbance with a slow recovery capacity. Substantial deposits take centuries, or millennia, to accumulate. Moreover, the anthropogenic physical damage can change the species diversity and functional relationships.

Effort required

50+ years
Naturally

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	unknown %	unknown %	unknown %	unknown %
EU 28+	unknown %	unknown %	unknown %	unknown %

Although there are reports and studies at some sites, there is limited information to get estimations of losses of this habitat for the majority of its distribution. Therefore the habitat type is assessed as Data Deficient under Criterion A.

Criterion B: Restricted geographic distribution

Criterion B	B1				B2				B3
	EOO	a	b	c	AOO	a	b	c	
EU 28	>50,000 Km^2	Unknown	Unknown	unknown	>50	Unknown	Unknown	Unknown	unknown
EU 28+	>50,000 Km^2	Unknown	Unknown	unknown	>50	Unknown	Unknown	Unknown	unknown

Both the EOO and the AOO exceed the thresholds for a threatened category, however there is no information on whether there is a continuing decline in the spatial extent or the biotic and abiotic quality, on whether a threatening process will likely cause continuing declines. Therefore, the habitat type is assessed as Data Deficient under Criterion B.

Criterion C and D: Reduction in abiotic and/or biotic quality

Criteria C/D	C/D1		C/D2		C/D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %
EU 28+	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %

Criterion C	C1		C2		C3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %
EU 28+	unknown %	unknown %	unknown %	unknown %	unknown %	unknown %

Criterion D	D1		D2		D3	
	Extent affected	Relative severity	Extent affected	Relative severity	Extent affected	Relative severity
EU 28	unknown %	unknown%	unknown %	unknown%	unknown %	unknown%
EU 28+	unknown %	unknown%	unknown %	unknown%	unknown %	unknown%

The assessment of reduction in abiotic and/or biotic quality is not possible due to the lack of studies and data on past state conditions of rhodolith habitats for most Mediterranean areas. However, ocean acidification is likely to have strong negative impacts on the calcareous algae, the habitat engineers. Moreover, seawater warming could also have particularly severe effects on some calcareous algal species due to their fragmented ranges and poor dispersal but only limited knowledge of temperature tolerances and optima are available for some species. These effects together with the ongoing pressures from the use of demersal fishing gear and pollution will also produce a moderate to even substantial impact on Mediterranean rhodolith beds unknown for the region.

Since there are no studies available on the past and current conditions of this habitat type, it is not possible to calculate the reductions in abiotic and/or biotic quality, although slight changes have happened and are likely occur in the abiotic conditions of this habitat in the future. Therefore, the habitat type is assessed as Data Deficient under Criterion C/D.

Criterion E: Quantitative analysis to evaluate risk of habitat collapse

Criterion E	Probability of collapse
EU 28	unknown
EU 28+	unknown

There is no quantitative analysis available to estimate the probability of collapse of this habitat type. Therefore, it is assessed as Data Deficient under criterion E.

Overall assessment "Balance sheet" for EU 28 and EU 28+

	A1	A2a	A2b	A3	B1	B2	B3	C/D1	C/D2	C/D3	C1	C2	C3	D1	D2	D3	E
EU28	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD
EU28+	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD	DD

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Data Deficient	-	Data Deficient	-

Confidence in the assessment
Low (mainly based on uncertain or indirect information, inferred and suspected data values, and/or limited expert knowledge)

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