

A3.13 Photophilic communities with canopy-forming algae in Mediterranean infralittoral and upper circalittoral rock

Summary

This habitat is represented by canopy forming algae that act as ecosystem-engineers forming 'forests' in infralittoral and circalittoral areas. It is recognized that this habitat of mostly large brown seaweeds (represented by the genera *Cystoseira* and *Sargassum*) is one of the most important marine habitats in the Mediterranean Sea, forming extended canopies comparable to land forests and providing refuge and subsistence for many organisms, including commercial species.

This habitat is very vulnerable to different anthropogenic disturbances, both direct (pollution, increased sedimentation, coastal urbanization, direct habitat transformation) and indirect (overfishing, invasive species, climate change) as well as destructive fishing (date mussel fishery). These disturbances produce changes in the fauna and flora composition. Excessive collection for research and educational purposes has been indicated as another cause of the decrease of the habitat at some sites as has outbreaks of herbivores which is sometimes a consequence of overfishing predators. Some of these canopy-forming algae habitats are in protected areas and several Natura 2000 sites. An ecosystem-based management applied to a network of MPAs with long-term monitoring programs and restoration actions, where necessary, is probably the best perspective for the preservation of this habitat in the Mediterranean Sea.

Synthesis

Although territorial data was not provided for all countries, there is an overall consensus in the expert opinion that this habitat has declined in quantity and quality in the EU 28 in the past 50 years. There is a lack of quantitative data for countries outside the EU 28 to infer the situation for the EU 28+.

Expert opinion that there has been a 77% reduction in the quantity of this habitat. and a substantial reduction in quality . This habitat is therefore assessed as Endangered under Criteria A. Due to the lack of quantitative data for countries outside the EU 28, the habitat is assessed as Data Deficient at the EU 28+ level.

| Overall Category & Criteria | | | |
|-----------------------------|-------------------|-------------------|-------------------|
| EU 28 | | EU 28+ | |
| Red List Category | Red List Criteria | Red List Category | Red List Criteria |
| Endangered | A1, A2b | Data Deficient | - |

Sub-habitat types that may require further examination

None.

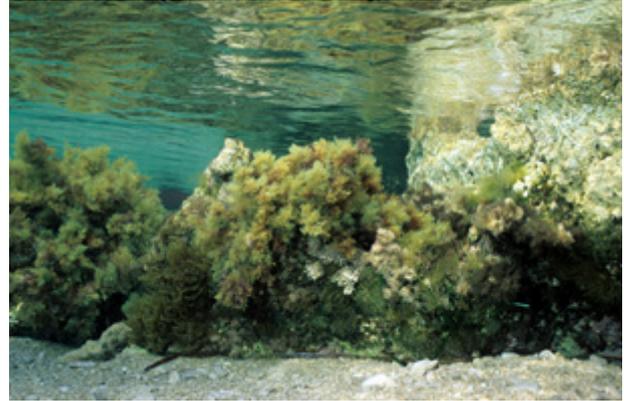
Habitat Type

Code and name

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Shallow water assemblage with *Halopteris scoparia*, Formentera, Spain (© E. Ballesteros).



Assemblage dominated by *Lobophora variegata*, in the rocky infralittoral zone, Cabrera, Spain. (© E. Ballesteros).

Habitat description

This habitat occurs on rocky bottoms and is characterised by communities macroalgae that form canopies. The structure includes bush-forming, turf forming algae, encrusting fauna and epiphytes. The coverage of the “bush” and turf strata is usually higher than in an assemblage dominated by canopy algae. Assemblages are also highly miniaturized (less than 20 cm high) and very rich in species (up to 110 species in a 400 cm² area).

This habitat is present from the upper infralittoral zone (0 m) to the upper circalittoral zone. Assemblages are always algal-dominated, although some invertebrates can be common in the understory and growing as epiphytes. Species composition greatly differs according to the environmental conditions. Factors accounting for the variability on the assemblages include light availability, hydrodynamism, nutrient concentration in seawater, substrate, sedimentation, temperature, salinity, grazing intensity, predation, frequency of disturbances. High densities of sea urchins (*Paracentrotus lividus*) can graze the algae, producing structurally less complex assemblages and even barren areas. Grazing by other fish species (*Sarpa salpa* or the exotic *Siganus rivulatus*, *S. luridus*) can modify the species composition.

Several associated biotopes have been described and are distinguished according to the dominant species. They include; *Corallina elongata* on shallow exposed shores; the red algae *Haliptilon virgatum*, growing on well-lit, shallow exposed shores in central and southern shores, usually accompanied by *Laurencia obtusa*, *Laurencia majuscula* and *Dictyota fasciola*; *Colpomenia sinuosa* growing on shallow sheltered rocks in nutrient-rich environments; *Cladophoropsis membranacea* growing on extremely sheltered zones in bays and lagoons; and *Arthrocladia villosa* and *Sporochnus pedunculatus* on moderately lit lower infralittoral to upper circalittoral rock, in places with strong unidirectional currents.

Indicators of quality:

This habitat is very variable according to the degree of anthropogenic disturbance. Indicators of quality can be measured by examining trends. The first signs of decline imply substitution of species, a decrease on diversity, an increase on invasive exotic species, and an increase in opportunistic, fast-growing species like some *Ulva*, *Cladophora*, *Acinetospora*, or stress resistant like *Corallina elongata* or *Lithophyllum incrustans*. Mussels can also replace the dominant algae in shallow waters when the charge of particulate organic matter is very high.

Characteristic species:

This community is characterised by the presence of many photophilic algae covering hard bottoms. The number of species is very large, and can be completely different according to the bathymetric level, exposure and geographical region. They include:

Rhodophyta (red algae) - *Liagora viscida*, *Liagora distenta*, *Amphiroa rigida*, *Corallina elongata*, *Haliptilon*

virgatum, *Tricleocarpa fragilis*, *Ceramium virgatum*, *Wrangelia penicillata*, *Chylocladia verticillata*, *Chrysomenia ventricosa*, *Halymenia floresii*, *Gelidium spinosum*, *Predaea ollivieri*, *Chondracanthus acicularis*, *Jania rubens*, *Lithophyllum incrustans*, *Neogoniolithon brassica-florida*, *Mesophyllum alternans*, *Halopithys incurva*, *Lophocladia lallemandii*, *Peyssonnelia squamaria*, *Asparagopsis armata*, *Asparagopsis taxiformis*, *Sphaerococcus coronopifolius*, *Laurencia obtusa*, *Laurencia majuscula*, *Digenea simplex*, *Rytiphlaea tinctoria*, *Alsidium corallinum*, *Pterothamnion crispum*, *Compsothamnion thuyoides*, *Plocamium cartilagineum*, *Schottera nicaeensis*, *Pterocladia capillacea*, *Botryocladia botryoides*, *Peyssonnelia squamaria*, *Palisada patentiramea*

Phaeophyta - *Dictyota fasciola*, *Colpomenia sinuosa*, *Taonia atomaria*, *Dictyota cf. dichotoma*, *Dictyota mediterranea*, *Styopodium schimperi*, *Lobophora variegata*, *Dictyota spiralis*, *Zonaria tournefortii*, *Padina pavonicoides*, *Padina ditristromatica*, *Arthrocladia villosa*, *Sporochnus pedunculatus*, *Carpomitra costata*, *Acinetospora crinita*, *Hydroclathrus clathratus*, *Dictyota dichotoma v. intricata*, *Sphacelaria cirrosa*, *Halopteris scoparia*, *Halopteris filicina*, *Padina pavonica*, *Cladostephus spongiosus*, *Dictyopteris polypodioides*.

Chlorophyta (green algae) - *Ulva rigida*, *Umbraulva olivascens*, *Dasycladus vermicularis*, *Flabellia petiolata*, *Acetabularia acetabulum*, *Parvocaulis parvulus*, *Caulerpa prolifera*, *Caulerpa cylindracea*, *Codium bursa*, *Anadyomene stellata*, *Cladophoropsis membranacea*, *Cladophora prolifera*.

Porifera - *Crambe crambe*, *Phorbas topsentii*, *Sarcotragus fasciculatus*, *Sarcotragus spinosulus*, *Hemimycale columella*.

Mollusca - *Bittium reticulatum*, *Conus ventricosus*, *Columbella rustica*, *Rissoa guerinii*.

Crustacea - *Macropodia longirostris*, *Maja crispata*.

Echinodermata - *Echinaster sepositus*, *Marthasterias glacialis*, *Paracentrotus lividus*, *Arbacia lixula*, *Holothuria tubulosa*, *Ophidiaster ophidianus*, *Ophiothrix fragilis*.

Fish - *Labrus merula*, *Coris julis*, *Serranus cabrilla*, *Serranus scriba*, *Symphodus ocellatus*, *Symphodus tinca*, *Scorpaena porcus*, *Epinephelus marginatus*, *Sciaena umbra*, *Diplodus sargus*, *Diplodus vulgaris*, *Diplodus cervinus*, *Diplodus puntazzo*, *Siganus rivulatus*, *Parablennius pilicornis*, *Trypterygion delaisi*, *Symphodus mediterraneus*, *Siganus luridus*, *Epinephelus costae*, *Sarpa salpa*, *Chromis chromis*, *Mullus surmuletus*, *Dentex dentex*, *Symphodus roissali*, *Sparisoma cretense*.

Classification

This habitat may be equivalent to, or broader than, or narrower than the habitats or ecosystems in the following typologies.

EUNIS (v1405)

Level 4: A sub-habitat of 'Mediterranean infralittoral rock' (A3.1).

Annex 1:

1160 Large shallow inlets and bays

1170 Reefs

MAES:

Marine - Marine inlets and transitional waters

Marine - Coastal

MSFD:

Shallow sublittoral rock and biogenic reef

EUSEaMap:

Shallow photic rock or biogenic reef

IUCN:

9.7 Macroalgal/kelp

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

Yes

Regions

Mediterranean

Justification

This habitat is common and widespread in the Mediterranean. The genus *Cystoseira* is represented by 42 species mostly distributed in the Mediterranean Sea. The Mediterranean basin is considered the hot-spot for *Cystoseira* genus with many endemic species.

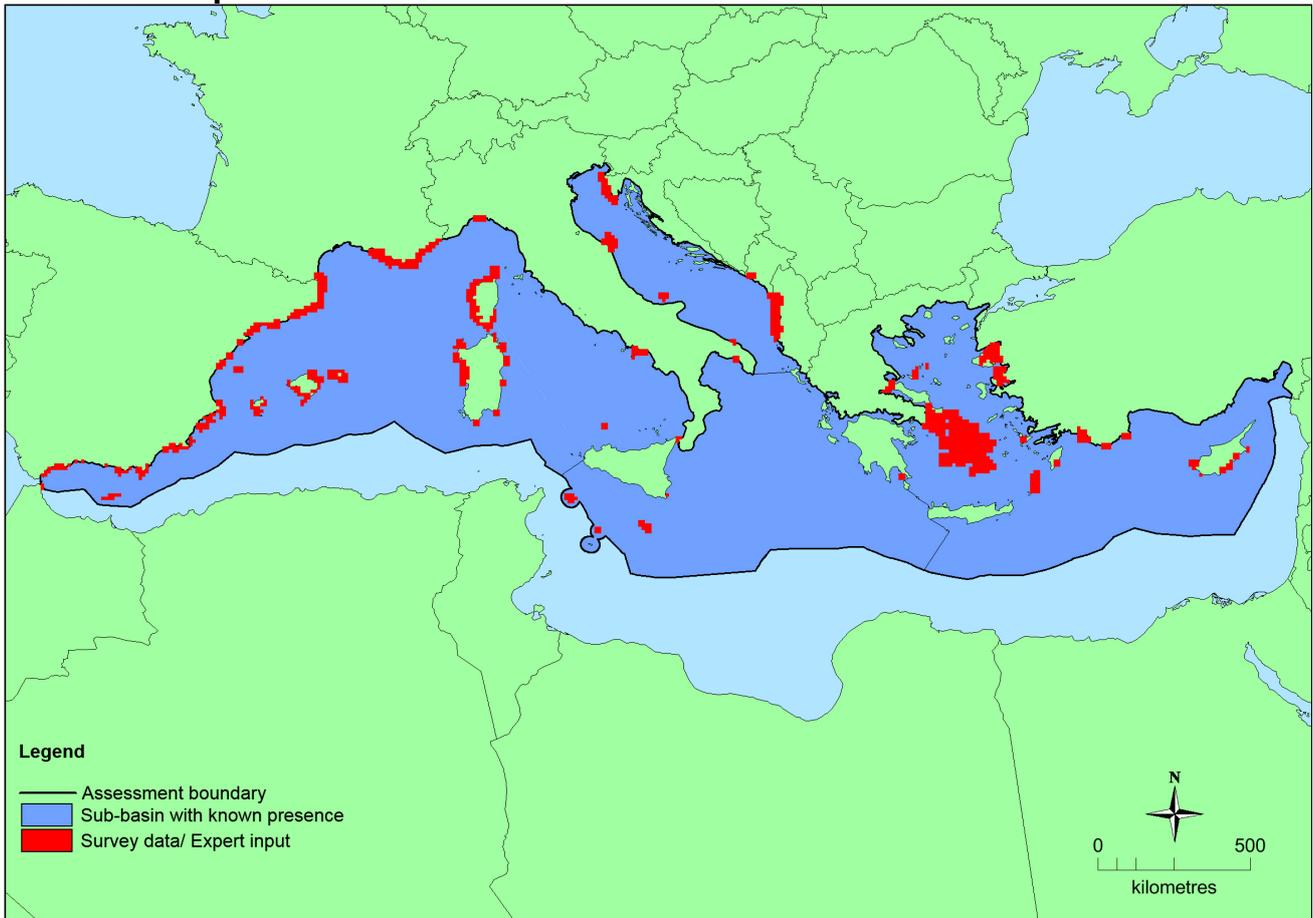
Geographic occurrence and trends

| Region | Present or Presence Uncertain | Current area of habitat | Recent trend in quantity (last 50 yrs) | Recent trend in quality (last 50 yrs) |
|--------------------------|---|-------------------------|--|---------------------------------------|
| <i>Mediterranean Sea</i> | Adriatic Sea: Present Aegian-Levantine Sea: Present Ionian Sea and the Central Mediterranean Sea: Present Western Mediterranean Sea: Present | 60,808 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 |
|--------|----------------------------|-------------------------|------------------------------|---|
| EU 28 | 2,011,255 Km ² | 765 | > 60,808 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+ | 2,229,910 Km ² | 1,032 | > 60,808 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 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?

Much of the current known information regarding the distribution of this habitat is in the EU 28. However, this habitat is also known to occur in the EU 28+. The percentage hosted by the EU 28 is therefore less than 100% but there is insufficient information to establish the proportion.

Trends in quantity

Cystoseira forests are regressing due to several impacts, among which are a decrease in water quality, coastline overbuilding, and the proliferation of herbivores (sometimes an indirect effect of overfishing). The decrease of *Cystoseira*-dominated communities has been described in several Mediterranean shores including the north and south Adriatic Sea, western Mediterranean as well as along the coasts of the Tyrrhenian and Ligurian seas. Along the Albères coasts (south France) only 5 out of 14 species of Fucales (*Cystoseira* and *Sargassum* spp.) documented as abundant in 1912 were still present in 2003, with the genus *Sargassum* entirely lost with an average decline of 78% over the last 50 years. Similarly, over 212 km of the French Riviera, five *Cystoseira* and *Sargassum* shallow water species have disappeared since the early 19th century. Nine others have suffered a dramatic decline or become nearly extinct and only one, *C. compressa* var *compressa* is still considered stable and plays a significant structural role as a habitat-forming species. *C. amentacea* remained abundant in the entire French coast including Corsica but the complete extinction of *C. squarrosa* along the French coast has been reported.

In the North Adriatic, the canopy forest has been reduced from seven species of *Cystoseira* and one of *Sargassum* to two species of *Cystoseira* since the 1940's, with a large decline in algae cover

between 2002 and 2005. To date, a high level of fragmentation of *Cystoseira* canopy is still observed and it is estimated to have declined by more than 70%.

Local extinction of canopy-forming algal communities has also been reported in other parts of the Mediterranean: *C. foeniculacea* (as *C. ercegovicii*), *C. sauvageauana* and *C. spinosa* in Mar Piccolo, Southern Italy; *C. dubia* (as *C. fucoides* Ercegović), *C. foeniculacea* (as *C. ercegovicii*); *C. crinita*, *C. foeniculacea*, *C. humilis*, *C. spinosa*, *S. acinarium* and *S. hornschurchii* at Tremiti Islands, Sicily; *C. brachycarpa*, *C. sauvageauana*, *C. spinosa*, *C. zosteroides*, *S. acinarium* and *S. trichocarpum* at Linosa Island, off Tunisia; *C. corniculata*, *C. foeniculacea* f. *tenuiramosa*, *C. spinosa*, *S. acinarium* and *S. hornschurchii* along the Adriatic Italian coastline; half of the species historically present in the Gulf of Naples were no longer collected; *C. crinitophylla* in the Gulf of Saronikos, Greece; *C. brachycarpa*, *C. corniculata*, *C. crinita*, *foeniculacea* and *S. vulgare* at Kos Island, Greece. Finally, *S. acinarium*, *S. hornschurchii* and *S. trichocarpum* were no longer observed in Algeria.

A recent study encompassing 2,970 km of the North-Western Mediterranean coastline, summarizes that all the species from the genus *Sargassum* (except the introduced *S. muticum*) are locally extinct or in more or less severe decline at all the sites.

- 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 has an EOO larger than 50,000 km².

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

No

Justification

The habitat is widespread along the Mediterranean coast and has a large EOO (>50,000km²)

Trends in quality

A decline in quality has been observed along different regions of the Mediterranean. In the North Adriatic (Monte Conero), well- formed canopy forest has been replaced by strands of simpler seaweeds with filamentous algal turfs and mixed mosaics with other dominant habitats and species (e.g. *Mytilus galloprovincialis* beds). It has also been observed that the decrease in size of the habitat and its dispersion along the French Riviera are also decreasing benthic assemblage diversity (i.e. homogenization of seascapes).

- Average current trend in quality

EU 28: Decreasing

EU 28+: Decreasing

Pressures and threats

This habitat is very vulnerable to different anthropogenic disturbances, both direct (pollution, increased sedimentation, coastal urbanization, direct habitat transformation) and indirect (overfishing, invasive species, climate change) as well as destructive fishing (date mussel fishery). These disturbances produce changes in the fauna and flora composition. Competition with two invasive macroalgae, *Caulerpa taxifolia* and *C. cylindracea* which are often present along the same coastlines as canopy-forming algae can also contribute to outcompeting *Cystoseira* spp.. Excessive collection for research and educational purposes has been indicated as another cause of the decrease of the habitat at some sites. Loss of *Cystoseira* and *Sargassum* forest has also been attributed to the outbreak of herbivores (e.g. sea urchins *Paracentrotus*

lividus or *Arbacia lixula*, fishes *Sarpa salpa*) that is sometimes a consequence of overfishing predators. For deeper habitats, the decrease in water transparency, fishing nets and trawling could be the responsible for the observed declines.

List of pressures and threats

Biological resource use other than agriculture & forestry

- Suspension culture
- Fishing and harvesting aquatic resources
- Benthic or demersal trawling

Human intrusions and disturbances

- Penetration/ Disturbance below surface of the seabed

Pollution

- Pollution to surface waters (limnic, terrestrial, marine & brackish)
- Marine water pollution

Invasive, other problematic species and genes

- Invasive non-native species

Conservation and management

Some of these canopy-forming algae habitats are in protected areas and several Natura 2000 sites (e.g. Scandola, Bouches de Bonifacio, Cerbères-Banyuls, Calanque and Port-Cros in France, Formentera-Espardell and Dragonera in Spain; Kimolos in Greece; St Peter's Island and Maratea in Italy). The declaration of other MPAs and the effective management of the existing ones where dense *Cystoseira* and other large brown algae forests thrive could favour the conservation of this habitat and its recovery when the herbivore pressure is not too high. Nonetheless, the protection of existing forests formed by *Cystoseira* and other subhabitats of canopy forming communities should complement regular monitoring programs in order to highlight potential threats and early signs of regression. Restoration of this habitat in priority areas with re-forestation methods has been suggested as a potential solution to assist fragmented/lost forests to recover and stimulate natural restoration of lost populations assisted at the same time with other measures such as improving sewage treatment or limitation of excessive herbivory at specific sites. An ecosystem-based management applied to a network of MPAs with long-term monitoring programs and restoration actions, where necessary, is probably the best perspective for the preservation of this habitat in the Mediterranean Sea.

List of conservation and management needs

Measures related to marine habitats

- Restoring marine habitats

Measures related to spatial planning

- Establish protected areas/sites

Conservation status

Annex 1:

1160: MMED XX

1170: MMED XX

Six Mediterranean species of *Cystoseira* are listed in the Annex I of the Bern Convention. The Mediterranean Action Plan, adopted within the framework of the Barcelona Convention, identifies the conservation of all but one *Cystoseira* species (*C. compressa*) as a priority.

In the North-Western Mediterranean and in the Adriatic Seas in the framework of the Water Directive 2000/60/EU shallow *Cystoseira* forests are used to assess the ecological status of coastal shallow waters.

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

Little information exist about the recovery potential of this habitat over a certain degree of deterioration. The low dispersal capacity of most *Cystoseira* species makes natural recovery unlikely, so artificial reforestation may be an extremely valuable solution for lost forest .

In the case of *Sargassum* canopy but also species like *C. barbarta*, *C. compressa* and *C. foeniculacea*, the presence of aericysts facilitates dispersion and the recovery of populations from distant areas.

Effort required

| |
|----------------------|
| 20 years |
| Through intervention |

Red List Assessment

Criterion A: Reduction in quantity

| Criterion A | A1 | A2a | A2b | A3 |
|-------------|-----------|-----------|-----------|-----------|
| EU 28 | 77 % | Unknown % | >50 % | >40 % |
| EU 28+ | Unknown % | Unknown % | Unknown % | Unknown % |

An average reduction in extent of this habitat by 77% has been reported from the Adriatic Sea, Ligurian and Western Mediterranean. The same pressures and threats are common in other regions, therefore the same percentage of reduction is inferred for the EU 28. Expert opinion is that reductions in quantity are also considered likely in the future although to a lesser extent. Historic losses are estimated to have exceeded 40%. This habitat has therefore been assessed as Endangered under Criterion A1 and A2b and Near Threatened under criteria A3 in the EU 28. This habitat has been assessed as Data Deficient in the EU 28+ although the majority of this habitat is likely to lie within the EU 28 area.

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 |

The habitat is widespread in the Eastern and Western Mediterranean. The EOO is larger than 50,000 km² and the AOO larger than 50, therefore exceeding the thresholds for a threatened category. The information available indicates a continuing decline in the spatial extent and the biotic and abiotic 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 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 | 50 % | 70% % | 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% |

Overall there has been a substantial reduction in quality of this habitat in the EU 28. An average intermediate decline (70% severity) affecting 50% of the extent of the habitat has been estimated in the EU 28. This decline in the number of erect algae species composing the forest is due to changes in biotic and abiotic conditions has been reported along a large part of the European Mediterranean coastline. Sea urchins outbreaks have also been reported at several sites causing the overgrazing of the macroalgal communities and the creation of barren grounds while contributing to the general loss of large brown algae forest by herbivores such as *Sarpa salpa*. The effects of these outbreaks cannot be quantified with the present knowledge. There is insufficient quantitative data to estimate the reduction in quality at the EU 28+ level. This habitat is therefore assessed as Vulnerable under Criterion C/D1 in the EU 28, and as Data Deficient for all other criteria in the EU 28 and in 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 | EN | DD | EN | NT | LC | LC | LC | VU | 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 |
| Endangered | A1, A2b | Data Deficient | - |

Confidence in the assessment

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

Assessors

M. Otero, L. Mangialajo and E. Ballesteros.

Contributors

T. Thibaut and L. Airoidi.

Reviewers

R. Haroun.

Date of assessment

12/11/2015

Date of review

17/03/2016

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