

2.7x Biogenic habitats of Mediterranean mediolittoral rock

Summary

Biogenic concretions such as those of *Lithophyllum byssoides* and platforms formed by the algae *Neogoniolithon brassica-florida* and the vermetid *Dendropoma petraeum* have been described from only a few locations along the Mediterranean coastline, and their distribution is restricted to the warmest part of the basin. Both reefs and rims represent unique archives to reconstruct past Mediterranean climate and especially sea level oscillations and play an important role in preventing or slowing down the rock erosive processes. Where these reefs are well developed they increase complexity and enhance the associated biodiversity on the narrow Mediterranean intertidal fringe.

This habitat is vulnerable to physical impacts, such as coastal developments and trampling, and very sensitive to environmental stresses related to water quality and changes in sea level as they develop. Ocean acidification is predicted to be one of the consequences of climate change, impairs recruitment success and causes shell dissolution, as well as altering the shell mineralogy of the reef-building gastropod *Dendropoma petraeum*. There are no specific conservation actions in place for this habitat at the present time although some are within protected areas. Regulation of coastal development and measures to minimise potential environmental threats, such as those associated with water quality and trampling would benefit this habitat. Better knowledge about this habitat is also needed to determine appropriate conservation measures.

Synthesis

The habitat type is assessed as Vulnerable both at the EU 28 and at the EU 28+ levels in view of its restricted Area of Occupancy (AOO) (less than 50) and the fact that it is experiencing a continuing decline in spatial extent and biotic quality as a result of water discharge, pollution, trampling and climate change. There is also considered likely to be a severe quality decline affecting 30% of the habitat in a period from the past 20 years to the future 30 years in the EU 28+.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Vulnerable	B2a,b	Vulnerable	B2a,b, C/D2

Sub-habitat types that may require further examination

None.

Habitat Type

Code and name

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Lithophyllum byssoides rims fringing rocky coastline (© E. Ballesteros).



Vermetid reef in Lebanon under the influence of pollution and excessive green algae growth (© M.Bariche).

Habitat description

This habitat is formed by the biogenic, tridimensional, hard structures built by either the red algae *Lithophyllum byssoides* or the red algae *Neogoniolithon brassica-florida* associated with the gastropod *Dendropoma cristatum* (in the central Mediterranean) or *D. petraeum*. The rims of *L. byssoides* are generally found just above the mean sea level, in the mesolittoral zone, where waves break. They can reach more than one metre of vertical thickness. For this reason, the habitat is host to different assemblages from its upper portion, which is situated in the lower mediolittoral zone, to the lower, submerged one. The development of this type of habitat in specific areas of the Mediterranean depends on several climatic, hydrological and sedimentary conditions. It seems to develop better over calcareous rocks, on steep shores in areas with strong hydrodynamism and where the temperature of surface coastal waters is no lower than 14°C in the winter. Under these environmental conditions, the *L. byssoides* rims are more frequent in the northwestern Mediterranean, but they can also be found in Sicily and the Adriatic Sea. Mediterranean bioconcretions composed of *N. brassica-florida* and *D. petraeum* may grow for thousands of years forming huge structures of several metres wide.

These reefs are host to many species, which distribute differently over the bioconcretion depending on wave action and the position on the reef. In the seaward part of the reef, the reef crest, the concretion is made of shells of *Dendropoma* actively growing while *Neogoniolithon* cements the reef and triggers the vermetid settlement. Behind the reef crest, a shallow lagoon covered by photophilic algal communities develops. This part ends close to the shore, where *Neogoniolithon* and *Dendropoma* dominate again. *Neogoniolithon-Dendropoma* reefs better develop in southern Mediterranean areas although tiny reefs can be found across 40° N latitudes at their northern limit.

Indicators of quality:

The *Lithophyllum byssoides* rims are particularly vulnerable to physical impacts and trampling, and they seem to be very sensitive to environmental stresses related to water quality. Rims are very sensitive to the increase or decrease of the water level. The amount of dead *L. byssoides* thalli in the upper part of the reef can be used as a health indicator. Both reefs represent unique archives to reconstruct past Mediterranean climate and especially sea level oscillations.

Characteristic species:

Phaeophyta (brown algae): *Ralfsia verrucosa*, *Cystoseira compressa*.

Chlorophyta (green algae): *Cladophora laetevirens*, *Bryopsis muscosa*, *Chaetomorpha capillaris* var. *crispa*, *Chaetomorpha aërea*.

Cnidaria: *Actinia equina*.

Polyplacophora: *Acanthochitona fascicularis*, *Lepidochitona corrugata*.

Bivalvia: *Mytilus galloprovincialis*, *Lasaea adansoni*, *Mytilaster minimus*.

Gastropoda: *Patella rustica*, *Patella ulyssiponensis*, *Dendropoma petraeum*, *Purpura haemastoma*, *Onchidella celtica*.

Classification

EUNIS (v1405):

Level 4. Sub-habitat of A2.7 Littoral biogenic reefs

Annex 1:

1160 Large shallow inlets and bays

1170 Reefs

MAES:

Marine - Coastal

Marine - Inlets and transitional waters

MSFD:

Littoral rock and biogenic reef

EUSEaMap:

Not mapped

IUCN:

12.1 Rocky shoreline

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

Yes

Regions

Mediterranean

Justification

This habitat type is composed of unique bioconcretions that develop only in specific areas of the Mediterranean depending on climatic, hydrological and sedimentary conditions.

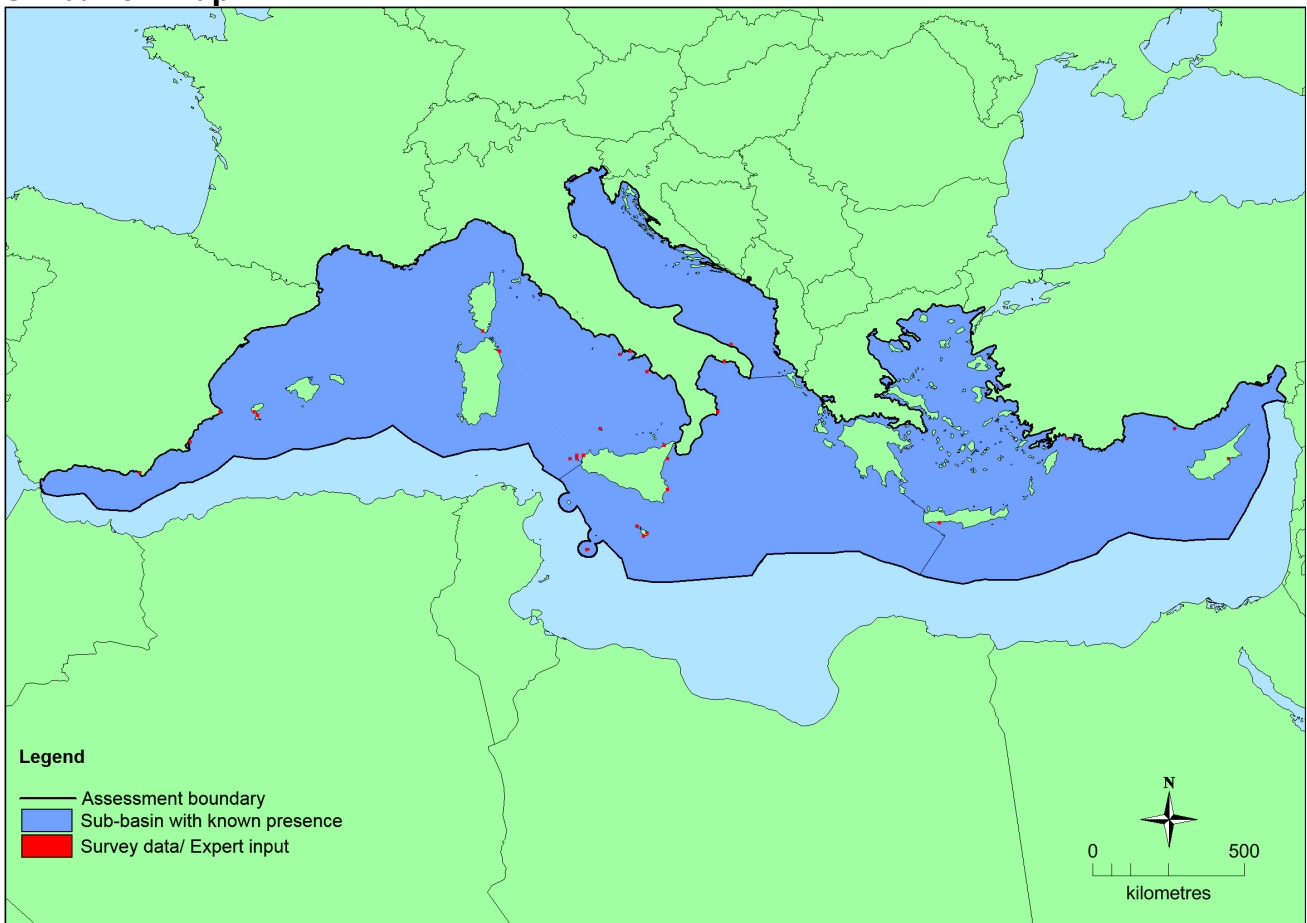
Geographic occurrence and trends

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

Extent of Occurrence, Area of Occupancy and habitat area

	Extent of Occurrence (EOO)	Area of Occupancy (AOO)	Current estimated Total Area	Comment
<i>EU 28</i>	1,305,051 Km ²	27	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.
<i>EU 28+</i>	1,533,327 Km ²	37	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 IUCN and the European Environment Agency (EEA), 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?

In the Mediterranean Sea, the distribution of vermetid reefs composed by *Dendropoma petraeum* in association with some coralline algae such as *Neogoniolithon brassica-florida*, is restricted to the warmest part of the basin, with the largest formations generally found off the coasts of Israel and Lebanon; although they have also been reported from Turkey, Crete, continental Spain and the Balearic Islands, Algeria, Morocco, and along Maltese and Italian shores. In the Spanish region, for instance, well-developed reefs of *D. petraeum* and *N. brassica-florida* are only found in its warmest regions between La Nao cape and Gata Cape as well as Pitiusas islands (Ibiza and Formentera), while other sides further north or south of these limits develop structures that are more disperse and less complex. More than 60% of its known distribution is considered likely to be in the EU 28. Spain (29 reefs) and Italy (20 reefs) are the coastal countries with the most conspicuous number of vermetid reefs, while in the Levantine Sea (29 reefs) and the Tyrrhenian Sea (26 reefs), these reefs have less representation.

Trends in quantity

The few reports of trends in quantity of this habitat from the western Mediterranean seem to indicate that it has experienced either a slight decline or remained stable. In the eastern Mediterranean (mostly outside of the EU 28+), the habitat seems to have suffered large losses over the last 50 years. In the central Mediterranean (Sicily), the habitat has also disappeared at some sites, while the trend in other sites is unknown.

A reduction in quantity reaching 25-30% in the EU 28 is inferred, based on the few existing reports where losses of more than 60% have been reported, and on the basis of expert opinion. Considering a 50-year period including the last decade and the next 40 years a continuing decrease is predicted given the potential impact of sea level rise and the current and ongoing pressures for the Mediterranean region.

- Average current trend in quantity (extent)

EU 28: Decreasing

EU 28+: Decreasing

- Does the habitat type have a small natural range following regression?

No

Justification

The habitat does not have a small natural range as the EOO larger than 50,000 km².

- Does the habitat have a small natural range by reason of its intrinsically restricted area?

No

Justification

Vermetid reefs develop in the tidal zone exclusively on rocky coasts with an abrasion platform, wave exposure, and a certain degree of slope. As a consequence, these bioconstructions are restricted to only a few localities in the Mediterranean. However as the EOO exceeds 50,000 km² this habitat does not have a small natural range.

Trends in quality

This habitat is believed to be decreasing in quality in the Mediterranean both within the EU and beyond. In Sicily, for example, the presence of a small port seems to have reduced the density of living reef-building organism together with the complexity of the substratum. Outside the EU 28+ (Lebanon) it is estimated that only 4-5% of the reefs remained in pristine condition and 35% are seriously degraded by algal growth, invasive species, runoff, and human trampling.

- Average current trend in quality

EU 28: Decreasing
EU 28+: Decreasing

Pressures and threats

Lithophyllum byssoides rims are particularly vulnerable to physical impacts, such as coastal developments and trampling, and they seem to be very sensitive to environmental stresses related to water quality. Rims are also very sensitive to changes in sea level as they develop above the belt of photophilous seaweeds and these can partially or fully cover the rims. Observations of this phenomenon have already been reported at few sites in the Spanish Mediterranean coast. The increase of ocean acidification which has been predicted to occur during the 21st century impairs recruitment success and causes shell dissolution, as well as altering the shell mineralogy of the reef-building gastropod *Dendropoma petraeum*. *Dendropoma* species could also be vulnerable to surface pollution because of their position on the shore.

List of pressures and threats

Human intrusions and disturbances

Other human intrusions and disturbances

Pollution

Pollution to surface waters (limnic, terrestrial, marine & brackish)

Natural System modifications

Human induced changes in hydraulic conditions

Climate change

pH-changes
Sea-level changes

Conservation and management

There are no specific conservation actions in place for this habitat at the present time although more than 50% of the habitat is thought likely to be present within Mediterranean Marine Protected Areas (MPAs) and Natura 2000 sites. No reefs are protected in Cyprus, while Turkey protects less than 20% of their reefs. Regulation of coastal development and measures to minimise potential environmental threats, such as those associated with water quality and trampling would benefit this habitat. Better knowledge about this habitat is also needed to determine appropriate conservation measures.

List of conservation and management needs

Measures related to spatial planning

Other spatial measures
Establish protected areas/sites
Legal protection of habitats and species

Conservation status

Annex 1
1160: MMED XX
1170: MMED XX

Lithophyllum byssoides and the gastropod *Dendropoma petraeum* are listed in Annex II to the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean Revised at the 17th COP meeting (UNEP/MAP, 2012).

The association of *Lithophyllum byssoides* is also listed as an endangered natural habitat type requiring specific conservation measures under the Bern Convention.

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

Since the ability of the components of this habitat to disperse is very limited and the habitat is largely affected by water acidification and sea level rise, recovery is likely to be over a long time scale. It is worthy to note that the growth of the main engineering species is very slow and therefore its recovery capacity very limited. The search for intervention activities that could also include transplantations of the three different species that inhabit this habitat type are needed.

Effort required

200+ years
Naturally

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	Unknown %	Unknown %	25-30 %	Unknown %
EU 28+	Unknown %	Unknown %	Unknown %	Unknown %

The few reports from the western Mediterranean seem to indicate that the habitat has experienced a slight decline in extent or remained stable. However, in the eastern Mediterranean (mostly outside of the EU 28+), the habitat seems to have suffered large losses in the last 50 years. In the central Mediterranean (Sicily), the habitat has also disappeared at some sites, while the trend in other sites is unknown.

A reduction in quantity of between 25-30% in the EU28 is inferred, based on the few existing reports where losses of more than 60% have been reported, and on the basis of expert opinion. Considering a 50-year period including the last decade and the next 40 years a continuing decrease is predicted given the potential impact of sea level rise and the current and ongoing pressures for the Mediterranean region.

This habitat has therefore been assessed as Near Threatened under Criteria A2b for EU 28 and Data Deficient for EU 28+ .

Criterion B: Restricted geographic distribution

Criterion B	B1				B2				B3
	EOO	a	b	c	AOO	a	b	c	
EU 28	>50,000 Km ²	Yes	Yes	No	27	Yes	Yes	No	No
EU 28+	>50,000 Km ²	Yes	Yes	No	37	Yes	Yes	No	No

This habitat has a restricted distribution (AOO <50), there are continuing declines in its spatial extent and biotic quality and there is a threatening process that is likely to cause a continuing decline in the quantity and/or quality within the next 20 years, given its vulnerability to current impacts such as pollution and sea level rise. It has therefore been assessed as Vulnerable at both EU 28 and EU 28+ levels under Criterion B. This impact will affect the habitat over its whole distribution in the Mediterranean,

although it is certain that some areas will be more resilient than others. The current threats are likely to result in heavy losses in the habitat in the eastern Mediterranean.

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 %	30 %	Slight %	Unknown %	Unknown %
EU 28+	Unknown %	Unknown %	30 %	Severe %	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%

Although there are no estimates on the percentage of change in community composition in this habitat, based on a decrease on the biotic quality (increase of green algae growth) and abiotic quality (pollution) that is affecting widely all the reefs and rims, it is inferred that a severe decline affecting more than 30% of the habitat from the past 20 years to the future 30 years is likely at the EU 28+ level. At the EU 28 level a slight decline in quality is suspected. This habitat has therefore been assessed as Vulnerable at the EU 28+ level and as Least Concern at the EU 28 level under Criterion C/D2.

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 that estimates 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	NT	DD	LC	VU	LC	DD	LC	DD	DD	DD	DD	DD	DD	DD	DD
EU28+	DD	DD	DD	DD	LC	VU	LC	DD	VU	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
Vulnerable	B2a,b	Vulnerable	B2a,b, C/D2

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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Date of assessment

13/11/2015

Date of review

16/03/2016

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