

A5.6x: Infralittoral biogenic habitats in the Mediterranean - coralligenous bioconcretions

Summary

Coralligenous habitats are hard bottoms of biogenic origin mainly produced by the accumulation of calcareous encrusting algae growing in dim light conditions. They can develop in the infralittoral zone provided that light is dim enough to allow growth of the coralline algae that produce the build-up; therefore, infralittoral coralligenous concretions always develop on almost vertical walls, deep channels, or overhangs, and occupy reduced surfaces.

Many coralligenous habitats have already been affected by various stressors such as nutrient enrichment, overfishing, invasive species, increase of sedimentation, mechanical impacts as well as climate change, resulting in dramatic consequences for many species and even for the structure of the whole habitat. There are few spatio-temporal studies or baseline data at over large scales and limited information from the southern Mediterranean shores.

Besides the designation of protected areas and fisheries reserves, beneficial measures might include the following: Improvements in water quality, the prohibition of trawling in areas with coralligenous outcrops and their vicinity and management of traditional and recreational fisheries.

Synthesis

This is a widespread habitat throughout the Mediterranean Sea. Country information and literature show an ongoing decline in quality due to warming, fishing activities, water quality and invasive species. There are no evidences of a general decline in quantity in the country information, however, taking into account the impacts this habitat is submitted to and further evidence and decreases described in the literature, it must be considered that quantity decreases have happened. Both quality and quantity decreases are expected to continue in the future. Taking into consideration the decline in habitat extent and quality the habitat is classified as Near Threatened for EU 28 and Data Deficient for EU 28+.

Given the future climate change scenarios for the Mediterranean, the decline of some of the structural species and the ongoing impacts, it is suggested a revision of the assessment in 5-10 years time to provide more quantitative evidences as the habitat is close to Vulnerable status criteria.

Overall Category & Criteria			
EU 28		EU 28+	
Red List Category	Red List Criteria	Red List Category	Red List Criteria
Near Threatened	A1, A2a, A2b, C/D1	Data Deficient	-

Sub-habitat types that may require further examination

Coralligenous outcrops with gorgonians. Most of the impacts are described on gorgonians, which seem to be a vulnerable component of this habitat.

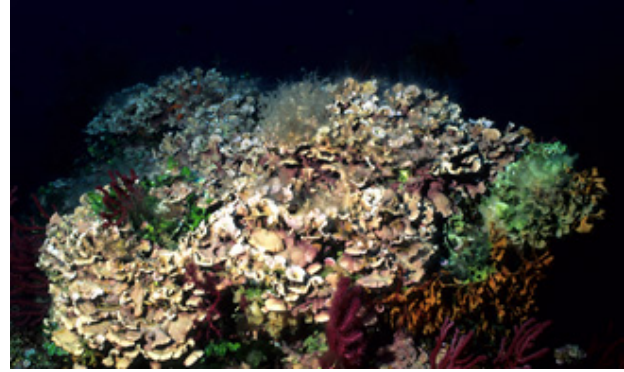
Habitat Type

Code and name

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Coralligenous wall in Scandola (Corsica, France) at 48 meters depth (© E. Ballesteros).



Coralligenous outcrop dominated by *Mesophyllum expansum* at 40 m depth (Columbretes, Spain) (© E. Ballesteros).

Habitat description

Coralligenous habitats are hard bottoms of biogenic origin mainly produced by the accumulation of calcareous encrusting algae growing in dim light conditions. Although more extended in the circalittoral zone, they can also develop in the infralittoral zone, provided that light is dim enough to allow growth of the coralline algae that produce the build-up; therefore, infralittoral coralligenous concretions always develop in almost vertical walls, deep channels, or overhangs, and occupy reduced surfaces.

Coralligenous bioconcretions are always very complex in structure allowing the development of several kinds of communities including those dominated by living algae (on the upper part of the concretions), suspension feeders (upper and lower part of the concretions, wall cavities, and overhangs of the build-up), borers (inside the concretions), and even soft-bottom fauna (in the sediment deposited in cavities and holes).

This is a highly variable habitat that can be subdivided into different sub-habitats with different dominant species. For example coralligenous outcrops dominated by *Halimeda tuna* and *Mesophyllum* spp. usually between 15 and 45 meters depth; by *Peyssonnelia rosa-marina* and other Peyssonneliaceae and *Flabellia petiolata*, in places with high sedimentation rates; on walls with *Eunicella cavolini*, in places with strong currents, between 15 and 40 meters depth; by *Alcyonium acaule*, in relatively shallow waters (15 to 45 meters depth) subjected to strong currents; and by *Eunicella verrucosa*, in places with high sedimentation rates.

Indicators of quality:

Several indicators have been proposed to assess the health of coralligenous habitats based on the composition and abundance of species (biotic cover and conspicuous species richness), the percent cover of different benthic assemblages (encrusting calcified Rhodophyta, non-calcified encrusting algae and fauna, turf forming algae, and sediment), boring species marks, percent cover of each species and the percentage of necrosis, bryozoa percent cover, sludge percent cover and the builder species percent cover.

Characteristic species:

Rhodophyta (red algae)- *Mesophyllum expansum*, *Mesophyllum alternans*, *Mesophyllum*

macedonis, Lithophyllum stictaeforme, Lithophyllum cabiochiae, Neogoniolithon mamillosum, Peyssonnelia rosa marina, Peyssonnelia rubra, Peyssonnelia harveyana, Peyssonnelia bornetii, Peyssonnelia squamaria, Amphiroa beauvoisii, Aglaothamnion tripinnatum, Seirospora giraudyi, Gulsonia nodulosa, Balliella cladoderma, Eupogodon planus, Acrosorium ciliolatum, Erythrogllossum balearicum, Erythrogllossum sandrianum, Myriogramme tristromatica, Osmundaria volubilis, Rodriguezella pinnata, Rodriguezella bornetii, Rodriguezella strafforelloi, Gloioclada furcata, Gloioclada microspora, Gloioclada repens, Leptofauchea coralligena, Lomentaria subdichotoma, Botryocladia chiajeana, Sebdenia monardiana, Sebdenia rodrigueziana, Cryptonemia lomation, Aeodes marginata, Halymenia floresii, Predaea ollivieri, Platoma cyclocolpum, Bonnemaisonia asparagoides, Schmitzia neapolitana, Rhodophyllis divaricata, Neurocaulon foliosum, Kallymenia feldmannii, Kallymenia lacerata, Kallymenia patens, Kallymenia requienii, Phyllophora crispa, Contarinia squamariae, Sphaerococcus rhizophylloides, Ptilophora mediterranea

Phaeophyta- *Dictyopteris lucida, Dictyota sp., Halopteris filicina, Nereia filiformis, Zanardinia typus, Phyllariopsis brevipes, Laminaria rodriguezii, Cystoseira zosteroides, Dictyopteris polypodioides.*

Chlorophyta (green algae)- *Palmophyllum crassum, Codium coralloides, Halimeda tuna, Flabellia petiolata, Microdictyon tenuius, Valonia macrophysa*

Sponges- *Agelas oroides, Aplysina cavernicola, Axinella cannabina, Axinella damicornis, Axinella polypoides, Axinella verrucosa, Clathrina clathrus, Crella elegans, Dysidea avara, Hemimycale columella, Hexadella topsentii, Petrosia ficiformis, Pleraplysilla spinifera, Raspaciona aculeata, Reniera fulva, Spirastrella cunctatrix, Spongia lamella.*

Echinoderms- *Anseropoda placenta, Hacelia attenuata, Ophiothrix fragilis, Antedon mediterranea, Astropartus mediterraneus, Holothuria forskali, Echinus melo.*

Cnidarians- *Alcyonium acaule, Astroides calycularis, Corallium rubrum, Dendrophyllia ramea, Eunicella cavolini, Eunicella singularis, Eunicella verrucosa, Gerardia savaglia, Leptopsammia pruvoti, Paralcyonium spinulosum, Paramuricea clavata, Parazoanthus axinellae, Phyllangia mouchezii.*

Bryozoans- *Adeonella calveti, Bugula calathus, Cellaria salicornioides, Chartella tenella, Hornera frondiculata, Pentapora fascialis, Smittina cervicornis, Schizomavella linearis, Schizomavella mamillata, Rhynchozoon neapolitanum, Reteporella grimaldii, Reteporella feuerbornii, Turbicellepora avicularis*

Crustaceans- *Homarus gammarus, Scyllarides latus, Palinurus elephas, Galathea strigosa, Pilmunus hirtellus.*

Polychaetes- *Salmacina dysteri, Serpula vermicularis, Protula tubularia, Filograna implexa*

Molluscs- *Bolma rugosa, Simnia spelta, Charonia lampas, Monoplex corrugatus, Felimare picta, Umbraculum umbraculum, Pleurobranchus testudinarius, Peltodoris atromaculata, Platydorid argo, Felimare villafranca, Felimida luteorosea, Felimida krohni, Felimida purpurea, Pteria hirundo, Spondylus gaederopus, Lithophaga lithophaga.*

Tunicates- *Aplidium conicum, Aplidium elegans, Aplyidium pseudolobatum, Eudistoma banyulensis, Microcosmus sabatieri, Pseudodistoma cyrnusense, Pycnoclavella communis, Cystodytes dellechiaiei.*

Fish- *Anthias anthias, Serranus cabrilla, Epinephelus marginatus, Sciaena umbra, Scyliorhinus canicula, Muraena helena, Conger conger, Phycis phycis, Zeus faber, Scorpaena scrofa, Pagrus pagrus, Coris julis, Labrus mixtus, Lappanella fasciata, Acantholabrus palloni, Gobius vittatus, Gobius kolombatovici.*

Classification

EUNIS (v1405):

Level 4. A sub-habitat of A5.6 Infralittoral biogenic habitats.

Annex 1:

1170 Reefs

MAES:

Marine - Coastal

MSFD:

Shallow sublittoral rock and biogenic reef

EUSEaMap:

Shallow photic rock or biogenic reef

IUCN:

9.2 Subtidal rock and rocky reefs

Barcelona Convention (RAC/SPA):

III. 6. 1. 35. Facies and association of Coralligenous biocenosis

IV. 3. 1. Coralligenous biocenosis

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

Yes

Regions

Mediterranean

Justification

Coralligenous habitat is a typical Mediterranean underwater seascape. The algal component of the coralligenous is largely constituted by mediterranean endemics, which quantitatively represent between the 33 and 48% of the total flora in this habitat.

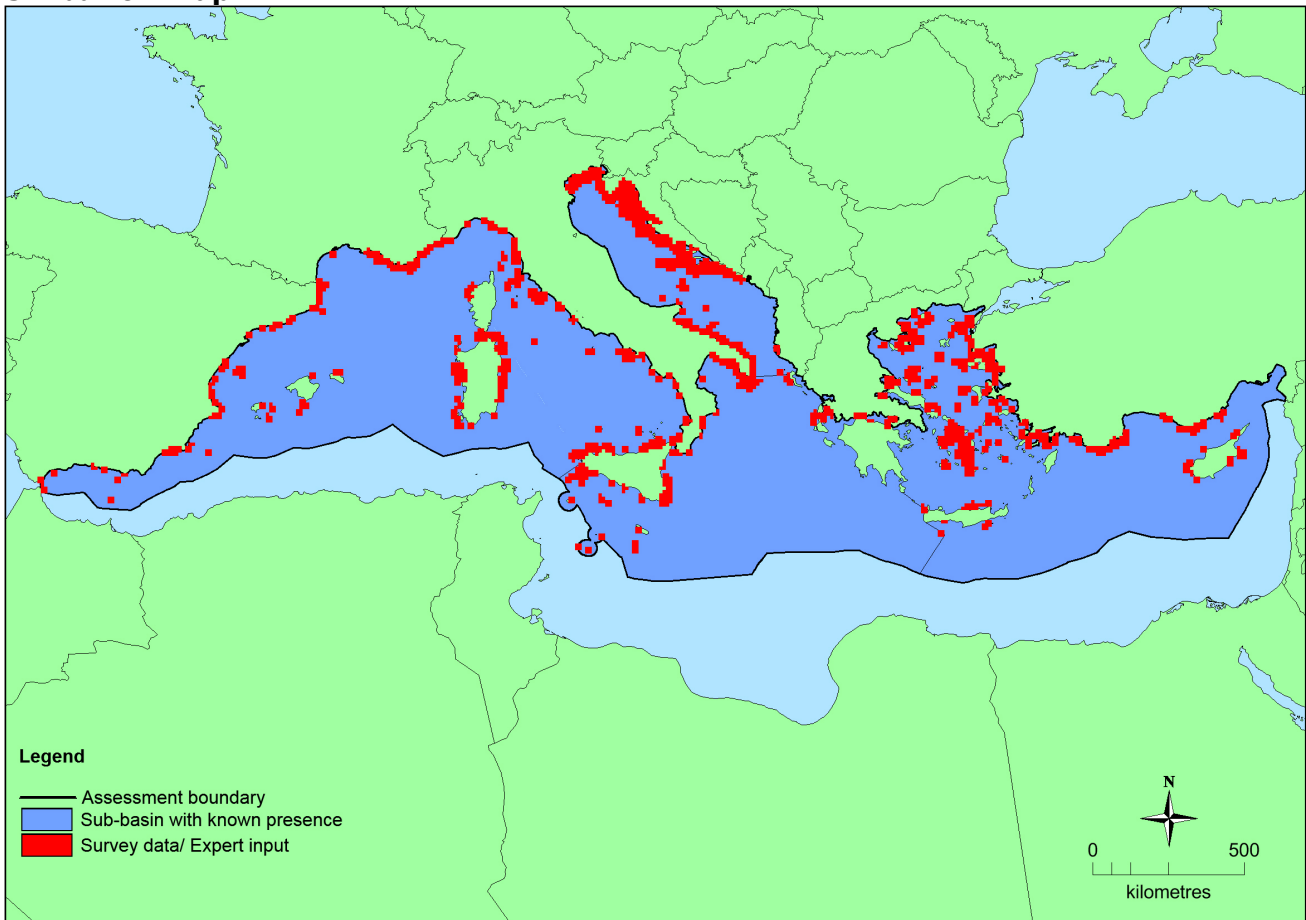
Geographic occurrence and trends

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>	Adriatic Sea: Present Aegian-Levantine Sea: Present Ionian Sea and the Central Mediterranean Sea: Present Western Mediterranean Sea: Present	147,102 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>	2,483,265 Km ²	1,913	137,180 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>	2,525,121 Km ²	2,100	147,102 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 the IUCN based on Giakoumi S. *et al.* (2013) 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?

Coralligenous outcrops are reported to occur primarily in the northern part of the Mediterranean basin, with few records from the eastern or southern basin. Nonetheless, there is very limited knowledge from the east and south Mediterranean.

Trends in quantity

While the given data on current trend in habitat quantity in the country information shows that it seems mostly stable/decreasing in most sites, trends in subhabitat coralligenous outcrops with gorgonians are most probably decreasing in many shallow coastal zones. However, there are many sites where the condition is unknown and declining trends are most probable in some areas due to fishing impacts, warming, turbidity and water quality, as described in the literature. It has to be taken into consideration that besides other impacts, several episodes of suspension feeders (e.g. gorgonians, sponges) mortality have been detected in the northwestern Mediterranean and some large-scale mortality events that affected shallow water assemblages (10–40 m depth) in some other areas of the central-western Mediterranean as well as Aegean Sea. Mass mortality of 2003 triggered necrosis in over 80 % of gorgonian colonies in some NW Mediterranean sites.

Long-term (>50 yr.) quantitative analysis in some sites show a significant decline. In Mesco Reef (Italy, NW Mediterranean) significant declines have been reported since quantitative data is available (1961), gorgonian dominated sub-habitat has practically disappeared and the reported changes in species composition are driving losses in the main characterising species of this habitat (including declines in calcareous algae).

It has to be considered that in the near future the extent of this habitat might be seriously impacted by ocean acidification, which could cause the disappearance of this habitat due to drastic shifts in species composition as has been recently reported in natural CO₂ vents (Columbretes Islands, Spain).

Mass mortalities are expected to continue as seawater warming and the frequency of extreme events are projected to increase in the future.

- 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

This habitat has a large natural range extending throughout the Mediterranean Sea and EOO exceeds 50,000km².

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

No

Justification

The EOO exceeds 50,000km² therefore this habitat does not show a small natural range although it is likely that some of the sub-habitats might have a more restricted natural range.

Trends in quality

Current quality of this habitat is compromised by the described impacts on some key species. Mass mortality events affecting benthic invertebrates inhabiting coralligenous assemblages have occurred recurrently during the past 15 years, affecting hundreds of kilometers of Mediterranean coast. This has significantly affected the quality of this habitat in many sites because of the high impact of warming on

structuring species like gorgonians (e.g. *Paramuricea clavata*). Invasive species are impacting coralligenous communities in an increasing number of sites, compromising habitat quality. Other impacts causing reductions in quality are fishing activities (e.g. trawling) and water quality. Furthermore, synergistic effects among global stressor such as warming, invasive species and acidification as well between global and local stressors can cause drastic declines in quality.

In addition, ocean acidification must be considered a potential threat to this habitat as it has been reported that small changes in pH (as those reported for the end of the century) force drastic shifts in species composition in coralligenous assemblages, if not their complete disappearance.

Habitat quality reduction is expected to continue in the future.

- Average current trend in quality

EU 28: Decreasing

EU 28+: Decreasing

Pressures and threats

Pollution (e.g. wastewater discharge, aquaculture), which results in increased turbidity and sedimentation, has a severe impact on coralligenous outcrops where coralline algae are being substituted first by *Mesophyllum alternans* and lately by *Peyssonnelia rosa-marina*. Mechanical disturbance and re-suspension of nearby sediments, particularly by bottom trawling, is probably the most destructive human activity currently affecting coralligenous outcrops. The disturbance and breaks of the bioconstruction with increases of turbidity and sedimentation can also be observed. Fishing target species can affect the abundance of certain species (i.e. fish, lobsters) and overgrowth and pre-emption can be observed in invaded coralligenous outcrops by exotic algae, altering assemblages composition especially under high sedimentation rates. Other threats include artisanal and recreational fishing (e.g. fishnets, long-lines), coastal or offshore construction activities (including submarine cables), and unregulated diving activities and anchoring. Climate change (increase and unusual fluctuations of seawater temperature) and storms are also known to affect several key species that are part of coralligenous habitats. Some invasive algal species, such as *Caulerpa cylindracea* and *Wormersleyella setacea*, can also pose a severe threat to these communities, either by forming dense carpets (i.e. physical barriers) or by increasing sedimentation. Moderate ocean acidification, as the pH levels expected at the end of the century, might entail major shifts in the distribution and dominance of coralligenous outcrops. Ocean acidification must be considered as a potential threat to this habitat taking into consideration recent evidence of drastic species composition shifts (in CO₂ vents) due to pH levels similar to those projected for the end of the century.

List of pressures and threats

Urbanisation, residential and commercial development

Urbanised areas, human habitation

Biological resource use other than agriculture & forestry

Fishing and harvesting aquatic resources

Professional passive fishing

Professional active fishing

Pollution

Marine water pollution

Invasive, other problematic species and genes

Invasive non-native species

Climate change

Changes in abiotic conditions

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

pH-changes

Habitat shifting and alteration

Decline or extinction of species

Conservation and management

Besides the designation of protected areas and fisheries reserves, specific measures aimed at protecting the coralligenous environment might include the following: Improvements in water quality, the prohibition of trawling in areas with coralligenous outcrops and their vicinity and management of traditional and recreational fisheries to prevent stock depletion of target fish and crustaceans.

List of conservation and management needs

Measures related to wetland, freshwater and coastal habitats

Restoring/Improving water quality

Measures related to marine habitats

Restoring marine habitats

Measures related to spatial planning

Establish protected areas/sites

Legal protection of habitats and species

Conservation status

Annex 1:

1170: MMED XX

Some of the species that form part of this environment are included in the Annex II (*Astroides calycularis*) and Annex III (*Corallium rubrum*) of the Barcelona Convention.

Key species in this habitat are listed under the IUCN Red List Mediterranean Assessment (2014): *Corallium rubrum* is Endangered, *Paramuricea clavata* is Vulnerable, *Eunicella* sp as Near Threatened.

Coralligenous beds is one of the 14 habitats selected by the Scientific Advisory Committee of the General Fisheries Commission for the Mediterranean as criteria for identifying Essential Marine Habitats (EMH) of relevance for the management of priority species (General Fisheries Commission for the Mediterranean 2009).

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

The effect of disturbances in coralligenous assemblages is poorly understood, and there are no data at all on the capacity of this environment to recover (with the exception of fish stocks after fishing ban).

However, as the most abundant and structuring species of coralligenous habitats are long-lived and slow-growing species with limited recruitment rates, and native and non-native species can rapidly colonise the structures, local recover can be difficult and extremely slow.

Effort required

50+ years
Naturally

Red List Assessment

Criterion A: Reduction in quantity

Criterion A	A1	A2a	A2b	A3
EU 28	30 %	30 %	30 %	unknown %
EU 28+	unknown %	unknown %	unknown %	unknown %

No information on quantity and its reductions have been reported for this habitat as a whole and country quantitative information is lacking. However, published information on the sub-habitat coralligenous outcrops with gorgonians in Western Mediterranean Sea shows that reductions of between 10 - 80 % have occurred during the last 15 years due to mass mortality events in shallow (<40m) coastal areas. Additionally, long-term quantitative (>50 yr.) analysis in some sites show a significant decline. In Mesco Reef (Italy, NW Mediterranean) significant declines have been reported since quantitative data is available (1961), gorgonian dominated sub-habitat has practically disappeared and the reported changes in species composition are driving losses in the main characterising species of this habitat (including declines in calcareous algae).

While the given data on current trend in habitat quantity in the country information shows that it seems stable/decreasing in most sites, trends in sub-habitat coralligenous outcrops with gorgonians are most probably decreasing in many shallow coastal zones. There are many sites where the condition is unknown and declining trends are most probable in some areas due to fishing impacts, warming, turbidity and water quality, described in the literature and specially in coralligenous outcrops with gorgonians.

It has to be considered that in the near future the extent of this habitat might be seriously impacted by ocean acidification, which could cause the disappearance of this habitat due to drastic shifts in species composition.

Expert opinion is that overall there has been a decline in quantity of this habitat of upto 30% in the EU 28 over the last 50 years. This habitat has therefore been assessed as Near Threatened under Criterion A1, A2a and 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	>50	Yes	Yes	no	No
EU 28+	>50,000 Km ²	Yes	Yes	no	>50	Yes	Yes	no	No

This habitat is present in the Eastern and Western Mediterranean basins. The precise extent is unknown however as EOO >50,000 km² and AOO >50, this exceeds the thresholds for a threatened category on the basis of restricted geographic distribution. There are predicted to be continuing declines in spatial extent and abiotic and biotic quality. The nature and size of threats to this habitat and the distribution data which are available suggest that no known threats are likely to affect all localities at once. This habitat has therefore been assessed as Least Concern under criteria 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	45 %	intermediate %	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 reduction in abiotic quality is reported (both in the country information and the literature) mostly due to water warming, more intense in the upper occurrence limits of this habitat (where it should be considered as 'intermediate severity') and to fishing related impacts. In some sites the reduction is also due to sedimentation, turbidity, eutrophication, pollution, diving activities, hypoxia and anchoring.

The reduction in biotic quality is reported (both in the country information and the literature) mainly in relation to species shifts and declines, invasive species, algal blooms (e.g. *Acinetospora* sp.) and mucilage (mucilaginous aggregates, both benthic and planktonic after sedimentation) events.

In some sites (e.g. Columbretes Islands) community composition in shallow limits of this habitat has been notably altered by the decline of structuring species like gorgonians (*Paramuricea clavata*) during the past 15 years, having almost completely disappeared in many sites. In Mesco Reef (Ligurian Sea, Italy) quantitative data since 1961 show an important shift in species composition, with an acceleration in declining trends since 1990. Until 1990 coralligenous assemblages in Mesco Reef were on average dominated by gorgonians and bryozoans, since 1996 the assemblages became dominated by filamentous algae (including invasive species like *Wormersleyella setacea*) and large hydroids. Many species that characterise this habitat have suffered a severe decline or have disappeared in sites like Mesco Reef.

It has to be noted that most of the reported impacts relate to gorgonians and corals, little information is available in relation to other groups.

Taking into account the evidence of warming-related impacts, in addition to others like invasive species, shown in the literature and warming predictions, abiotic and biotic quality is expected to continue decreasing in the future. Evidence reviewed in the literature shows that warming is expected to have a higher impact on the shallower limits of this habitat. Furthermore, synergistic effects among global stressor such as warming, invasive species and acidification as well between global and local stressors can cause drastic declines. In addition, ocean acidification must be considered a potential threat to this habitat as it has been reported that small changes in pH (as those reported for the end of the century) force drastic shifts in species composition in coralligenous assemblages if not their complete disappearance.

Based on all this information and assumptions on future trends, expert opinion is that there has been fairly substantial reduction in biotic and abiotic quality (around 45% of the extent having an intermediate decline). The habitat type is therefore assessed as Near Threatened under Criterion C/D1 for the EU 28 and

Data Deficient for the EU 28+.

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	NT	NT	NT	DD	LC	LC	LC	NT	DD	DD	DD	DD	DD	DD	DD	DD	DD
EU28+	DD	DD	DD	DD	LC	LC	LC	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
Near Threatened	A1, A2a, A2b, C/D1	Data Deficient	-

Confidence in the assessment

Medium (evenly split between quantitative data/literature and uncertain data sources and assured expert knowledge)

Assessors

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Contributors

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Reviewers

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Date of assessment

15/12/2015

Date of review

07/01/2016

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