COMPILATION OF AN INTERPRETATION MANUAL FOR MARINE HABITATS WITHIN THE 25 NM FISHERIES MANAGEMENT ZONE AROUND THE REPUBLIC OF MALTA

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I. ABSTRACT

Several EU Directives and regional conventions are concerned with the protection and conservation of marine habitats of special importance; a necessary prerequisite to implement such legislation are marine habitat classification systems and information on the distribution of marine habitat types. There are several habitat classification schemes in use for the description, designation and monitoring of habitats. The 'Interpretation Manual for Marine Habitats within the 25 NM Fisheries Management Zone around the Republic of Malta' provides an updated description of marine habitats found around the Maltese Islands, as well as a cross-referencing scheme for the different habitat classification systems. Marine habitats are listed according to bathymetric zone, going from shallow to deep water. The bathymetric zones included in the interpretation manual are: (1) mediolittoral, (2) infralittoral, (3) circalittoral, and (4) bathyal. Habitats listed in the European Nature Information System (EUNIS) database were reviewed, habitats which are present in the Maltese Islands were identified, and 'new' habitat categories have been included in the manual where there was no equivalent EUNIS habitat. For each habitat category presented, cross-references to the system used in connection with the Protocol for Specially Protected Areas and Biodiversity in the Mediterranean (SPABM) of the Barcelona Convention, to the Marine Strategy Framework Directive (MSFD) classification system of predominant habitat types, as well as to the marine habitats listed in Annex I of the 'Habitats Directive', were established. In addition a scheme to enable the assessment of the conservation status of marine habitats as required under the 'Habitats Directive' was drawn up by considering the habitat range, the area occupied by a habitat, habitat structure and function, and the habitat's future prospects. Suitable indicators to assess favourable conservation status are presented for (i) sandbanks, (ii) Posidonia beds, (iii) reefs and (iv) sea caves. In addition, indicators to assess the conservation status of maerl beds are presented due to the local significance and the sensitivity of this habitat. The manual thus intends to aid in the implementation of measures for the protection of marine habitats and hence, ultimately, to ensure effective and efficient management of the marine environment under the jurisdiction of Malta up to the 25 NM boundary, in line with the relevant legislation.

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II. INTRODUCTION

In the past decade, European Union (EU) efforts to promote nature conservation have evolved from focusing on the protection of particular species towards giving more importance to habitat diversity. Several EU Directives (Habitats Directive, 92/43/EEC; Marine Strategy Framework Directive, 2008/56/EC) now aim at protecting and conserving marine resources in general, and habitats of special importance in particular. In addition several regional treaties and conventions (e.g. Barcelona / Bern Conventions) address the need for greater habitat protection.

The Habitats Directive is an important EU instrument which aims to conserve listed natural habitats and listed species of wild flora and fauna in EU territory. It requires Member States to take measures to maintain habitats listed in Annex I at a favourable conservation status, or to take measures to restore habitats to such a status where relevant. Moreover, the Habitats Directive contains provisions for the setting up of a European-wide network of Special Areas of Conservation (SACs) that should include sites containing habitats listed in Annex I. The designation of protected areas should offer adequate protection to habitats and species of international and national importance through the application of various management measures. The scope of the EU's Marine Strategy Framework Directive (MSFD) is to achieve "good environmental status" of the EU's marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend. In order to reach this goal, each Member State has to carry out a detailed assessment of the state of the environment, define "good environmental status", and establish clear environmental targets and monitoring programs.

The Convention for the Protection of the Mediterranean Sea against Pollution, more commonly known as the Barcelona Convention, through its *Protocol for Specially Protected Areas and Biodiversity in the Mediterranean* (SPABM), obliges parties to establish specially protected areas, to manage such areas, and where appropriate, to restore such areas. The Convention on the Conservation of European Wildlife and Natural Habitats, or the Bern Convention, is designed to protect threatened species of flora and fauna, the habitats of these species, the habitats of migratory species, as well as endangered natural habitats.

Each of the legislative instruments mentioned above refers to lists of habitats, and thus has an associated habitat classification scheme. In addition, the European Environment Agency (EEA) has created a European habitat classification system called EUNIS (European Nature Information System). EUNIS aims to develop an overarching typology of all habitat types present in Europe, including terrestrial, freshwater and marine habitats; the current version in use dates from 2004 (Davies et al. 2004). There are thus several habitat classification systems in use for description, designation and monitoring of habitats. Whilst the systems do have similarities they also have many differences, which makes cross-referencing and the simultaneous implementation of the different legislation difficult. There is thus a clear need for cross-referencing habitat categories between the different schemes in order to meet the needs and integrate the goals of national, European and international conservation initiatives.

The main objective of MEPA Tender T02/2013 'Compilation of an Interpretation Manual for Marine Habitats within the 25 NM Fisheries Management Zone around the Republic of Malta' is to develop an adequate interpretation and description of the marine habitats around Malta so as to aid in the implementation of measures for their protection and hence, ultimately, to ensure effective and efficient management of the marine environment under the jurisdiction of Malta up to the 25 NM boundary, in line with the relevant national and regional legislation. More specifically, the tender Terms of Reference (ToR) state the following specific objectives:

1. To list and describe the habitats around Malta.
2. To devise a correlation table for different habitats classification systems.
3. To provide a scheme to enable the assessment of the conservation status of a habitat as required under the Habitats Directive.

III. HABITAT INTERPRETATION MANUAL

The interpretation manual was compiled by revising and building upon the marine habitats 'alignment report' written by Borg and Schembri in 2002 in order to meet the tender specific objectives 1 and 2. An extensive review of all available literature and freely available data on marine habitat types in the marine area extending up to the 25 NM limit was carried out. In addition, consultations with relevant local experts were made, and information from the present consultants' own unpublished research was incorporated. In this manner the information contained in Borg and Schembri 2002 was updated, data gaps addressed where feasible and necessary, and conclusions made in 2002 revised.

Unlike the report written by Borg and Schembri (2002), which followed the classification system used in the Barcelona Convention's Protocol concerning specially protected areas and biological diversity in the Mediterranean (also known as the RAC/SPA system, named after the UNEP's Regional Activity Centre for Special Protected Areas), the present manual is based on the EUNIS typology, with modifications where relevant.

The habitats included in the present interpretation manual are listed according to bathymetric zone, going from shallow to deep waters; bathymetric zones included in the interpretation manual are: (1) mediolittoral, (2) infralittoral, (3) circalittoral, and (4) bathyal. The supralittoral zone and coastal habitats (e.g. saltmarshes, saltworks etc.) were not included since these are usually treated with terrestrial habitats in habitat manuals and split off in the EUNIS system at the highest level of habitat sub-division, i.e. Level one (see below).

There are six hierarchical levels of marine habitats in the EUNIS classification system:

- The first level of the hierarchy splits off marine habitats from coastal and terrestrial habitats.
- The second level of sub-divisions uses the bathymetric zones and the presence / absence of hard substrata as classification criteria. For example, category A1 refers to 'littoral rock and other hard substrata', and category A2 refers to 'littoral sediment'.
- Level 3 introduces energy or exposure levels (low, moderate, high exposure) into the classification for hard substrata, and splits the soft substrata according to different sediment types (i.e. mud, sand, coarse sediment); for example A1.1 = High-energy littoral rock while A2.1 = Littoral coarse sediment. Until Level 3 of the EUNIS system is thus based completely on abiotic parameters.
- The presence of certain dominant or 'diagnostic' species characterising biological communities is first used to distinguish between habitats at Level 4, where the epifauna is used to distinguish between rocky habitats. For soft sediments, abiotic attributes are still used at Level 4 so that, for example, A1.11 = 'mussel and/or barnacle communities' but A2.11 = 'shingle (pebble) and gravel shores.
- At Level 5 sub-divisions are based on both abiotic and biotic habitat characteristics; for soft substrata divisions are defined mainly by infaunal species, for example A 2.112 = [Pectengammarus planicrurus] in mid-shore well-sorted gravel or coarse sand.
- At Level 6, the lowest level of sub-division in the EUNIS system, notable variations in the community structure of Level 5 habitats are described, for example A1.1121 = [Chthamalus montagui] and [Chthamalus stellatus] on exposed upper eulittoral rock.

A diagrammatic overview of the EUNIS classification system and the main criteria used at each sub-division level are given in Figure 1.

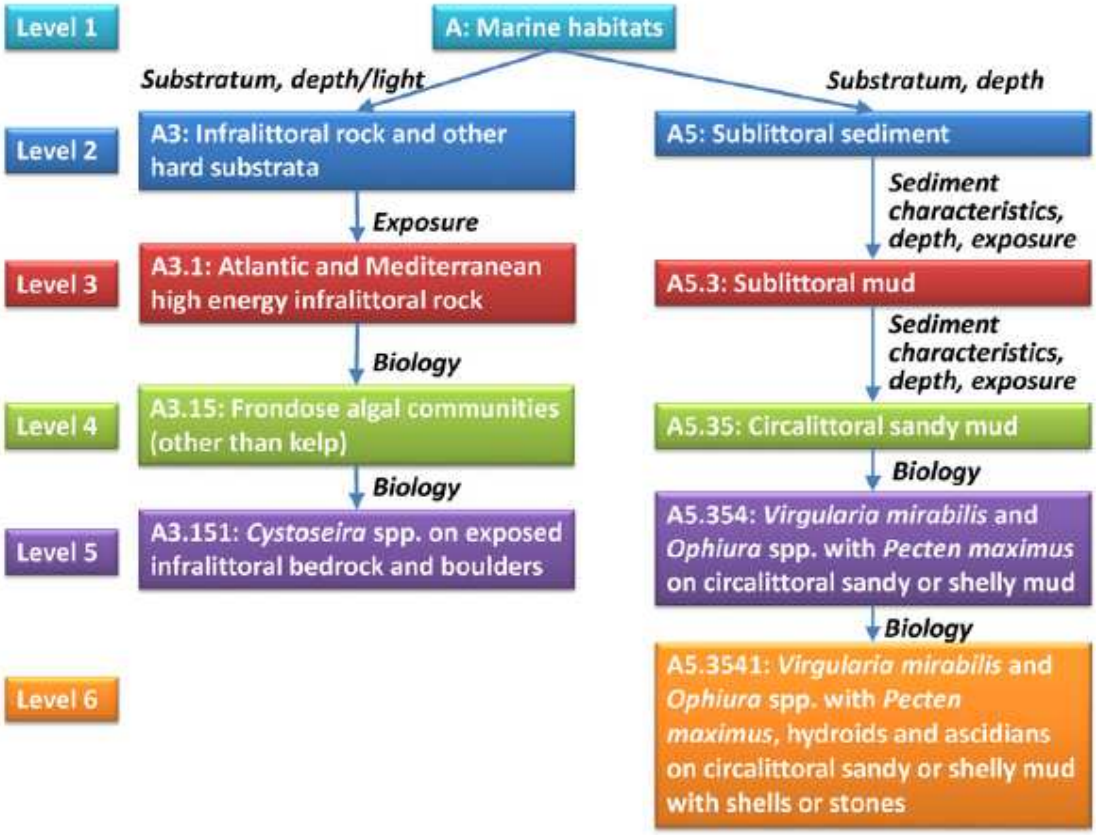

Figure 1. Diagrammatic representation of the EUNIS classification system; hard substratum environments are on the left and soft substratum environments are on the right (illustration taken from Galparsoro et al., 2012).

In order to ensure information is relevant to the local situation, habitats listed in the EUNIS database were reviewed and habitats which are actually present in the Maltese Islands were identified. Where necessary, some additional 'new' habitat categories were proposed and included in the manual. The taxonomic status of species names (for the listed habitats) was verified, and where relevant updated after consulting the 'AlgaeBase' (Guiry and Guiry, 2013) and 'WORMS' (World Register of Marine Species; Appeltans et al., 2012) databases.

For each habitat category presented, cross-references to the RAC/SPA system in its most recent edition (UNEP-MAP, 2006), the MSFD classification system of predominant habitat types, as well as the marine habitats listed in Annex I of the Habitats Directive, are given. For the RAC/SPA system, the priority habitat identification sheets according to the SPABM Protocol (Barcelona Convention) developed by Relini and Giaccone (2009) were referred to. MSFD seabed habitat types were based on the sub-divisions proposed in a 2011 Commission Staff Working Paper

(Reference SEC (2011) 1255 final). Predominant habitat types to be used across regions and sub-regions for the purpose of implementing the MSFD, listed in this document, are:

- Littoral rock and biogenic reef
- Littoral sediment
- Shallow sublittoral rock and biogenic reef
- Shallow sublittoral coarse sediment
- Shallow sublittoral sand
- Shallow sublittoral mud
- Shallow sublittoral mixed sediment
- Shelf sublittoral rock and biogenic reef
- Shelf sublittoral coarse sediment
- Shelf sublittoral sand
- Shelf sublittoral mud
- Shelf sublittoral mixed sediment
- Upper bathyal rock and biogenic reef
- Upper bathyal sediment
- Lower bathyal rock and biogenic reef
- Lower bathyal sediment
- Abyssal rock and biogenic reef
- Abyssal sediment

With regards to the Habitats Directive, the following four Annex I categories were cross-referenced:

- Sandbanks which are slightly covered by sea water all the time; NATURA 2000 code 1110
- *Posidonia* beds (*Posidonion oceanicae*); NATURA 2000 code 1120
- Reefs; NATURA 2000 code1170
- Submerged or partially submerged sea caves; NATURA 2000 code 8330

In order to cross-reference between the different habitats classification systems, the relationships between the different typologies were established and included in the interpretation manual. Classification systems can correspond in several manners depending on the purpose of the respective classification systems and the actual methodology used to categorize habitats. In the context of RAC/SPA versus EUNIS, the latter adopts an approach where the characterizing species are the ones that are the most obvious, as for example when mapping habitats. On the other hand, RAC/SPA adopts a mainly (but not exclusively) phytosociologial approach, where the species used to characterize the various biocoenoses are 'diagnostic species' that may not be the ones that are the most obvious, or indeed very common. In line with the EUNIS classification system, new habitat categories proposed for the Maltese Islands in the present interpretation manual are based on conspicuous species dominant in the relevant assemblages since these will be the species which are most easily recognisable during benthic mapping exercises. However, this does not mean that small, low growing or encrusting species are not present or important.

Relationships between habitat classification systems were assessed on the basis of both environmental attributes and species characteristics; five possible categories of correspondence between systems were identified. If A and B represent two different habitat classifications, the possible relationships are:

(1) A and B are the same; A = B. For instance RAC/SPA habitat II.3.1.1 'Facies of banks of dead leaves of *Posidonia oceanica* and other phanerogams' corresponds to EUNIS habitat

A2.131 ‘Facies of banks of dead leaves of [Posidonia oceanica] and other phanerogams’. Many Mediterranean marine habitats listed in the EUNIS system at Levels 5 and 6 were in fact transposed from the RAC/SPA system, so the classifications are identical.

(2) A is included in B, i.e. A is one habitat within B; A < B. For instance RAC/SPA habitat II.4.3 ‘Mediolittoral caves’ is part of the EUNIS habitat ‘Communities of littoral caves and overhangs’.

(3) A contains B, i.e. B is one habitat within A; A > B. For instance EUIS habitat ‘Communities of littoral caves and overhangs’ would contain RAC/SPA habitat II.4.3 ‘Mediolittoral caves’.

(4) Some parts of habitat A corresponds to some parts of habitat B; A # B. For instance RAC/SPA habitat II.1.1 ‘Biocoenosis of muddy sands and muds’ partly corresponds to EUNIS habitat A2.2 ‘Littoral sand and muddy sand’ and EUNIS habitat A2.3 ‘Littoral mud’.

(5) There is no correspondence between the classification systems. For instance, there is no EUNIS habitat which corresponds to RAC/SPA habitat II.1.1.1 ‘Association with halophytes’.

The symbols =, <, >, #, as defined above are used in the habitat classification tables below to indicate the relationship between the RAC/SPA and EUNIS habitat classification systems.

Tables with details on characteristic physical and chemical features were included for the highest level habitat categories listed in the interpretation manual. However, such tables could not be included for associations which are rare in the Maltese Islands, or which have not been well studied to date. Indeed, a lack of information on benthic habitats found within the 25 NM Fisheries Management Zone hampered the compilation of a comprehensive habitats interpretation manual. Whilst all efforts were made to include available information based on (1) a review of up to date scientific literature, (2) consultation with relevant local experts, and (3) the consultants’ own research, only very limited information was available for many habitats. This was in particular the case for habitats found in deeper (> 50 m) waters since a full inventory of the deeper water habitats of the Maltese Islands, in particular bathyal habitats, is not yet available.

A. MEDIOLITTORAL

A1 Littoral rock and other hard substrata (EUNIS Level 2)

A1.1 High energy littoral rock (EUNIS Level 3)

A1.13 Mediterranean and Black Sea communities of upper mediolittoral rock (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	II.4.1
RAC/SPA Name	Biocenosis of upper mediolittoral rock
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Littoral rock and biogenic reef

Description

The species assemblages of these biocoenoses are strongly affected by variations in wave action and submersion. Several assemblages are listed under this heading in the EUNIS classification, some of which occur locally. However our knowledge of local assemblages is too rudimentary to suggest the inclusion of 'new' associations to fit the local situation.

Key References

Borg and Schembri (2002); ICRAM (2005)

A1.131 Association with [Bangia atropurpurea] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	II.4.1.1
RAC/SPA Name	Association with *Bangia atropurpurea*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Littoral rock and biogenic reef

Description

This association occurs locally where there is some organic pollution and wave action and is characterised by a more or less continuous belt of the red alga *Bangia atropurpurea*.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Mediolittoral
Depth range	From -20 cm to +40 cm vertical distance relative to sea level
Water temperature	Various
Currents and water movements	Exposed shores subject to wave motion
Salinity	Various
Seabed composition	Hard rocky substrate

Mapped locations	None
Key recognition features	This habitat occurs on exposed rocky shores and can be recognised by the presence of barnacles, gastropods, and amphipods and other crustaceans
Habitat sensitivity	Sensitive to pollution from sewage and hydrocarbons, and trampling.

Key References

Borg and Schembri (2002); ICRAM (2005).

A1.132 Association with [Porphyra leucosticta] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	II.4.1.2
RAC/SPA Name	Association with *Poryphyra leucosticta*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Littoral rock and biogenic reef

Description

This assemblage occurs locally where there is some organic pollution and wave action, and is characterised by a more or less continuous belt of the red alga *Porphyra leucosticta*.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria

Zone	Mediolittoral
Depth range	From -20 cm to +40 cm vertical distance relative to sea level
Water temperature	Various
Currents and water movements	Exposed shores subject to wave motion
Salinity	Various
Seabed composition	Hard rocky substrate
Mapped locations	None
Key recognition features	This habitat occurs on exposed rocky shores and can be recognised by the presence of barnacles, gastropods, and amphipods and other crustaceans.
Habitat sensitivity	Sensitive to pollution from sewage and hydrocarbons, and trampling.

Key References

Borg and Schembri (2002); ICRAM (2005).

A1.134 Association with [Lithophyllum papillosum] and [Polysiphonia] spp. (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	II.4.1.4
RAC/SPA Name	Association with *Lithophyllum papillosum* and *Polysiphonia* spp.
RAC/SPA to EUNIS	=
Habitats Directive Code	1170
Habitats Directive Name	Reefs

Habitats Directive to EUNIS	>
MSFD Classification	Littoral rock and biogenic reef

Description

This association is characterised by a continuous belt of the red algae *Lithophyllum papillosum* and *Polysiphonia* spp., which may occur in the Maltese Islands. No information is available to date.

Additional Notes

This is an example of a biogenic reef.

Key References

Borg and Schembri (2002); ICRAM (2005).

A1.14 Mediterranean and Black Sea communities of lower mediolittoral rock very exposed to wave action (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	II.4.2
RAC/SPA Name	Biocenosis of lower mediolittoral rock
RAC/SPA to EUNIS	#
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Littoral rock and biogenic reef

Description

Associations located on the lower horizon of the mediolittoral zone on rocky substrata subjected to strong wave action; as a general rule the rocky substratum remains moist.

Key References

Borg and Schembri (2002); ICRAM (2005)

A1.141 Association with [Lithophyllum byssoides] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	II.4.2.1 & II.4.2.2
RAC/SPA Name	Association with *Lithophyllum lichenoides* & Association with *Lithophyllum byssoides*.
RAC/SPA to EUNIS	=
Habitats Directive Code	1170
Habitats Directive Name	Reefs
Habitats Directive to EUNIS	>
MSFD Classification	Littoral rock and biogenic reef

Description

This association refers to 'rims' or 'cornices' made by the red alga *Lithophyllum byssoides*, an important bio-constructor in the Mediterranean. Locally, biogenic concretions in the form of 'knobs' of *L. byssoides* are known to occur, but are rare.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Mediolittoral
Depth range	From -5 cm to -10 cm vertical distance relative to sea level
Water temperature	14-20°C
Currents and water	Exposed shores

movements	
Salinity	36-39%
Seabed composition	Rocks with various degrees of inclination
Mapped locations	None
Key recognition features	Layers of encrusting calcareous thalli forming rims, knobs and projecting platforms.
Habitat sensitivity	Trampling; alteration of natural currents through the coastal construction works; sewage and hydrocarbon pollution. Listed as priority habitat in RAC/SPA classification system.

Additional Notes

This species is also known by its synonym *Lithophyllum lichenoides* but *L. byssoides* is adopted as the correct taxonomic name following the interpretations taken by both EUNIS and Algaebase.

Key References

Borg and Schembri (2002); ICRAM (2005).

A1.2 Moderate energy littoral rock (EUNIS Level 3)

A1.23 Mediterranean communities of lower mediolittoral rock moderately exposed to wave action

Habitat Classification

RAC/SPA Code	II.4.2
RAC/SPA Name	Biocenosis of lower mediolittoral rock
RAC/SPA to EUNIS	#
Habitats Directive Code	n/a
Habitats Directive Name	n/a

Habitats Directive to EUNIS	n/a
MSFD Classification	Littoral rock and biogenic reef

Description

Associations located on the lower horizon of the mediolittoral zone on rocky substrata subjected to moderate wave action; as a general rule the rocky substratum remains moist.

Key References

Borg and Schembri (2002); ICRAM (2005).

A1.231 Association with [Ceramium ciliatum] and [Corallina elongata] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	II.4.2.4
RAC/SPA Name	Association with *Ceramium cilatum* and *Corallina elongata*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Littoral rock and biogenic reef

Description

This association, characterised by the red algae *Ceramium cilatum* and *Corallina elongata*, is common locally. *Corallina elongata* is particularly abundant in polluted inlets, but is also abundant in clean waters in shaded places.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Mediolittoral
Depth range	From -20 cm to +30 cm vertical distance relative to sea level
Water temperature	Various
Currents and water movements	Moderately exposed shores
Salinity	Various
Seabed composition	Hard rocky substrate
Mapped locations	None
Key recognition features	Dense tufts of the red alga *Corallina elongata* in polluted harbour inlets and in clean waters in shaded places.
Habitat sensitivity	Trampling; sewage and hydrocarbon pollution

Key References

Borg and Schembri (2002); ICRAM (2005).

A1.232 [Neogoniolithon brassica-florida] concretion (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	II.4.2.8
RAC/SPA Name	*Neogoniolithon brassica-florida* concretion
RAC/SPA to EUNIS	=

Habitats Directive Code	1170
Habitats Directive Name	Reefs
Habitats Directive to EUNIS	>
MSFD Classification	Littoral rock and biogenic reef

Description

The coralline alga *Neogoniolithon brassica-florida* occurs at the lower mediolittoral-upper infralittoral transition of local rocky shores, especially in shallow depressions where it forms a crust on the rock.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Mediolittoral
Depth range	From -5cm to +50 cm vertical distance relative to sea level
Water temperature	14-20°C
Currents and water movements	Moderately exposed shores
Salinity	37-39%
Seabed composition	Hard rocky substrate and various
Mapped locations	None
Key recognition features	Thin crusts of red alga *Neogoniolithon brassica-florida* or concretions several cm thick; associations of *Neogoniolithon brassica-florida* with vermetids.
Habitat sensitivity	Trampling; sewage and hydrocarbon pollution. Listed as priority habitat in RAC/SPA classification system.

Additional Notes

It is not clear whether this EUNIS category refers to crusts of this species alone (which occur) or to associations of this species with vermetids (the vermetid 'trottoir'), which also occur. In the latter association, this algal species acts as the matrix filling in the spaces between the vermetid shells.

Key References

Azzopardi and Schembri (1997); ICRAM (2005).

A1.233 Association with [Gelidium] spp. (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	II.4.2.9
RAC/SPA Name	Association with *Gelidium* spp.
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Littoral rock and biogenic reef

Description

Associations characterised by a dominance of red algae *Gelidium* spp. are common in the Maltese Islands.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Mediolittoral
Depth range	From -20 cm to +30 cm vertical distance relative to sea level

Water temperature	Various
Currents and water movements	Moderately exposed shores
Salinity	Various
Seabed composition	Hard rocky substrate
Mapped locations	None
Key recognition features	Presence of red algae belonging to the genus *Gelidium*.
Habitat sensitivity	Trampling; sewage and hydrocarbon pollution.

Key References

Borg and Schembri (2002); ICRAM (2005).

A1.234 Pools and lagoons sometimes associated with [Vermetus] spp. (infralittoral enclave) (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	II.4.2.10
RAC/SPA Name	Pools and lagoons sometimes associated with vermetids
RAC/SPA to EUNIS	=
Habitats Directive Code	1170
Habitats Directive Name	Reefs
Habitats Directive to EUNIS	>
MSFD Classification	Littoral rock and biogenic reef

Description

Associations with vermetid gastropods occur in the Maltese Islands and are quite common; however these occur on the open coast, not in lagoonar conditions.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Mediolittoral
Depth range	From -5 cm to +50 cm vertical distance relative to sea level
Water temperature	Various
Currents and water movements	Moderately exposed shores
Salinity	Various
Seabed composition	Hard rocky substrate
Mapped locations	None
Key recognition features	Pools with vermetids or found on the open coast.
Habitat sensitivity	Trampling; sewage and hydrocarbon pollution.

Additional Notes

This biocoenosis locally is more common on the open coast rather than in pools or in lagoonal situations. This is an example of a biogenic reef.

Key References

Borg and Schembri (2002); ICRAM (2005).

A1.3 Low energy littoral rock (EUNIS Level 3)

A1.34 Mediterranean communities of lower mediolittoral rock sheltered from wave action (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	II.4.2
RAC/SPA Name	Biocenosis of lower mediolittoral rock
RAC/SPA to EUNIS	#
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Littoral rock and biogenic reef

Description

Associations located on the lower horizon of the mediolittoral zone on sheltered rocky shores; as a general rule the rocky substratum remains moist.

Key References

Borg and Schembri (2002); ICRAM (2005).

A1.341 Association with [Enteromorpha compressa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	II.4.2.6
RAC/SPA Name	Association with *Enteromorpha compressa*
RAC/SPA to EUNIS	=

Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Littoral rock and biogenic reef

Description

Association characterized by the green alga *Ulva compressa* (ex *Enteromorpha compressa)* which occurs on sheltered shores subject to some organic pollution and/or fluctuating salinity.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Mediolittoral
Depth range	From -20 cm to +30 cm vertical distance relative to sea level
Water temperature	Various
Currents and water movements	Sheltered shores
Salinity	Various
Seabed composition	Hard rocky substrate
Mapped locations	None
Key recognition features	Presence of green algal species *Enteromorpha compressa* in sheltered, polluted waters.
Habitat sensitivity	Low, habitat is found in sheltered shores with fluctuating salinity subject to organic pollution.

Additional Notes

Locally, associations with *Enteromorpha linza* are more common than associations with *Enteromorpha compressa*. Given the fact that the two species are difficult to distinguish and have similar characteristics we recommend referring to both as 'Associations with *Enteromorpha* spp.'.

Key References

Borg and Schembri (2002); ICRAM (2005).

A1.4 Features of littoral rock (EUNIS Level 3)

A1.44 Communities of littoral caves and overhangs (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	II.4.3
RAC/SPA Name	Mediolittoral caves
RAC/SPA to EUNIS	<
Habitats Directive Code	8330
Habitats Directive Name	Submerged or partially submerged sea caves
Habitats Directive to EUNIS	>
MSFD Classification	Littoral rock and biogenic reef

Description

Associations found under overhangs in the mediolittoral zone of rocky shores and in the mediolittoral of emergent caves will be influenced by reduced wave action, wetting by sea spray and illumination. These factors will reduce the amount of desiccation and help keep environments moist, relative to exposed rock. Associations from nearby marine habitats may on occasion extend into cave entrances, while sciaphilic algae, typically *Corallina elongata*, occur in shaded places. The diversity of faunal species decreases with increasing distance into the cave as light levels are reduced.

Key References

Borg and Schembri (2002); Connor et al. (2004).

A1.448 Faunal crusts on wave-surged littoral cave walls (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	II.4.3.1
RAC/SPA Name	Association with *Phymatolithon lenormandii* and *Hildebrandia rubra*
RAC/SPA to EUNIS	=
Habitats Directive Code	8330
Habitats Directive Name	Submerged or partially submerged sea caves
Habitats Directive to EUNIS	>
MSFD Classification	Littoral rock and biogenic reef

Description

Associations with *Phymatolithon lenormandii* and *Hildebrandia rubra* can be found at the entrance of semi-submerged caves or under biogenic constructions in the mediolittoral zone. The fauna associated with such habitats includes barnacles, encrusting sponges, limpets, hydroids, tube-forming polychaetes and bryozoans. This biotope has yet to be studied in detail locally but it is known to occur, for instance, in the mediolittoral of semi-submerged caves along the cliff shores of western / southwestern Malta as well as western / southwestern / southern Gozo.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Mediolittoral
Depth range	From -20 cm to +5 cm vertical distance relative to sea level
Water temperature	14-20°C

Currents and water movements	Exposed shores
Salinity	36-39%
Seabed composition	Rock exposed to reflected light
Mapped locations	None.
Key recognition features	Red-violet crusts of considerable size growing on exposed shores in association with *Lithophyllum bissoides* knobs / platforms or at the entrance to littoral caves. Mosaics of differently coloured encrusting algae are characteristic.
Habitat sensitivity	Pollution of surface waters, light pollution of littoral caves. Listed as priority habitat in RAC/SPA classification system.

Key References

Borg and Schembri (2002); Connor et al. (2004).

A2 Littoral sediment (EUNIS Level 2)

A2.1 Littoral coarse sediment (EUNIS Level 3)

A2.13 Mediterranean communities of mediolittoral coarse detritic bottoms (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	II.3.1
RAC/SPA Name	Biocenosis of mediolittoral coarse detritic bottoms
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a

Habitats Directive to EUNIS	>
MSFD Classification	Littoral sediment

Description

Biocoenoses which consist mainly of detritus-feeding species feeding on decaying vegetation and/or finely divided organic particles (= detritus). Such assemblages are exposed to alternating submersion and emersion by seawater, as well as to wetting by precipitation and runoff because of variations in the sea-level, wave activity and precipitation episodes; habitats typically remain moist during most of the year but may dry out during prolonged periods of calm weather in the dry season.

Key References

Borg and Schembri (2002); ICRAM (2005)

A2.131 Facies of banks of dead leaves of [Posidonia oceanica] and other phanerogams (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	II.3.1.1
RAC/SPA Name	Facies of banks of dead leaves of *Posidonia oceanica* and other phanerogams
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	>
MSFD Classification	Littoral sediment

Description

Banks of plant debris made mainly up of *Posidonia oceanica* leaves and some rhizomes with variable amounts of other vegetal remains, including algae and *Cymodocea nodosa*, washed ashore on sandy beaches and other sedimentary shores. This facies is particularly common in

winter; in summer most are removed to clear the sand for recreational use and as a result such banks only persist in remote pocket beaches or those which are not cleared. In many cases, locally, this facies grades into the supralittoral 'Facies of phanerogams which have washed ashore' (B1.224). This bioceonosis is populated by detritivorous organisms feeding on plant debris or epiphytes and their remains, and associated predators. Both terrestrial and marine species can be encountered, and the actual species composition depends on several factors such as the length of time the bank has existed, the thickness of the bank, the nature of the underlying substratum, season, and the degree of wetting by both seawater and freshwater.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Mediolittoral
Depth range	From -20 cm to +150 cm vertical distance relative to sea level
Water temperature	Various
Currents and water movements	Exposed shores but also sheltered shores subject to occasional pronounced wave action during particular meteorological conditions.
Salinity	Various
Seabed composition	Littoral coarse sediment
Mapped locations	None.
Key recognition features	The habitat consists of banks of vegetal debris, mainly leaves of *Posidonia oceanica* but also other phanerogams and some algae, deposited in the littoral zone. Easily recognizable.
Habitat sensitivity	Disturbance due to mechanical removal of deposits on beaches. Disturbance by amateur fishermen who sift the banks to collect isopods for use as bait. Listed as priority habitat in RAC/SPA classification system.

Additional Notes

An impoverished version of such seagrass banks are also washed up on exposed low-lying rocky shores; such habitats have yet to be studied locally. There is no corresponding EUNIS

classification for the biocoenosis of banks of dead leaves of *Posidonia oceanica* and other phanerogams on rocky shores.

Key References

Borg and Schembri (2002); ICRAM (2005); Deidun et al. (2009); Relini and Giaccone (2009).

A2.2 Littoral sand and muddy sand (EUNIS Level 3)

A2.25 Mediterranean and Pontic communities of mediolittoral sands (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	II.2.1
RAC/SPA Name	Biocenosis of mediolittoral sands
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Littoral sediment

Description

This habitat occurs in the Maltese Islands and is characterised by opheliid polychaetes and isopod crustaceans.

Key References

Borg and Schembri (2002); ICRAM (2005).

A2.251 Facies with [Opelia bicornis]

Habitat Classification

RAC/SPA Code	II.2.1.1
RAC/SPA Name	Facies with *Ophelia bicornis*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS Relation	n/a
MSFD Classification	Littoral sediment

Description

This biocoenosis of mediolittoral sands is characterised by a high abundance of the opheliid polychaete *Ophelia bicornis*. Although this facies occurs at several Maltese beaches, *O. bicornis* is not found on all local sandy beaches (some are almost completely devoid of mediolittoral fauna).

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Mediolittoral
Depth range	Sea level to +/-1 m
Temperature	Various
Currents and water movements	Exposed to wave action
Salinity	Various
Seabed composition	Littoral sediment

Mapped locations	None
Key recognition features	Wet areas of sandy beaches; species more common in winter.
Habitat sensitivity	Listed as priority habitat in RAC/SPA classification system.

Key References

Sammult (1995); Saliba (2001); Deidun et al. (2003); Deidun et al. (2009).

B. INFRALITTORAL

A3 Infralittoral rock and other hard substrata (EUNIS Level 2)

A3.1 Atlantic and Mediterranean high energy infralittoral rock (EUNIS Level 3)

A3.13 Mediterranean and Pontic communities of infralittoral algae very exposed to wave action (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	III.6.1
RAC/SPA Name	Biocenosis of infralittoral algae
RAC/SPA to EUNIS	#
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Locally, photophilic algae, mostly phaeophytes, dominate the upper infralittoral (0-20m) on hard substrata in well-lit situations wherever seagrasses are absent. They may also be co-dominant with seagrasses. Synoptically, local photophilic algal assemblages may be classified into a small number of sub-types: (a) Mono-specific assemblages with one species completely dominant over several others that occur only in small numbers. (b) Assemblages in which 2-3 species are co-dominant while other species occur in very small numbers. (c) Mixed assemblages with no apparent dominant species but with 4-10 species co-occurring in varying relative abundances in more or less equal abundance.

Semi-dark rocky substrata such as deep drop-offs, underhangs and the mouth of caves are characterised by sciaphilic assemblages dominated by encrusting corallines, by *Fabellia petiolata, Peyssonellia squamaria* and *Halimeda tuna*, and by *Halopteris* spp. and *Zonaria tournefortii*. Away from the entrance, caves are dominated by rhodophytes, mainly encrusting species, together with

bryozoans and sponges. In the inner parts that are dimly lit or dark, the biota mainly consists of bryozoans, serpulid and spirorbid polychaetes and sponges. Local cave assemblages have been little studied, however.

Additional Notes

The EUNIS classification system splits the RAC/SPA category III.6.1, 'biocenosis of infralittoral algae' into three corresponding categories: EUNIS A3.13, 'Mediterranean and Pontic communities of infralittoral algae very exposed to wave action'; EUNIS A3.23, 'Mediterranean and Pontic communities of infralittoral algae moderately exposed to wave action'; EUNIS A3.33, 'Mediterranean submerged fucoids, green or red seaweeds on full salinity infralittoral rock'.

Key References

Borg and Schembri (2002); ICRAM (2005)

A3.131 Overgrazing facies with incrustant algaes and sea urchins[1] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.1
RAC/SPA Name	Overgrazed facies with encrusting algae and sea urchins
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

[1] Official EUNIS name is provided; correct name should read 'Overgrazed facies with encrusting algae and sea urchins'.

Description

Occurs; often referred to as 'sea-urchin barrens'. Locally this biocoenosis takes the form of bedrock, very often with a considerable slope, that has high populations of the rock urchin *Paracentrotuis lividus* that excavate shallow burrows in the rock from which they perform feeding excursions. When the population density is very high, very few if any macroalgae will grow on the rock due to the grazing pressure, and the algal component of the biocoenosis will be dominated by quick-growing turf species and by encrusting corallines. Note that this is a dynamic habitat maintained by the balance between sea urchin grazing and colonisation of the substratum by algae, such that any disruption of this balance will shift the biocoenosis to another type, as has happened when a disease of *Paracentrotus* decimated local populations in 1980s and most previous sea urchin barrens reverted to biocoenoses dominated by photophilic algae.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From surface to approximately -6 m depth
Water temperature	14-22°C
Currents and water movements	Various
Salinity	37-39%
Seabed composition	Hard rocky substrata
Mapped locations	None
Key recognition features	Presence of rock urchin *Paracentrotus lividus* and characteristic shallow burrows, grazing marks.
Habitat sensitivity	Sensitive to sea urchin collection by recreational fishers and natural disease outbreaks when urchins are present in high numbers.

Additional Notes

At present any increases in rock urchin population size is being prevented through collection by divers, who sell the animals to local restaurants. This is resulting in two effects: (1) Rare occurrence of sea urchin barrens and (2) Preventing recurrence of the disease episode which apparently resulted from overstressed urchin populations as a result of high densities.

Key References

Borg and Schembri (2002); ICRAM (2005)

A3.132 Association with [Cystoseira amentacea] (var. [amentacea], var. [stricta], var. [spicata]) (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.2
RAC/SPA Name	Association with *Cystoseira amentacea*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by the brown alga *Cystoseira amentacea* and is the dominant upper infralittoral algal biocoenosis on moderately exposed to exposed shores where there are no other conditions that favour a different biocoenoses, as for example, low or variable light intensities which favour *Corallina elongata*, or nutrient input or fluctuating salinities, which favour Ulvales.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Upper infralittoral
Depth range	From 0 m to -2 m vertical distance relative to sea level
Water temperature	14-20°C
Currents and water movements	Moderately exposed to exposed shores subject to wave motion
Salinity	37-39%
Seabed composition	Hard rocky substrata
Mapped locations	None
Key recognition features	Association forms dense stands in the upper infralittoral zone.
Habitat sensitivity	Sensitive to invasion by alien species, in particular *Caulerpa racemosa*; pollution from sewage, hydrocarbons, agricultural runoff. Listed as priority habitat in RAC/SPA classification system.

Key References

Borg and Schembri (2002); ICRAM (2005); Thibaut (2011).

A3.133 Facies with [Vermetus] spp. (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.3
RAC/SPA Name	Facies with vermetids
RAC/SPA to EUNIS	=

Habitats Directive Code	1170
Habitats Directive Name	Reefs
Habitats Directive to EUNIS	>
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This biocoenosis is characterised by a high abundance of vermetids building continuous belts called "trottoirs". In the Maltese Islands, two species of vermetids occur on rocky shores from more or less mean sea-level to ca 30 cm below MSL in the uppermost infralittoral. *Dendropoma petraeum* may occur singly or in small groups but is usually embedded in a calcareous matrix made of the rhodophyte *Neogoniolithon notarisii* to form a compound bioconstruction that covers the bedrock underneath, known as a vermetid reef or vermetid platform or trottoir. Such bioconstructions occur on exposed rocky shores and mark MSL and the uppermost infralittoral that is only occasionally exposed during sea-level lows or by receding waves. The second species is *Vermetus triquetrus*. This species occurs in situations where it is rarely uncovered by water and may occur in depressions in the rock that act as miniature rockpools and in the lee of the *Dendropoma* trottoir. Normally *V. triquetrus* occur singly or in small groups but may occasionally also occur in association with *Neogoniolithon notarisii* to form a compound structure.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Uppermost infralittoral
Depth range	From -2 to -30 cm
Water temperature	14-26°C
Currents and water movements	Exposed shores subject to wave motion
Salinity	37-39%
Seabed composition	Hard rocky substrata
Mapped locations	None

Key recognition features	Compound bioconstructions resembling crusts, ledges, knobs covering bedrock underneath or found in depressions on rocks. Easily recognizable.
Habitat sensitivity	Sensitive to pollution from sewage and hydrocarbons, and trampling. Listed as priority habitat in RAC/SPA classification system.

Additional Notes

The EUNIS name for this biocoenosis is inaccurate as in the Mediterranean, while *Vermetus* occurs, there are other genera of vermetids. The RAC/SPA name is more appropriate in this regard.

Key References

Azzopardi and Schembri (1997); ICRAM (2005).

A3.134 Mediterranean and Pontic facies with [Mytilus galloprovincialis] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.4
RAC/SPA Name	Facies with *Mytilus galloprovincialis*.
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This biocoenosis, characterised by the dominance of the mollusc bivalve *Mytilus galloprovincialis*, is typical of areas with high levels of organic input. However this mussel occurs only rarely and never forms mussel beds and thus a biocoenosis locally, although it may form clumps on the mooring lines of offshore fish-farms.

Additional Notes

The alien mussel *Brachidontes pharaonis* forms beds on the shore, but so far only one such bed has been identified in the Maltese Islands.

Key References

Borg and Schembri (2002); Black Sea Commission / EEA (2007); Bonnici et al. (2012).

A3.135 Association with [Corallina elongata] and [Herposiphonia secunda] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.5
RAC/SPA Name	Association with *Corallina elongata* and *Herposiphonia secunda*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association with the red algae *Corallina elongata* and *Herposiphonia secunda* is typical of the upper infralittoral with strong wave action and strong luminosity. In the Maltese Islands *Corallina elongata* is usually dominant on shaded, vertical, submarine drop-offs in clean waters at a depth of 0-1 m and on rocky substrata in polluted creeks and inlets. *Herposiphonia secunda* is common and

may co-occur with *Corallina elongata* but it does not dominate. It also occasionally forms dense populations but in small patches.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Upper infralittoral
Depth range	From surface to approximately -2 m depth
Water temperature	14-22°C
Currents and water movements	Exposed shores subject to wave action
Salinity	37-39%
Seabed composition	Hard rocky substrata
Mapped locations	None
Key recognition features	Presence of *C. elongata* and *H. secunda* on exposed shores.
Habitat sensitivity	Sewage, agricultural runoff and hydrocarbon pollution

Key References

Cormaci et al. (1997); Borg and Schembri (2002); ICRAM (2005); E. Lanfranco (pers. com. 2013).

A3.136 Mediterranean and Pontic association with [Corallina officinalis] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.6
RAC/SPA Name	Association with *Corallina officinalis*

RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Note

Although records of *Corallina officinalis* from Malta exist in the literature, the presence of this species has not been confirmed. Therefore, this association probably does not exist.

Key References

Cormaci et al. (1997).

A3.137 Association with [Schottera nicaeensis] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.29
RAC/SPA Name	Association with *Schottera nicaeensis*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Although *Schottera nicaeensis* occurs locally, normally as part of the sciaphilic assemblage under overhangs, this is a rare species that does not dominate the assemblage.

Key References

Cormaci et al. (1997); Borg and Schembri (2002); ICRAM (2005); E. Lanfranco (pers. com. 2013).

A3.2 Atlantic and Mediterranean moderate energy infralittoral rock (EUNIS Level 3)

A3.23 Mediterranean and Pontic communities of infralittoral algae moderately exposed to wave action (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	III.6.1
RAC/SPA Name	Biocoenosis of infralittoral algae
RAC/SPA to EUNIS	#
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This community is characterised by the presence of many species of photophilic algae covering hard bottoms in moderately exposed areas.

Key References

ICRAM (2005).

A3.231 Association with [Codium vermilara] and [Rhodymenia ardissonei] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.7
RAC/SPA Name	Association with *Codium vermilara* and *Rhodymenia ardissonei*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Codium vermilara is found locally but is very rare; where present this species only occurs in very small patches. *Rhodymenia ardissonei* also occurs locally but not in association with *Codium vermilara*.

Additional Notes

Although both species are found in Maltese Islands, the association does not occur.

Key References

Borg and Schembri (2002); ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A3.232 Association with [Dasydadus vermicularis] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.8

RAC/SPA Name	Association with *Dasycladus vermicularis*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association with the green alga *Dasycladus vermicularis* populates the middle horizon of the infralittoral zone with low light and hydrodynamics. In the Maltese Islands this association is found on rocky bottoms covered with a thin layer of sediment.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Middle horizon of infralittoral
Depth range	From -3 m to -25 m vertical distance relative to sea level
Water temperature	14-22°C
Currents and water movements	Sheltered shores subjected to limited water movement
Salinity	37-39%
Seabed composition	Hard rocky substrata
Mapped locations	None
Key recognition features	Presence of green alga *D. vermicularis* on rocky bottoms covered with a thin layer of sediment.

Habitat sensitivity	Sewage and hydrocarbon pollution.

Additional Notes

Ubiquitous distribution in Maltese Islands.

Key References

Borg and Schembri (2002); ICRAM (2005).

A3.237 Mediterranean and Pontic association with [Ceramium rubrum] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.13
RAC/SPA Name	Association with *Ceramium rubrum*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

*Ceramium virgatum (*ex *Ceramium rubrum)* is found locally but it does not occur in large populations or dominate the assemblages if forms part of.

Key References

Borg and Schembri (2002); ICRAM (2005); E. Lanfranco (pers. com. 2013).

A3.238 Facies with [Cladocora caespitosa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.14
RAC/SPA Name	Facies with *Cladocora caespitosa*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This biocoenosis is characterised by the occurrence of the Mediterranean coral *Cladocora caespitosa*. In the Maltese Islands this species forms small patchily distributed colonies each not more that 15cm in diameter. No 'reefs' (a continuous cover of colonies) such as found at Mljet (Croatia, Adriatic Sea) and the Columbretes Islands (NW Mediterranean, Spain) and to a lesser extent at a few other localities, are formed. This facies occurs in a variety of ecological situations, ranging from clean waters to rather polluted and turbid waters such as those found in harbours and some creeks.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralitoral
Depth range	From -3 m to -30 m vertical distance relative to sea level
Water temperature	13-24°C
Currents and water movements	Moderately to sheltered shores

Salinity	37-39%
Seabed composition	Hard rocky substrata
Mapped locations	None
Key recognition features	Small patchy colonies formed by the coral *C. caespitosa*. Easily recognizable.
Habitat sensitivity	Collecting by divers, accidental direct physical damage by swimmers and divers, and anchoring. Locally present in rather polluted / turbid waters so apparently resistant to water pollution, however this biocoenosis is sensitive to overgrowth by invasive algae (e.g. *Caulerpa racemosa*, algal turfs). Listed as priority habitat in RAC/SPA classification system.

Key References

Borg and Schembri (2002); ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A3.239 Association with [Cystoseira brachycarpa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.15
RAC/SPA Name	Association with *Cystoseira brachycarpa*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by the brown alga *Cystoseira brachycarpa* and occurs in a number of localities around the Maltese Islands. Also, local records of *C. barbata* may have referred to this species. This association is indicative of clean water.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From -3 m to -25 m vertical distance relative to sea level
Water temperature	14-18°C
Currents and water movements	Exposed shores subject to water movement
Salinity	37-39%
Seabed composition	Hard rocky substrata
Mapped locations	None
Key recognition features	Dense tufts of *C. brachycarpa* forming miniature 'forests', often found on irregularly shaped rocks.
Habitat sensitivity	Sewage, desalinization and power station effluents. This association is listed as a priority habitat in the RAC/SPA classification system.

Additional Notes

C. brachycarpa has been recorded as *C. balearica* in past studies carried out in the Maltese Islands.

Key References

Cormaci et al. (1997); E. Lanfranco (pers. com. 2002); ICRAM (2005); Bonnici (2013).

A3.23A Mediterranean and Pontic association with [Cystoseira crinita] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.16
RAC/SPA Name	Association with *Cystoseira crinita*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by the brown alga *Cystoseira crinita*, living in clean waters with high dynamism and strong luminosity. Although *Cystoseira crinita* is found in the Maltese Islands it is a rare species.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Upper infralittoral
Depth range	From -50 cm to -2 m vertical distance relative to sea level
Water temperature	14-20°C
Currents and water movements	Sheltered and moderately exposed shores
Salinity	37-39%

Seabed composition	Hard rocky substrata
Mapped locations	None
Key recognition features	Tufts of *C. crinita* mixed with brown algae and covered with epibionts.
Habitat sensitivity	Trampling; sewage and hydrocarbon pollution.

Additional Notes

C. crinita is similar to the common *C. brachycarpa*, so the two species may have been confused in some studies.

Key References

Borg and Schembri (2002); ICRAM (2005); Thibaut (2011); E. Lanfranco (pers. com. 2013).

A3.23B Association with [Cystoseira crinitophylla] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.17
RAC/SPA Name	Association with *Cystoseira crinitophylla*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by the brown alga *Cystoseira crinitophylla*, which has not been recorded locally. However this species is easily mistaken for the very common *C. brachycarpa*; association may or may not occur.

Additional Notes

Similar to the common *C. brachycarpa*; the two species may have been confused in some studies.

Key References

Borg and Schembri (2002); ICRAM (2005); E. Lanfranco (pers. com. 2013).

A3.23D Association with [Cystoseira spinosa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.19
RAC/SPA Name	Association with *Cystoseira spinosa*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by the brown alga *Cystoseira spinosa* and is common locally. *Cystoseira spinosa* may also occur accompanied by a variety of subdominants, including: *Cystoseira* cf. *squarrosa*, *Cystoseira ercegovicii*, *Sargassum vulgare* and *Dictyopteris polypodioides*.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Lower infralittoral
Depth range	From -15 m to -40 m vertical distance relative to sea level
Water temperature	14-18°C
Currents and water movements	Moderately exposed shores subject to currents
Salinity	36-39%
Seabed composition	Hard rocky substrata
Mapped locations	None
Key recognition features	Forms brown-yellowish tufts which are not very dense; marks upper biological limit of infralittoral zone.
Habitat sensitivity	Sensitive to high levels of sedimentation. Listed as priority habitat in RAC/SPA classification system.

Key References

Borg and Schembri (2002); ICRAM (2005).

A3.23E Association with [Sargassum vulgare] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.20
RAC/SPA Name	Association with *Sargassum vulgare*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a

Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by the brown alga *Sargassum vulgare*, living in clear waters with high dynamism and strong luminosity. This is a common association locally. Associations in which *Sargassum vulgare* is co-dominant also occur, for example, co-dominance with *Cystoseira spinosa* or *Dictyopteris polypodioides*.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Upper infralittoral
Depth range	From -0.5 m to -40 m vertical distance relative to sea level
Water temperature	16-20°C
Currents and water movements	Moderately exposed and exposed shores
Salinity	37-39%
Seabed composition	Sloping and flat hard substrata
Mapped locations	None
Key recognition features	Forms dense belts with attached epibionts in the upper layer and various sciaphilic algae in the understory. Yellowish spherical vesicles are characteristic. Easily recognizable.
Habitat sensitivity	Trampling; sewage and hydrocarbon pollution.

Key References

Borg and Schembri (2002); ICRAM (2005).

NEW Association with [Sargassum acinarium] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest RAC/SPA entry is III.6.1.20
RAC/SPA Name	None; the closest RAC/SPA entry is 'association with *Sargassum vulgare*'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

In the Maltese Islands, associations dominated by *Sargassum acinarium* occur on upper to mid-infralittoral rocky bottoms in clean waters with good illumination. However, this association has not been well studied locally.

Additional Notes

There are no equivalent entries in EUNIS. The closest EUNIS entry is A3.23E Association with [Sargassum vulgaris].

Key References

Cormaci et al. (1997); Borg and Schembri (unpubl. data 2013).

A3.23F Association with [Dictyopteris polypodioides] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.21
RAC/SPA Name	Association with *Dictyopteris polypodioides*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by the brown alga *Dictyopteris polypodioides*, living in waters with high dynamism and strong luminosity. In places, this association has been recorded from coastal areas having some nutrient input, e.g. in the vicinity of sewage outfalls. This is a common association locally where *Dictyopteris polypodioides* may also occur accompanied by a variety of subdominants, including: *Cystosiera* cf. *squarrosa* and *Cystoseira ercegovicii* (= *C. schiffneri* var *tenuiramosa*).

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From -1 m to -30 m vertical distance relative to sea level
Water temperature	16-20°C
Currents and water movements	Exposed shores and waters subject to high dynamism

Salinity	37-39%
Seabed composition	Hard rocky substrata
Mapped locations	None
Key recognition features	Presence of the brown alga *D. polypodioides* on exposed shores.
Habitat sensitivity	Hydrocarbon pollution.

Key References

Borg and Schembri (2002); ICRAM (2005).

A3.23G Association with [Calpomenia sinuosa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.22
RAC/SPA Name	Association with *Calpomenia sinuosa*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by the brown alga *Colpomenia sinuosa*. The association has been recorded from several locations around the Matese Islands but is not frequent and has not been well studied.

Key References

Borg and Schembri (2002); ICRAM (2005).

A3.23H Association with [Rhodymenia ardissonei] and [Rhodophyllis divaricata] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.30
RAC/SPA Name	Association with *Rhodymenia ardissonei* and *Rhodophyllis divaricata*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Rhodymenia ardissonei is found in the Maltese Islands but does not occur in abundance in the assemblages it forms part of. *Rhodophyllis divaricata* has not been recorded locally.

Additional Notes

The EUNIS description of this association is not applicable in the Maltese Islands since *R. divaricata* has not been recorded locally.

Key References

Borg and Schembri (2002); ICRAM (2005); E. Lanfranco (pers. com. 2013).

A3.23I Facies with [Astroides calycularis] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.31
RAC/SPA Name	Facies with *Astroides calycularis*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This biocoenosis is characterised by the madreporian *Astroides calycularis* and in the Maltese Islands is common on rock in shady situations from the uppermost infralittoral to depths of ca 40 m, although coverage is greatest at shallower depths. This biocoenosis is characteristic of overhangs, vertical rock faces and the mouth of caves and tunnels, as well as the sides of the larger boulders in boulder fields.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From -1 m to -40 m vertical distance relative to sea level
Water temperature	15-20°C
Currents and water movements	Moderately exposed shores

Salinity	37-39%
Seabed composition	Hard rocky substrata, especially common below overhangs when present in shallow waters (0 m – 10 m), on vertical rock faces, at the mouth of caves and tunnels and on the sides of large boulders.
Mapped locations	None
Key recognition features	The azooxanthellate scleractinian coral *A. calycularis* is easily recognizable by its round, encrusting, orange coloured colonies.
Habitat sensitivity	Sensitive to high levels of sedimentation and pollution by sewage and hydrocarbons.

Key References

Borg and Schembri (2002); ICRAM (2005).

A3.23J Facies with [Flabellia petiolata] and [Peyssonnelia squamaria] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.32
RAC/SPA Name	Association with *Flabellia petiolata* and *Peyssonnelia squamaria*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by a mixed cover of the green alga *Flabellia petiolata* and the red alga *Peyssonnelia squamaria* and is typical of semi-sciaphilous (shady) hard bottoms. In the Maltese Islands the typical association of a mixed cover of *Flabellia petiolata* and *Peysonnelia squamaria* is common in a variety of shady situations: on strongly sloping rocky seabeds or the vertical faces of drop-offs at water depths exceeding 25m, or in shallower waters in situations receiving diminished light, for example, below overhangs. In many cases, other sciaphilic species of algae are present in varying abundances and such species may co-dominate with *Flabellia petiolata* and *Peysonnelia squamaria*.

On rocky slopes at depths exceeding 15m, these accompanying species include: *Codium bursa*, *Halimeda tuna*, *Lithophyllum* spp. and *Pseudolithophyllum* sp.; facies with *Padina pavonica*, and with the alien *Caulerpa racemosa* also occur.

On the sides of the massive boulders forming boulder fields at the foot of submarine rock faces, the association of *Flabellia petiolata* and *Peysonnelia squamaria* may also include other species of *Peyssonnelia* as well as *Zonaria tournefortii*, *Halopteris scoparia*, encrusting corallines and sponges.

At the entrance of submarine caves, the association of *Flabellia petiolata* and *Peysonnelia squamaria* includes also *Zonaria tournefortii*, *Lithophyllum fronduosum*, other encrusting corallines, and sponges.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From -5 m to -60 m vertical distance relative to sea level
Water temperature	Various
Currents and water movements	Moderately exposed shores
Salinity	Various
Seabed composition	Hard rocky substrata; strongly sloping seabeds, vertical faces of drop-offs, below overhangs, at entrance of caves, on sides of large boulders.

Mapped locations	None
Key recognition features	Mixed cover of the green alga *F. petiolata* and the red alga *P. squamarina* on semi-shaded hard bottoms.
Significant associated species	Variable depending on depth and precise nature of rocky bottom (see detailed description above and additional note below).
Habitat sensitivity	Sewage pollution, increased sedimentation, invasive alien species (*Caulerpa racemosa* in particular).

Additional Notes

Any one of the sciaphilic algal species listed above, or several together, may dominate or co-dominate this sciaphilic assemblage resulting in different facies, which may be formally designated at Level 6 if necessary. An association dominated by *Peysonnelia squamaria* with very little, or even no *Flabellia petiolata*, also occurs. This too may be designated at Level 6 if necessary.

Key References

Borg and Schembri (2002); ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A3.23K Facies with [Halymenia floresia] and [Halarachnion ligatum] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.33
RAC/SPA Name	Association with *Halymenia floresia* and *Halarachnion ligulatum*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Halymenia floresia occurs locally but while it is not a rare species, it does not dominate the assemblages if forms part of. *Halarachnion ligatatum* has not been recorded from the Maltese Islands.

Additional Notes

The EUNIS description of this association is not applicable in the Maltese Islands since *H. ligatum* has not been recorded locally.

Key References

Borg and Schembri (2002); ICRAM (2005); E. Lanfranco (pers. com. 2013).

A3.23L Association with [Peyssonnelia rubra] and [Peyssonnelia] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.34
RAC/SPA Name	Association with *Peyssonnelia rubra* and *Peyssonnelia* spp.
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by a mixed cover of the red algae *Peyssonnelia rubra* and other members of the genus *Peyssonnelia* and is typical of semi-sciaphilous (shady) hard bottoms. This association occurs in some localities as patches of limited area on hard substrata in shady places. Locally the species of *Peyssonnelia* that characterise this association may be accompanied by a variety of subdominants, including: *Flabellia petiolata*, *Halimeda tuna* and *Pseudolithophyllum* spp.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From -5 m to -60 m vertical distance relative to sea level
Water temperature	Various
Currents and water movements	Moderately exposed shores
Salinity	Various
Seabed composition	Hard rocky substrata
Mapped locations	None
Key recognition features	Presence of *Peyssonnelia* spp. and accompanying species on shady hard bottoms
Habitat sensitivity	Sewage pollution, agricultural run-off and hydrocarbon pollution. However, some *Peyssonellia* spp. occur in polluted harbours and creeks

Key References

Borg and Schembri (2002); ICRAM (2005); Borg and Schembri (unpubl. data 2013).

NEW Association with [Peyssonnelia sp. / spp.] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest RAC/SPA entries are III.6.1.32, III.6.1.34 and IV.2.2.3
RAC/SPA Name	None; the closest RAC/SPA entries are 'Association with *Flabellia petiolata* and *Peyssonnelia squamarina*'; 'Association with

	Peyssonnelia rubra and *Peyssonnelia* spp.'; 'Association with *Peyssonnelia rosa-marina*'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Associations on hard substrata in shady situations dominated by species of *Peysonnelia* other than *Peyssonnelia squamaria* and *Peyssonnelia rubra*.

The EUNIS list presently includes three associations characterised by species of *Peyssonnelia*, as follows:

A3.23J Association with [Flabellia petiolata] and [Peyssonnelia squamaria]
This association is characterised by a mixed cover of the green alga *Flabellia petiolata* and the red alga *Peyssonnelia squamaria* and is typical of semi-sciaphilous (shady) hard bottoms.

A3.23L Association with [Peyssonnelia rubra] and [Peyssonnelia] spp.
This association is characterised by a mixed cover of the red algae *Peyssonnelia rubra* and other members of the genus *Peyssonnelia* and is typical of semi-sciaphilous (shady) hard bottoms.

A5.52H Association with [Peyssonnelia rosa-marina]
This association on coastal detritic bottoms is characterised by an abundance of the red alga *Peyssonnelia rosa-marina*.

All three associations are present in the Maltese Islands and are considered in the present manual. The last named (A5.52H) is an association of sedimentary bottoms (the 'coastal detritic'), however associations dominated by *Peyssonnelia rosa-marina* also occur in some localities as patches of limited extent on hard substrata, typically the vertical faces of drop-offs, where there is partial shading.

In addition, a number of species of *Peysonnelia* other than *Peyssonnelia squamaria*, *Peyssonnelia rubra* and *Peyssonnelia rosa-marina* are known to occur in the Maltese Islands; these include: *P. armorica, P. bornetii, P. crispata, P. dubyi, P. harveyana*, and *P. inamoena.* Most of the local

species of *Peyssonnelia* cannot be distinguished on gross morphology alone and therefore it may not be possible to distinguish between assemblages dominated by different species of *Peyssonnelia* or even more than one co-occurring species. Some *Peyssonellia* spp. also occur in polluted harbours and creeks. To accommodate these associations of hard substrata dominated by *Peysonnelia rosa-marina* or other species of the same genus apart from *Peyssonnelia squamaria* and *Peyssonnelia rubra*, the present new 'Association with *Peysonnelia* sp./spp.' is proposed.

Key References

Borg and Schembri (2002); Borg and Schembri (unpubl. data 2013).

NEW Association with [Dictyota spp.] and [Halimeda tuna] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.6.1
RAC/SPA Name	None; the closest higher level RAC/SPA entry is 'Biocenosis of infralittoral algae'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Associations of *Dictyota dichotomoa* and *Dictyota* spp. with *Halimeda tuna* occur on hard substrata in polluted ports and harbours.

Key References

Borg and Schembri (2002); Borg and Schembri (unpubl. data 2013).

NEW Association with [Cladophora prolifera] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.6.1
RAC/SPA Name	None; the closest higher level RAC/SPA entry is 'Biocenosis of infralittoral algae'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Cladophora prolifera associations are found in shallow parts of polluted and mildly polluted ports and harbours.

Key References

Borg and Schembri (2002); Templado et al. (2012); Borg and Schembri (unpubl. data 2013).

NEW Association with [Padina pavonica] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.6.1
RAC/SPA Name	None; the closest higher level RAC/SPA entry is 'Biocenosis of infralittoral algae'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a

Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Associations of *Padina pavonica* found on rocky substrata of sheltered and moderately exposed coastal areas, in clear, well illuminated waters.

Key References

Borg and Schembri (2002); Templado et al. (2012); Borg and Schembri (unpubl. data 2013).

NEW Association with [Acetabularia acetabulum.] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.6.1
RAC/SPA Name	None; the closest higher level RAC/SPA entry is 'Biocenosis of infralittoral algae'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Associations on sheltered, well illuminated, hard substrata dominated by *Acetabularia acetabulum*.

Key References

Borg and Schembri (2002); Templado et al. (2012); Borg and Schembri (unpubl. data 2013).

NEW Association with [Cystoseira foeniculacea] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest RAC/SPA entries are: III.6.1.2, III.6.1.15, III.6.1.16, III.6.1.17, III.6.1.18, III.6.1.19, III.6.1.25
RAC/SPA Name	None; the closest RAC/SPA entries are: 'Association with *Cystoseira amentacea'*, 'Association with *Cystoseira brachycarpa'*, 'Association with *Cystoseira crinita'*, 'Association with *Cystoseira crinitophylla'*, 'Association with *Cystoseira sauvageauana*', 'Association with *Cystoseira spinosa*', 'Association with *Cystoseira compressa*'.
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Associations on sheltered, well illuminated, hard substrata dominated by *Cystoseira foeniculacea* v. *tenuiramosa*.

Key References

Borg and Schembri (2002); Templado et al. (2012); Borg and Schembri (unpubl. data 2013).

NEW Association with [Zonaria tournefortii] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.6.1

RAC/SPA Name	None; the closest higher level RAC/SPA entry is ‘Biocenosis of infralittoral algae’
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Associations of *Zonaria tournefortii* are found in shallow waters (5 m – 20 m) at the entrance to caves, and in deep waters (55 m – 80 m) on accumulations of stones and pebbles.

Key References

Borg and Schembri (2002); Templado et al. (2012); Borg and Schembri (unpubl. data 2013).

NEW Association with [Halimeda tuna.] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.6.1
RAC/SPA Name	None; the closest higher level RAC/SPA entry is ‘Biocenosis of infralittoral algae’
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a

MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Associations of *Halimeda tuna* are found on infralittoral rocky substrata in dimly lit environments, and in polluted ports and harbours.

Key References

Borg and Schembri (2002); Templado et al. (2012); Borg and Schembri (unpubl. data 2013).

NEW Association with algal turf (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.6.1
RAC/SPA Name	None; the closest higher level RAC/SPA entry is 'Biocenosis of infralittoral algae'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Association composed of filamentous algae <3cm tall, but not forming a crust, on rocky bottoms; typical species include *Cladophora* spp., *Polysiphonia* spp., *Chondria* spp.

Key References

Pirotta and Schembri (2000); Borg and Schembri (unpubl. data 2013).

NEW Association with [Caulerpa racemosa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.6.1
RAC/SPA Name	None; the closest higher level RAC/SPA entry is 'Biocenosis of infralittoral algae'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Caulerpa racemosa grows on all types of bottom including vertical drop-offs and horizontal rocky bottoms within a wide depth range (0 m – 60 m).

Key References

Borg and Schembri (2002); Borg and Schembri (unpubl. data 2013).

A3.3 Atlantic and Mediterranean low energy infralittoral rock (EUNIS Level 3)

A3.33 Mediterranean submerged fucoids, green or red seaweeds on full salinity infralittoral rock (EUNIS Level 4)

A3.331 Association with [Stypocaulon scoparium] (=[Halopteris scoparia] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.23
RAC/SPA Name	Association with *Stypocaulon scoparium* (= *Halopteris scoparia*)
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by the brown alga *Stypocaulon scoparium* (recorded in the Maltese literature as *Halopteris scoparia*), living in clean, sheltered waters with strong luminosity. Associations dominated by *Stypocaulon scoparium* occur from the mediolittoral/infralittoral fringe to waters ca 20 m deep. Frequently, this species co-dominates with other photophilic algae. In shallow water these include: *Corallina elongata*, *Jania rubens*, *Padina pavonica*, *Enteromorpha linza* and *Cystoseira compressa* in the uppermost reaches of the infralittoral, and *Dilophus* sp., *Dictyopteris polypodiodes* and *Cystoseira* spp, at depths greater than 2 m. In deeper waters it co-occurs with *Halopteris filicina*, species of *Cystoseira*, *Dictyopteris polypodiodes*, *Amphiroa rigida*, *Dictyota* spp., *Sargassum vulgare*, *Codium bursa* and *Halimeda tuna*. *Stypocaulon scoparium* also occurs as a minor component in photophilic assemblages dominated by other species.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From -1 m to -20 m vertical distance relative to sea level
Water temperature	Various
Currents and water movements	Sheltered shores
Salinity	Various

Seabed composition	Hard rocky substrata
Mapped locations	None
Key recognition features	Presence of characteristic dark brown, fluffy clumps of *S. scoparium* (branches are fan-shaped when flat but cone shaped underwater due to numerous delicate filamentous branches). Easily recognizable.
Habitat sensitivity	Association is sensitive to water pollution e.g. from sewage and hydrocarbons, and agricultural run-off.

Key References

Borg and Schembri (2002); ICRAM (2005); Borg and Schembri (unpubl. data 2013).

NEW Association with [Stylocaulon scoparium] and [Padina pavonica] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest RAC/SPA entry is III.6.1.23
RAC/SPA Name	None; the closest RAC/SPA entry is '*Association with Stypocaulon scoparium*'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Association of the brown algae *Stylocaulon scoparium* and *Padina pavonica* (commonly known as 'peacock's tail alga') found from the shallow infralittoral to a depth of around 20 m.

Key References

Borg and Schembri (2002); Borg and Schembri (unpubl. data 2013).

A3.333 Association with [Cystoseira compressa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.25
RAC/SPA Name	Association with *Cystoseira compressa*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by the brown alga *Cystoseira compressa* and occurs in very shallow waters (0 – 1 m), sometimes with epiphytic *Jania rubens* and with *Corallina elongata* or *Padina pavonica* as sub-dominant. It also occurs in deeper water (3 - 5 m) where other species of *Cystoseira* may be sub-dominant (for example, *Cystoseira brachycarpa*). A considerable number of low-growing algae form part of these associations and intermix with the dominants; such undergrowth species include *Sargassum vulgare*, *Padina pavonica*, and *Halopteris* spp.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Upper infralittoral
Depth range	From -20 cm to -1 m vertical distance relative to sea level
Water temperature	14-20°C

Currents and water movements	Sheltered shores to moderately exposed shores
Salinity	36-39%
Seabed composition	Hard rocky substrata, often slightly sloping
Mapped locations	None
Key recognition features	Dense miniature 'forest' of olive-brown *C. compressa*; appearance of the branches may vary according to hydrodynamics and seasonally.
Habitat sensitivity	Sewage, desalinization and power station effluents although able to tolerate slight pollution. This association is listed as a priority habitat in the RAC/SPA classification system.

Key References

Borg and Schembri (2002); ICRAM (2005).

NEW Association with [Pterocladiella capillacea] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest RAC/SPA entry is III.6.1.26
RAC/SPA Name	None; the closest RAC/SPA entry is '*Association with Pterocladiella capillacea* and *Ulva laetevirens*.
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Association with *Pterocladiella capillacea* (recorded in the Maltese Islands as *Pterocladia capillacea*) found on shallow infralittoral rocks in polluted, turbid waters of exposed coasts.

Additional Notes

The EUNIS and RAC/SPA classification systems contain an association with *Pterocladiella capillacea* and *Ulva laetevirens*, but the two do not co-occur locally. Instead *P. capillacea* is found on exposed coasts and *U. laetevirens* on sheltered shores.

Key References

Borg and Schembri (2002); Templado et al. (2012); Borg and Schembri (unpubl. data 2013).

NEW Association with [Ulva laetevirens] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest RAC/SPA entry is III.6.1.26
RAC/SPA Name	None; the closest RAC/SPA entry is '*Association with Pterocladiella capillacea* and *Ulva laetevirens*.
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Association with *Ulva laetevirens*, which is dominant in the uppermost infralittoral zone of some sheltered rocky shores. The association is found in polluted, turbid waters, typically in ports and harbours where it co-occurs with *Ulva (= Enteromorpha) linza.*

Additional Notes

The EUNIS and RAC/SPA classification systems contain an association with *Pterocladiella capillacea* and *Ulva laetevirens*, but the two do not co-occur locally. Instead *P. capillacea* is found on exposed coasts and *U. laetevirens* on sheltered shores.

Key References

Borg and Schembri (2002); Templado et al. (2012); Borg and Schembri (unpubl. data 2013).

A3.335 Facies with large Hydrozoa (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.27
RAC/SPA Name	Facies with large Hydrozoa
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This biocoenosis is characterised by a high abundance of large Hydrozoa (e.g. *Aglaophenia* spp. and *Eudendrium* spp.). Species of *Aglaophenia* occur locally on rocky substrata in patches amongst assemblages of photophilic algae and on shaded, vertical submarine drop-offs in clean waters at a depth of 1-2 m and on the submerged wall of emergent caves. These large hydroids also occur as part of the fouling community on natural and anthropogenic floating objects, such as buoys, including in polluted creeks and inlets. Locally, species of *Eudendrium* have been recorded from wrecks and dumped material.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From -1 m to -5 m vertical distance relative to sea level
Water temperature	14-20°C
Currents and water movements	Sheltered and moderately exposed coastal areas
Salinity	37-39%
Seabed composition	Rocky substrata; floating objects (e.g. buoys)
Mapped locations	None
Key recognition features	Patches of large benthic colonial hydrozoa of the genus *Aglaophenia*, which have a distinctive pinnate growth form, and the genus *Eudendrium* which have an irregularly branched tree-like appearance.
Habitat sensitivity	Depending on the species: chemical pollution; light pollution of littoral caves. Listed as priority habitat in RAC/SPA classification system.

Key References

Borg and Schembri (2002); ICRAM (2005).

A3.336 Association with [Pterothamnion crispum] and [Compsothamnion thuyoides (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.6.1.28

RAC/SPA Name	Association with *Pterothamnion crispum* and *Compsothamnion thuyoides*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by a mixed cover of the red algae *Pterothamnion crispum* and *Compsothamnion thuyoides*. These two species have not been recorded from the Maltese Islands, however, they may occur since they belong to difficult taxonomic groups that have not been well studied locally. Therefore, this sciaphilic association may or may not occur locally.

Key References

Borg and Schembri (2002); ICRAM (2005); E. Lanfranco (pers. com. 2013).

A5 Sublittoral sediment (EUNIS Level 2)

A5.1 Sublittoral coarse sediment (EUNIS Level 3)

A5.13 Infralittoral coarse sediment (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	III.3.1, III.3.2, III.4.1[2]
RAC/SPA Name	Biocenosis of coarse sands and fine gravels mixed by waves; Biocenosis of coarse sands and fine gravels under the influence of bottom currents; Biocenosis of infralittoral stones and pebbles
RAC/SPA to EUNIS	<

[2] The RAC/SPA category III.3.3, 'Biocenosis of coarse sands and muddy heterogeneous sediment' as lited in Borg and Schembri 2002 no longer exists in the updated RAC/SPA manual and has thus not been included here.

Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral coarse sediment

Description

Infralittoral coarse sediments such as coarse sand, gravelly sand, shingle and gavel found on moderately exposed coasts subject to disturbance by wave action. Locally coarse sands mixed by waves and/or under the influence of bottom currents occupy extensive areas of bottom in deeper waters. The habitat may also occur in shallower waters as pockets or patches under and in between boulders, at the foot of drop-offs or as 'fill' in canals, trenches and large depressions on the seabed. Infralittoral stones and pebbles are a less common habitat locally.

Additional Notes

Locally the biocoenosis of stones and pebbles may include enclaves with fine sands or with patches of photophilic algae on bedrock and/or boulders

Key References

Borg and Schembri (2002); Connor et al. (2004).

NEW Association with [Spatangus purpureus] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.3.2[3]
RAC/SPA Name	None; the closest higher level RAC/SPA entry is 'Biocenosis of coarse sands and fine gravels under the influence of bottom currents'

[3] Classified under RAC/SPA entry III.3.3, 'Biocenosis of coarse sands and muddy heterogeneous sediment' in Borg and Schembri 2002. This category no longer exists in the updated RAC/SPA manual but would have been a better description of the biocoenosis where this facies occurs.

RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral coarse sediment

Description

Associations with *Spatangus purpureus* found on infralittoral muddy sands and gravels.

Additional Notes

This association is also found in the circalittoral.

Key References

Borg and Schembri (2002); Templado et al. (2012); Borg and Schembri (unpubl. data 2013).

NEW Association with [Cymodocea nodosa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.3.2
RAC/SPA Name	None; the closest higher level RAC/SPA entry is 'Biocenosis of coarse sands and fine gravels under the influence of bottom currents'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a

MSFD Classification	Shallow sublittoral coarse sediment

Description

Deep-water *Cymodocea nodosa* assemblages found on muddy coarse sands and fine gravels. This habitat is usually found at depths >30 m.

Key References

Borg and Schembri (2002); Templado et al. (2012); Borg and Schembri (unpubl. data 2013).

NEW Association with [Caulerpa racemosa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.3.2
RAC/SPA Name	None; the closest higher level RAC/SPA entry is 'Biocenosis of coarse sands and fine gravels under the influence of bottom currents'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral coarse sediment

Description

Associations of *Caulerpa racemosa* found on coarse sediments in the infralittoral zone.

Additional Notes

This association is also found in the circalittoral.

Key References

Borg and Schembri (2002); Templado et al. (2012); Borg and Schembri (unpubl. data 2013).

A5.139 Association with [Gouania wildenowi] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.4.1.1
RAC/SPA Name	Association with *Gouania wildenowi*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral coarse sediment

Description

This association is characterised by the clingfish *Gouania wildenowi*. Locally, shallow water pebble and cobble beds are known to host species of clingfish; however the species have yet to be identified. *G. wildenowi* occurs locally so it is likely that this association occurs.

Key References

Borg and Schembri (2002); ICRAM (2005).

A5.2 Sublittoral sand (EUNIS Level 3)

A5.23 Infralittoral fine sand (EUNIS Level 4)

A5.235 Mediterranean communities of fine sands in very shallow waters (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.2.1
RAC/SPA Name	Biocenosis of fine sands in very shallow waters
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral sand

Description

Fine sands usually characterised by a homogenous granulometry and of terrigenous origin, which occur in shallow waters. Surficial macroscopic epibiota do not occur.

Key References

Borg and Schembri (2002); ICRAM (2005).

A5.2351 Facies with [Lentidium mediterraneum] (EUNIS Level 6)

Habitat Classification

RAC/SPA Code	III.2.1.1
RAC/SPA Name	Facies with *Lentidium mediterraneaum*

RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral sand

Description

Association with the tellinid bivalve *Lentidium mediterraneum* found in the shallow infralittoral zone. This tellinid bivalve does occur locally but unlike elsewhere in the Mediterranean, it is very rare in the Maltese Islands.

Key References

Borg and Schembri (2002); ICRAM (2005).

A5.236 Mediterranean communities of well sorted fine sands (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.2.2
RAC/SPA Name	Biocenosis of well-sorted fine sands
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral sand

Description

Communities of well sorted fine sands occur and are widespread locally.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From 0 m to -5 m vertical distance relative to sea level
Water temperature	10-26°C
Currents and water movements	Exposed to wave action in shallow waters; exposure decreases with depth
Salinity	35-37%
Seabed composition	Well sorted fine sands
Mapped locations	None
Key recognition features	Generally this habitat lacks algae and phanerogams; bivalves dominate.
Habitat sensitivity	Alteration of natural currents through beach nourishment and coastal construction works; sewage pollution.

Additional Notes

The biocoenosis of well-sorted fine sands may also include enclaves with patches of *Posidonia oceanica* and/or patches of photophilic algae on bedrock and/or boulders.

Key References

Borg and Schembri (2002); ICRAM (2005).

A5.28 Mediterranean communities of superficial muddy sands in sheltered waters (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	III.2.3
RAC/SPA Name	Biocenosis of superficial muddy sands in sheltered waters
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral mixed sediment

Description

Habitats found in shallow sheltered environments, where the substratum is dominated by muddy sands. Epiflora, filter-feeding species and burrowing species can be found in such habitats.

Additional Notes

We interpret the descriptor "superficially muddy sand" to mean that the superficial layer of sediment consists of muddy sand, irrespective of what the subsurface sediment is.

Key References

Borg and Schembri (2002); ICRAM (2005).

NEW Communities of superficially muddy sands with thalassinid shrimps (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest RAC/SPA entry is III.2.3.1

RAC/SPA Name	None; the closest RAC/SPA entry is 'Facies with *Callianassa tyrrhena and Kellia corbuloides'*
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral coarse sediment

Description

Assemblages with *Callianassa truncata* and other species of thalassinid shrimps burrowing in soft sublittoral sediment. Thalassinid burrows, mostly belonging to *Upogebia* spp., occur in places where Upper Globigerina Limestone or Blue Clay is submerged, or where muddy sediment accumulates.

Additional Notes

A similar EUNIS entry exists: A5.281, 'Facies with [Callianassa tyrrhena] and [Kellia corbuloides], however neither species has been recorded locally.

Key References

Borg and Schembri (2002); Templado et al. (2012); Borg and Schembri (unpubl. data 2013).

NEW Association of sediment subject to reducted or fluctuating salinity with [Cerastoderma glaucum]

Habitat Classification

RAC/SPA Code	None; the closest RAC/SPA entry is III.2.3.2
RAC/SPA Name	None; the closest RAC/SPA entry is 'Facies with freshwater resurgences with *Cerastoderma glaucum* and *Cyathura carinata*'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a

Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral mixed sediment

Description

An association of *Cerastoderma glaucum* occurs in lagoonal conditions characterised by fluctuating salinity, usually due to freshwater input at some time of the year.

Additional Notes

The closest EUNIS entries to this association are A5.21 'Sublittoral sand in low or reduced salinity', A5.41 'Sublittoral mixed sediment in low or reduced salinity' and A5.282 'Facies with fresh water resurgences with [Cerastoderma glaucum] and [Cyathura carinata]; to date, *Cyathura carinata* has not been recorded in the Maltese Islands.

Key References

Borg and Schembri (2002); ICRAM (2005).

A5.283 Facies with [Loripes lacteus], [Tapes] spp. (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.2.3.3
RAC/SPA Name	Facies with *Loripes lacteus* and *Ruditapes* spp.
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral mixed sediment

Description

The bivalve molluscs *Loripes lacteus* and *Tapes decussatus* occur in bays and harbours with muddy sand.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From 0 to -4 m vertical distance relative to sea level
Water temperature	10-26°C
Currents and water movements	Sheltered environments
Salinity	30-37%
Seabed composition	Fine muddy sands
Mapped locations	None
Key recognition features	This facies is made up of two characteristic and abundant bivalves, *L. lacteus* and *T. decussates*, often found together with a rich mobile epifauna of gastropods, decapod crustaceans and echinoderms. Easily recognisable.
Habitat sensitivity	This habitat is sensitive to a number of disturbances, including trampling, harvesting of associated fauna as bait for recreational fisheries, smothering due to excessive amounts of sedimentation, dredging and pollution. Listed as priority habitat in RAC/SPA classification system.

Key References

Borg and Schembri (2002); ICRAM (2005).

A5.284 Association with [Caulerpa prolifera] on superficial muddy sands in sheltered waters (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.2.3.6
RAC/SPA Name	Association with *Caulerpa prolifera* on superficially muddy sands in sheltered waters
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral mixed sediment

Description

This association is not common. It occurs mostly at the head of bays and inlets receiving considerable inputs of terrestrial sediments following rainfall, and in shallow waters in polluted harbours.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From 0m to -4 m vertical distance relative to sea level
Water temperature	15-26°C
Currents and water movements	Sheltered shores
Salinity	Various
Seabed composition	Superficial muddy sands

Mapped locations	None
Key recognition features	Presence of the green alga *Caulerpa prolifera* in sheltered, sometimes rather turbid waters.
Habitat sensitivity	Association is resistant to considerable amounts of terrestrial sedimentation and pollution.

Key References

Borg and Schembri (2002); ICRAM (2005).

NEW Community of superficially muddy sands with [Caulerpa racemosa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest RAC/SPA entry is III.2.3.6
RAC/SPA Name	None; the closest RAC/SPA entry is 'Association with *Caulerpa prolifera* on superficially muddy sands in sheltered waters'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral mixed sediment

Description

Facies with the green alga *Caulerpa racemosa* found on superficially muddy sands in the infralittoral zone of sheltered shores.

Key References

Borg and Schembri (2002).

NEW Community of superficially muddy sands with [Diogenes pugliator] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.2.3
RAC/SPA Name	None; the closest higher level RAC/SPA entry is 'Biocenosis of superficial muddy sands in sheltered waters'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral mixed sediment

Description

Facies with the small hermit crab *Diogenes pugliator* found on superficially muddy sands in the infralittoral zone of sheltered shores, especially at the head of bays and inlets.

Key References

Borg and Schembri (2002).

A5.5 Sublittoral macrophyte-dominated sediment (EUNIS Level 3)

A5.51 Maerl beds (EUNIS Level 4)

A5.515 Association with rhodolithes[4] in coarse sands and fine gravels under the influence of bottom currents (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.3.2.2
RAC/SPA Name	Association with rhodoliths
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral mixed sediment

Description

The difference between a rhodolith bed and a maerl bottom is the proportion of rhodoliths covering the bottom, being dense and carpeting the bottom with interlocking rhodoliths in 'maerl beds', and sparse and only forming local accumulations or being dispersed as single rhodoliths amongst other sediment components in 'rhodolith bottoms'. Apart from the same rhodolith-forming species listed for 'maerl beds', a variety of other species completely coat coarse sediment granules to form 'cored rhodoliths'; these include: *Lithophyllum incrustans*, *Lithothamnion valens*, *Mesophyllum alternans* and *Sporolithon ptychoides*.

Characteristic Physical and Chemical Features

[4] Official EUNIS name is provided; the correct term is 'rhodoliths'.

Aspect	Main Identification Criteria
Zone	Lower infralittoral, circalittoral
Depth range	From -20 m to -100 m vertical distance relative to sea level
Water temperature	14-16℃
Currents and water movements	Exposed to moderate bottom currents
Salinity	37-39%
Seabed composition	Coarse sands and fine gravels
Mapped locations	None.
Key recognition features	Sediment where rhodoliths are sparse but occur; rhodoliths may form small local accumulations due to current movements. Easily recognisable.
Habitat sensitivity	Changes in sedimentation regime due to coastal development; bottom trawl fisheries; mariculture activities.

Additional Notes

A distinction needs to be made between maerl beds (where the rhodoliths dominate the bottom, EUNIS A5.513 above) and sediment with rhodoliths (where the rhodoliths are sparse; the association being considered here); the two types grade into one another.

Rhodolith associations occur transitionally between the lower infralittoral and the upper circalittoral and as such this habitat may be found in both zones.

Key References

Lanfranco et al. (1999); Borg and Schembri (2002); Connor et al. (2004); Sciberras et al. (2009).

A5.52 Kelp and seaweed communities on sublittoral sediment (EUNIS Level 4)

A5.52A Association with [Gracilaria spp.] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.1.1.5
RAC/SPA Name	Association with *Gracilaria* spp.
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral mixed sediment

Description

Association characterised by red algae *Gracilaria* spp.; association may or may not occur locally. This association may occur where the sediment has hard inclusions (cobbles or pebbles or stones) to which the dominant alga may attach.

Additional Notes

Gracilaria mediterranea occurs locally, although typically on hard substrata; this species has not been recorded as an association on sublittoral sediments.

Key References

Cormaci et al. (1997); Borg and Schembri (2002); ICRAM (2005).

A5.52D Association with [Ulva laetevirens] and [Enteromorpha linza] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.1.1.9
RAC/SPA Name	Association with *Ulva laetevirens* and *Enteromorpha linza*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral mixed sediment

Description

Associations with the green algae *Ulva laetevirens* and *Ulva linza* (ex *Enteromorpha linza*) growing in the infralittoral zone. *Ulva laetevirens* does not usually form an association on soft sediments unless coarse material (cobbles and pebbles) is present, in which case the alga establishes itself and forms an association. Locally this association is only observed in shallow waters (< 5 m) in polluted ports and harbours, hence sheltered conditions, where the coarse sediments are not disturbed frequently by water movement.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From surface to -5 m vertical distance relative to sea level
Water temperature	10-26°C
Currents and water movements	Sheltered shores
Salinity	Various
Seabed composition	Coarse materials (pebbles, cobbles)

Mapped locations	None.
Key recognition features	Presence of green algae *Ulva laetevirens* and *Ulva linza* in embayments, polluted ports and harbours.
Habitat sensitivity	Limited, association is able to tolerate polluted conditions and variations in salinity

Key References

Borg and Schembri (2002); ICRAM (2005).

A5.53 Sublittoral seagrass beds (EUNIS Level 4)

A5.531 [Cymodocea] beds (EUNIS Level 5)

A5.5313 Mediterranean [Cymodocea] beds (EUNIS Level 6)

A5.53131 Association with [Cymodocea nodosa] on well sorted fine sands (EUNIS Level 7)

Habitat Classification

RAC/SPA Code	III.2.2.1
RAC/SPA Name	Association with *Cymodocea nodosa* on well-sorted fine sands
RAC/SPA to EUNIS	=
Habitats Directive Code	1110*
Habitats Directive Name	Sandbanks which are slightly covered by sea water all the time*
Habitats Directive to EUNIS	>
MSFD Classification	Shallow sublittoral sand

***** *Cymodocea nodosa* may be found on sandbanks, however on many sandbanks macrophytes do not occur.

Description

Associations with the seagrass *Cymodocea nodosa* occur throughout the infralittoral from very shallow depths of less than 1 m down to about 45-48 m. The association may occur as a dense meadow or very sparsely; although usually the leaves are rather short they may grow to about 20-30 cm high in shallow waters. *Cymodocea nodosa* may occur as almost monospecific stands or in association with other seagrasses (*Posidonia oceanica* and *Halophila stipulacea*) and/or macroalgae (for example, *Caulerpa racemosa* or *Caulerpa prolifera*).

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From -0.5 m to -50 m vertical distance relative to sea level
Water temperature	10-26°C
Currents and water movements	Exposure to waves in shallow areas which diminishes as depth increases
Salinity	35-37%
Seabed composition	Well-sorted fine sand
Mapped locations	None
Key recognition features	Presence of seagrass *Cymodocea nodosa* in monospecific stands or in association with other seagrasses or macroalgae.
Habitat sensitivity	Pollution from hydrocarbonsexcessive sedimentation, and anchoring

Key References

Borg and Schembri (2002); ICRAM (2005)

A5.53132 Association with [Cymodocea nodosa] on superficial muddy sands in sheltered waters (EUNIS Level 7)

Habitat Classification

RAC/SPA Code	III.2.3.4
RAC/SPA Name	Association with *Cymodocea nodosa* on superficially muddy sands in sheltered waters
RAC/SPA to EUNIS	=
Habitats Directive Code	1110*
Habitats Directive Name	Sandbanks which are slightly covered by sea water all the time*
Habitats Directive to EUNIS	>
MSFD Classification	Shallow sublittoral mixed sediment

***** *Cymodocea nodosa* may be found on sandbanks, however on many sandbanks macrophytes do not occur.

Description

Meadows of *Cymodocea nodosa* are most extensive in shallow waters (0 m – 10 m) at the head of local bays and inlets on sandy bottoms, including ones where the sand includes a proportion of mud. In such places, the seagrass grows to a considerable length, while the horizontal rhizomes interlace extensively producing a thin 'matte' that may sometimes be up to 10-15 cm high but is usually completely buried in the sediment. This 'matte', as well as individual shoots of the seagrass, are easily ripped off by moderate wave action during storms. The associated algae may include *Caulerpa racemosa*, *Caulerpa prolifera* and *Halophila stipulacea*. This association can also occur in creeks where the turbidity is high and there is some organic pollution.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral

Depth range	From 0 m to -10 m vertical distance relative to sea level
Water temperature	10-26°C
Currents and water movements	Exposure to waves in shallow areas which diminishes as depth increases
Salinity	35-37%
Seabed composition	Superficially muddy sands
Mapped locations	None
Key recognition features	Meadows of the seagrass *Cymodocea nodosa* in shallow waters at the head of local bays and inlets on sandy bottoms. Asociated algae may include *Caulerpa racemosa*, *Caulerpa prolifera* and *Halophila stipulacea*
Habitat sensitivity	Hydrocarbon pollution, excessive sedimentation, and anchoring

Key References

Borg and Schembri (2002); ICRAM (2005).

A5.532 [Halophila] beds (EUNIS Level 5)

A5.5322 Mediterranean [Halophila] beds (EUNIS Level 6)

Habitat Classification

RAC/SPA Code	III.2.2.2
RAC/SPA Name	Association with *Halophila stipulacea*
RAC/SPA to EUNIS	<
Habitats Directive Code	n/a

Habitats Directive Name	n/a
Habitats Directive to EUNIS Relation	n/a
MSFD Classification	Shallow sublittoral sand

Description

This facies is characterised by the seagrass *Holophila stipulacea*, which lives on fine sandy bottoms. This species spread into the Mediterranean following the opening of the Suez Canal and is uncommon in the Maltese Islands. It does however occur in a few places and is found in a wide depth range (1-32 m), often in association with *Cymodocea nodosa* (see EUNIS A5.53131) and very rarely forms more or less monospecific stands.

Key References

Borg and Schembri (2002); ICRAM (2005).

NEW Facies of well-sorted fine sands with [Caulerpa racemosa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest RAC/SPA entry is III.2.3.6
RAC/SPA Name	None; the closest RAC/SPA entry is 'Association with *Caulerpa prolifera* on superficially muddy sands in sheltered waters'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral sand

Description

Facies with the green alga *Caulerpa racemosa* found on well-sorted fine sands in the infralittoral zone.

Additional Notes

Locally, the biocenosis of well-sorted fine sands may also include enclaves with patches of *Posidonia oceanica* and/or patches of photophilic algae on bedrock and/or boulders.

Key References

Borg and Schembri (2002).

A5.534 [Ruppia] and [Zannichellia] communities (EUNIS Level 5)

A5.534 Tethyan marine [Ruppia] communities (EUNIS Level 6)

Habitat Classification

RAC/SPA Code	III.1.1.1
RAC/SPA Name	Association with *Ruppia cirrhosa* and/or *Ruppia maritima*
RAC/SPA to EUNIS	#
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral mixed sediment

Description

This association occurs in lagoonal conditions characterised by fluctuating salinity and input of freshwater, but is uncommon. Both species occur locally, but *R. maritima* seems to be the dominant species in places where there is incursion of seawater whether through a canal or via wave action.

Key References

Devillers et al. (2001); Borg and Schembri (2002); S. Lanfranco (pers. com. 2013).

A5.535 [Posidonia] beds (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	III.5.1
RAC/SPA Name	Biocenosis of *Posidonia oceanica* meadows
RAC/SPA to EUNIS	=
Habitats Directive Code	1120
Habitats Directive Name	*Posidonia* beds (*Posidonion oceanicae*)
Habitats Directive to EUNIS Relation	=
MSFD Classification	Shallow sublittoral sand

Description

This assemblage is characterised by the presence of the marine seagrass *Posidonia oceanica*, which is endemic to the Mediterranean. *P. oceanica* is found on sandy sediments without a well developed matte and may be patchy, continuous or reticulate. If reticulate, the 'spaces' between the *Posidonia* clumps may be sediment of various types ranging from fine sand to pebbles, cobbles and small boulders, or mixed sediment. The sediment may be bare of arborescent macrophytes or may include rhodoliths and/or encrusting algae on pebbles, or may have substantial stands of arborescent macrophytes growing on the sediment or the larger grains of the sediment. In places where the *P. oceanica* meadows are of the patchy or reticulate type, the sandy seabed that has not been colonised by the seagrass may support stands of *Cymodocea nodosa*.

Such meadows are usually present in exposed coastal areas outside bays and inlets in water depths of between 5 m and 43 m.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral

Depth range	From -5 m to -43 m vertical distance relative to sea level
Temperature	14-20°C
Currents and water movements	Moderately exposed environment
Salinity	37-39%
Seabed composition	Coarse and medium sands.
Mapped locations	None
Key recognition features	Presence of the seagrass *Posidonia oceanica*; meadows may be patchy, continuous or reticulate.
Habitat sensitivity	Changes in sedimentation levels due to coastal developments, beach nourishment, dredging; trawl fishing; anchoring; water pollution (waste waters). Listed as priority habitat in RAC/SPA classification system.

Additional Notes

Where the alga growing on the sediment is *Caulerpa prolifera*, this is named as a separate association: EUNIS A5.5354, 'Association with [Caulerpa prolifera] on [Posidonia] beds'.

Key References

Borg and Schembri (2002); ICRAM (2005).

A5.5352 Ecomorphosis of 'barrier-reef' [Posidonia oceanica] meadows (EUNIS Level 6)

Habitat Classification

RAC/SPA Code	III.5.1.2
RAC/SPA Name	Ecomorphosis of 'barrier reef' meadows

RAC/SPA to EUNIS	=
Habitats Directive Code	1120
Habitats Directive Name	*Posidonia* beds (*Posidonion oceanicae*)
Habitats Directive to EUNIS Relation	=
MSFD Classification	Shallow sublittoral sand

Description

An ecomorphosis of 'barrier reef' meadows can be found in some sheltered bays. The vertical growth of the rhizomes raises the matte, thus eventually enabling the meadow to reach the water surface. Such *Posidonia* 'barrier reefs' are very rare locally. Extensive barrier reefs are only known from two sites: Mellieha and Salina Bays. *Posidonia* meadows with high matte walls (which are more common) probably function similarly to barrier reefs as far as stability of sand and coastal protection are concerned.

Additional Notes

Listed as priority habitat in RAC/SPA classification system.

Key References

Borg and Schembri (2002); ICRAM (2005).

A5.5353 Facies of dead 'mattes' of [Posidonia oceanica] without much epiflora (EUNIS Level 6)

Habitat Classification

RAC/SPA Code	III.5.1.3
RAC/SPA Name	Ecomorphosis of dead matte without much epiflora
RAC/SPA to EUNIS	=
Habitats Directive Code	1120

Habitats Directive Name	*Posidonia* beds (*Posidonion oceanicae*)
Habitats Directive to EUNIS Relation	=
MSFD Classification	Shallow sublittoral sand

Description

Patches with dead matte of *P. oceanica* occur in local bays and inlets, and may result from either natural or anthropogenic disturbance. Although sparse, the epifloral species present on the dead matte surface vary depending on the water quality of the area. For example, in clean waters, the colonising algae include *Padina pavonica* and filamentous red algae, while in polluted waters the dead matte may support *Caulerpa* spp. This ecomorphosis is common in the Maltese Islands.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From -0.5 cm to -40 m vertical distance relative to sea level
Temperature	14-20°C
Currents and water movements	Moderately exposed environment
Salinity	37-39%
Seabed composition	Coarse and medium sands.
Mapped locations	None
Key recognition features	This facies is easily recognisable by the presence of dead *P. oceanica* matte.
Habitat sensitivity	Limited since habitat is the result of natural or anthropogenic disturbances.

Key References

Borg and Schembri (2002); ICRAM (2005).

A5.5354 Association with [Caulerpa prolifera] on [Posidonia] beds (EUNIS Level 6)

Habitat Classification

RAC/SPA Code	III.5.1.4
RAC/SPA Name	Association with *Caulerpa prolifera*
RAC/SPA to EUNIS	=
Habitats Directive Code	1120
Habitats Directive Name	*Posidonia* beds (*Posidonion oceanicae*)
Habitats Directive to EUNIS Relation	>
MSFD Classification	Shallow sublittoral sand

Description

This association is characterised by the presence of the green alga *Caulerpa prolifera* within *Posidonia oceanica* meadows. Occurs where *P. oceanica* meadows are degraded, for example, at the head of some bays and inlets that are under considerable anthropogenic disturbance, and where some siltation is present, resulting in a decreased seagrass shoot density. This leads to colonisation by *Caulerpa prolifera* which grows on the matte (if present) or on the sediment in between the seagrass shoots. This association is common in the Maltese Islands.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Infralittoral
Depth range	From -0.5 cm to -40 m vertical distance relative to sea level
Temperature	14-20°C

Currents and water movements	Moderately exposed environment
Salinity	37-39%
Seabed composition	Coarse and medium sands.
Mapped locations	None
Key recognition features	Presence of the green alga *Caulerpa prolifera* in association with the *Posidonia oceanica* meadows characterised by low shoot densities.
Habitat sensitivity	Limited since the association is found in bays and inlets that are subject to considerable anthropogenic pressure and where siltation may be taking place.

Key References

Borg and Schembri (2002); ICRAM (2005).

NEW [Posidonia oceanica] meadows on matte (EUNIS Level 6)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.5.1
RAC/SPA Name	None; the closest higher level RAC/SPA entry is 'Biocenosis of *Posidonia oc*eanica meadows'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	1120
Habitats Directive Name	*Posidonia* beds (*Posidonion oceanicae*)
Habitats Directive to EUNIS Relation	=

MSFD Classification	Shallow sublittoral sand

Description

Posidonia oceanica occurs on matte, which may be several metres thick, to form patchy, reticulate or continuous meadows. Such meadows typically overlie a soft sediment seabed in bays and inlets where the water depth ranges between 1 m and 20 m. Where the underlying seabed comprises soft sediments and the seagrass beds are of the reticulate type, 'intermatte' channels may be present, where the bottom comprises soft sediments, typically coarse sands. In places, the intermatte channels support stands of *Cymodocea nodosa*.

Key References

Borg and Schembri (2002).

NEW Biocenosis of [Posidonia oceanica] on rock (EUNIS Level 6)

Habitat Classification

RAC/SPA Code	None; the closest higher level RAC/SPA entry is III.5.1
RAC/SPA Name	None; the closest higher level RAC/SPA entry is 'Biocenosis of *Posidonia oceanica* meadows'
RAC/SPA to EUNIS	n/a
Habitats Directive Code	1120
Habitats Directive Name	*Posidonia* beds (*Posidonion oceanicae*)
Habitats Directive to EUNIS Relation	=
MSFD Classification	Shallow sublittoral rock and biogenic reef.

Description

In several places, *Posidonia oceanica* occurs on rock to form patchy, reticulate or continuous meadows. Such meadows are usually present in bays and inlets, as well as in exposed coastal areas in water depths of between 3 m and 35 m. When the meadows are of the patchy or reticulate type, the rocky substratum that has not been colonised by the seagrass supports associations with algae from the biocoenosis of infralittoral algae (see EUNIS A3.13).

Additional Notes

This association has been included in the section on soft bottoms instead of the section on hard bottoms despite the fact that the substratum is rock (1) for ease of reference and (2) due to the fact that seagrass on rock actually grows on the thin veneer of sediment that collects on rocks or that is trapped by ‘algal turf’ on rocks.

Key References

Borg and Schembri (2002).

C. CIRCALITTORAL

A4 Circalittoral rock and other hard substrata (EUNIS Level 2)

A4.2 Atlantic and Mediterranean moderate energy circalittoral rock (EUNIS Level 3)

A4.26 Mediterranean coralligenous communities moderately exposed to hydrodynamic action (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	IV.3.1
RAC/SPA Name	Coralligenous biocenosis
RAC/SPA to EUNIS	#
Habitats Directive Code	1170
Habitats Directive Name	Reefs
Habitats Directive to EUNIS	>
MSFD Classification	Shelf sublittoral rock and biogenic reef

Description

Coralligenous biocenoses are found on rock faces or rocky substrata where calcareous algae can build biogenic frameworks. They may also occur on maerl bottoms where the interlocking rhodoliths form a pseudo-hard substratum. So far, no true coralligene has been identified in Maltese waters. What occurs is the pre-coralligenous which is transitional between sciaphilic assemblages dominated by erect algae and the true coralligene formed by frame-work building coralline algae.

Additional Notes

The Barcelona Convention defines coralligenous communities as ‘a typical Mediterranean underwater seascape comprising coralline algal frameworks that grow in dim light conditions and in

relatively calm waters'. Most scientific publications on the coralligenous stress that it is not a single biocoenosis but a whole complex of biocoenoses that are characterised by frameworks of coralline algae in dim light and low hydrodynamism, i.e. the key characteristic is coralline algal frameworks. In the opinion of many workers, the true coralligenous has multiple layers of coralline algae such that the framework is built up from the underlying substratum. If there is only a single layer of algae (a crust), this is generally referred to as the 'pre-coralligenous'.

Based on such criteria, true coralligenous communities have to date not been recorded from the Maltese Islands. However sciaphilic assemblages that include substantial cover of encrusting coralline algae with sponges, corals, bryozoans and a variety of sciaphilic algae have been recorded (for example on the sides of submarine rock faces, at the entrance of caves etc.).

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A4.261 Association with [Cystoseira zosteroides] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.1.1
RAC/SPA Name	Association with *Cystoseira zosteroides*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral rock and biogenic reef

Description

This habitat is characterised by a high abundance of the brown alga *Cystoeira zosteroides*. Single specimens of this species have been found to occur in local waters at depths of 20 m or more on rock in low-light situations; may or may not occur in densities high enough to form an association but only scanty information is available at present.

Key References

ICRAM (2005); E. Lanfranco (pers. com. 2013).

A4.263 Association with [Cystoseira dubia] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.1.3
RAC/SPA Name	Association with *Cystoseira dubia*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral rock and biogenic reef

Description

This association is characterised by the brown alga *Cystoseira dubia*, and occurs on sheltered rocky substrata subject to sedimentation. While *Cystoseira dubia* is known to occur in the Maltese Islands, it has only been recorded as individual specimens and it does not seem to dominate; this association therefore has to date not been confirmed to occur locally.

Key References

ICRAM (2005); E. Lanfranco (pers. com. 2013).

A4.264 Association with [Cystoseira corniculata] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.1.4

RAC/SPA Name	Association with *Cystoseira corniculata*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral rock and biogenic reef

Description

This association is characterised by the brown alga *Cystoseira corniculata*, which in the Maltese islands is found at depths of 50 m or more on maerl bottoms. However, this species has only been recorded as individual specimens and it does not seem to dominate; this association therefore has to date not been confirmed to occur locally.

Key References

ICRAM (2005); E. Lanfranco (pers. com. 2013); Borg and Schembri (unpubl. data 2013).

A4.265 Association with [Sargassum] spp. (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.1.5
RAC/SPA Name	Association with *Sargassum* spp. (indigenous)
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral rock and biogenic reef

Description

This association is characterised by an abundance of brown algae of the genus *Sargassum* on relatively deep and well lit sublittoral rocks. Deep water species of *Sargassum* occur, including *Sargassum acinarum* which also occurs in the infralittoral where it may form an association (see new association created in section on infralittoral hard substrata). In circalittoral waters, only individual specimens of *Sargassum* spp. seem to occur, and this association therefore has not been confirmed to occur locally.

Key References

ICRAM (2005); E. Lanfranco (pers. com. 2013).

A4.266 Association with [Mesophyllum lichenoides] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.1.6
RAC/SPA Name	Association with *Mesophyllum lichenoides*
RAC/SPA to EUNIS	=
Habitats Directive Code	1170
Habitats Directive Name	Reefs
Habitats Directive to EUNIS	>
MSFD Classification	Shelf sublittoral rock and biogenic reef

Description

Association with the encrusting red alga *Mesophyllum lichenoides* which occurs on hard substrata exposed to currents. In the Maltese Islands this species is known to occur on steeply sloping rock faces in deep waters as well as a component of some rhodolith and maerl beds. However in general, *Mesophyllum lichenoides* occurs as small patches at the base of fleshy algae and does not dominate in any situation; therefore this association has not been confirmed to occur locally.

Key References

ICRAM (2005); E. Lanfranco (pers. com. 2013).

NEW Association with [Halimeda tuna] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	None; the closest RAC/SPA entry is IV.3.7
RAC/SPA Name	None; the closest RAC/SPA entry is 'Association with *Lithophyllum stictaeforme* and *Halimeda tuna'*
RAC/SPA to EUNIS	n/a
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

Associations with the green macroalga *Halimeda tuna* are found on upper circalittoral rocky substrata subject to moderate hydrodynamics. This alga may also be dominant on maerl and other rhodoliths beds in deep waters where it grows on the semi-hard bottom created by the interlocking rhodoliths.

Key References

Templado et al. (2012); Borg and Schembri (unpubl. data 2013).

A4.267 Algal bioconcretion with [Lithophyllum frondosum[5]] and [Halimeda tuna] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.1.7
RAC/SPA Name	Association with *Lithophyllum stictaeforme* and *Halimeda tuna*
RAC/SPA to EUNIS	=
Habitats Directive Code	1170
Habitats Directive Name	Reefs
Habitats Directive to EUNIS	>
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

In the Maltese Islands *Lithophyllum stictaeforme* occurs on submerged vertical rock faces and drop-offs and at the mouth of submerged caves. It forms part of the pre-coralligene assemblage, but does not co-occur with *Halimeda tuna.* Moreover it does not occur on horizontal sedimentary beds, and thus the local habitat does not seem to match the association described in the relevant EUNIS category; it is likely that this association does not occur locally.

Key References

E. Lanfranco (pers. com. 2013); ICRAM (2005).

[5] The currently accepted name is *Lithophyllum stictaeforme* according to Algaebase. There is however a great deal of confusion as to the specific identity of species referred to as *Lithophyllum stictaeforme* / *Lithophyllum frondosum* / *Pseudolithophyllum expansum* / *Lithophyllum expansum* in the literature.

A4.269 Facies with [Eunicella cavolinii] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.1.10
RAC/SPA Name	Facies with *Eunicella cavolinii*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is characterised by the high density of colonies of the gorgonian sea-fan *Eunicella cavolinii*. Sporadic records of this species from Maltese waters exist, but this and other species of *Eunicella* are rare and only present as single or small groups of individuals in a few restricted localities; therefore, the occurrence of this species assemblage is not confirmed.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A4.26A Facies with [Eunicella singularis] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.1.11
RAC/SPA Name	Facies with *Eunicella singularis*
RAC/SPA to EUNIS	=

Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral rock and biogenic reef

Description

This association is characterised by a high density of colonies of the gorgonian sea-fan *Eunicella singularis*. It is more common than *Eunicella cavolinii* but still rare and sparsely distributed in a few localities. No high density populations are known; the occurrence of this biocoenosis needs confirmation.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A4.26B Facies with [Paramuricea clavata] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.1.13
RAC/SPA Name	Facies with *Paramuricea clavata*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral rock and biogenic reef

Description

This association is characterised by a high density of colonies of the gorgonian sea-fan *Paramuricea clavata*. *Paramuricea clavata* occurs but is rare and sparsely distributed in a few localities. No high density populations are known; the occurrence of this biocoenosis needs confirmation.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A4.26C Facies with [Parazoanthus axinellae] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.1.14
RAC/SPA Name	Facies with *Parazoanthus axinellae*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral rock and biogenic reef

Description

This association is characterised by the high density of the hexacorallian anthozoan *Parazoanthus axinellae*. This species has not been confirmed to occur locally, although it probably does; no local information about this biocoenosis exists.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A4.26D Coralligenous platforms (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.1.15
RAC/SPA Name	Coralligenous platforms
RAC/SPA to EUNIS	=
Habitats Directive Code	1170
Habitats Directive Name	Reefs
Habitats Directive to EUNIS	>
MSFD Classification	Shelf sublittoral rock and biogenic reef

Description

Small patches of this biocoenosis occur on maerl beds where plate-like encrusting coralline algae cover the underlying interlocking rhodoliths creating a crust that incorporates the rhodoliths and other sediment inclusions. However, such concretions do not occupy areas of more than a few square centimetres and no extensive formations of this type have been reported so far.

Key References

Borg and Schembri (unpubl. data 2013); ICRAM (2005).

A4.27 Faunal communities on deep moderate energy circalittoral rock (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	IV.3.3
RAC/SPA Name	Biocenosis of shelf-edge rock
RAC/SPA to EUNIS	#

Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shallow sublittoral rock and biogenic reef

Description

This association is found on hard substrata subject to strong sedimentation. This association occurs in the Maltese Islands but is rare since circalittoral rock is rare. Very little is known about this biocoenosis in Maltese waters. A variant of this biocoenosis occurs on discarded limestone blocks used to moor Fish Aggregation Devices (FADs) in the dolphinfish fishery.

Key References

ICRAM (2005); Pace et al. (2007).

A4.3 Atlantic and Mediterranean low energy circalittoral rock (EUNIS Level 3)

A4.32 Mediterranean coralligenous communities sheltered from hydrodynamic action (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	IV.3.1
RAC/SPA Name	Coralligenous biocenosis
RAC/SPA to EUNIS	#
Habitats Directive Code	1170
Habitats Directive Name	Reefs
Habitats Directive to EUNIS	>

MSFD Classification	Shelf sublittoral rock and biogenic reef

Description

Coralligenous biocenoses are found on rock faces or rocks where calcareous algae can build biogenic frameworks. So far, no true coralligene has been identified in Maltese waters. What occurs is the pre-coralligenous which is transitional between sciaphilic assemblages dominated by erect algae and the true coralligene formed by framework building coralline algae.

Additional Notes

Refer to explanation of difference between true coralligene and pre-coralligenous given for EUNIS category A4.26.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A4.321 Association with [Rodriguezella strafforelli] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.1.9
RAC/SPA Name	Association with *Rodriguezella strafforelli*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral rock and biogenic reef

Description

This association is found on poorly lit rocky substrata in sheltered environments. *Rodriguezella strafforelli* has not been recorded from the Maltese Islands, however there are indications that this species may occur. There is no local information on the occurrence of this biocoenosis.

Key References

ICRAM (2005); E. Lanfranco (pers. com. 2013).

A4.322 Association with [Lophogorgia sarmentosa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.1.12
RAC/SPA Name	Facies with *Lophogaria sarmentosa* (ex *Lophogaria ceratophyta*)
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral rock and biogenic reef

Description

This facies is characterised by the high density of colonies of the gorgonian sea-fan *Lophogorgia sarmentosa*. This species occurs but is rare and sparsely distributed in a few localities. No high density populations are known so the occurrence of this biocoenosis needs confirmation.

Key References

Borg and Schembri (unpubl. data 2013); ICRAM (2005).

A4.7 Features of circalittoral rock (EUNIS Level 3)

A4.71 Communities of circalittoral caves and overhangs (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.2
RAC/SPA Name	Semi-dark caves (also in enclave in upper stages)
RAC/SPA to EUNIS	#
Habitats Directive Code	8330
Habitats Directive Name	Submerged or partially submerged sea caves
Habitats Directive to EUNIS	IV.3.2
MSFD Classification	Semi-dark caves (also in enclave in upper stages)

Description

This habitat is characterised by caves and overhangs in sheltered environments. Although very likely to occur in Maltese waters, this biocoenosis has not been studied.

Key References

Connor et al. (2004); Borg and Schembri (unpubl. data 2013).

A4.712 Caves and overhangs with [Parazoanthus axinellae] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.2.1
RAC/SPA Name	Facies with *Parazoanthus axinellae*

RAC/SPA to EUNIS	=
Habitats Directive Code	8330
Habitats Directive Name	Submerged or partially submerged sea caves
Habitats Directive to EUNIS	>
MSFD Classification	Semi-dark caves (also in enclave in upper stages)

Description

This association, characterised by the presence of the hexacorallian *Parazoanthus axinellae* is found on exposed rocky bottoms characterised by poor illumination. This species has not been confirmed to occur in the Maltese Islands, although it probably does; no local information about this biocoenosis exists.

Key References

Borg and Schembri (unpubl. data 2013); ICRAM (2005).

A4.713 Caves and overhangs with [Corallium rubrum] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.2.2
RAC/SPA Name	Facies with *Corallium rubrum*
RAC/SPA to EUNIS	=
Habitats Directive Code	8330
Habitats Directive Name	Submerged or partially submerged sea caves
Habitats Directive to EUNIS	>
MSFD Classification	Semi-dark caves (also in enclave in upper stages)

Description

This association, characterised by a high abundance of the red coral *Corallium rubrum*, is found under poorly illuminated overhangs, on walls of caves or in cavities. The species occurs in the Maltese islands but very little is known about it and the biocoenosis it forms part of locally (see review by Deidun et al., 2010). However, a bathyal association with *Corallium rubrum* and deep-water corals has been reported and characterised (Taviani et al., 2010).

Key References

ICRAM (2005); Deidun et al. (2010); Taviani et al. (2010).

A4.714 Caves and overhangs with [Leptopsammia pruvoti] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.3.2.3
RAC/SPA Name	Facies with *Leptopsammia pruvoti*
RAC/SPA to EUNIS	=
Habitats Directive Code	8330
Habitats Directive Name	Submerged or partially submerged sea caves
Habitats Directive to EUNIS	>
MSFD Classification	Semi-dark caves (also in enclave in upper stages)

Description

This association with the yellow madreporian coral *Leptopsammia pruvoti* occurs on rocky substrata under overhangs and at the entrance to caves and tunnels. The association also occurs as part of the pre-coralligene but this biocoenosis has not been studied in the Maltese Islands.

Key References

Borg and Schembri (unpubl. data 2013); ICRAM (2005).

A4.715 Caves and ducts in total darkness (including caves without light or water movement at upper levels) (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	V.3.2
RAC/SPA Name	Caves and ducts in total darkness (in enclave in the upper stages)
RAC/SPA to EUNIS	#
Habitats Directive Code	8330
Habitats Directive Name	Submerged or partially submerged sea caves
Habitats Directive to EUNIS	>
MSFD Classification	Semi-dark caves (also in enclave in upper stages)

Description

This habitat is characterised by the absence of light and confined space. In the Maltese Islands habitats with such characteristics may occur in caves, tunnels, isolated cavities and in micro-cavities in piles of boulders / rocks. In the absence of light photosynthetic organisms will not occur in such habitats.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zones	Infralittoral, circalittoral and bathyal (depending on location of caves / cavities / tunnels)
Depth range	Various
Water temperature	Various

Currents and water movements	Virtually absent; water exchange inside cave may be poor
Salinity	37-39%
Seabed composition	Rocky
Mapped locations	None
Key recognition features	Totally dark habitats on rocky substratrum characterised by the presence of sessile animals such as scleractinians, sponges, bryozoans and serpulid polychaetes. Mobile fauna can include mysids which form swarms that may migrate out of caves during the nocturnal phase, decapod crustaceans, gastropods and fish. The characterising species will depend on depth zone.
Habitat sensitivity	Sensitive to disturbance from scuba diving when located in infralittoral / upper circalittoral zone.

Additional Notes

This habitat is classified in the bathyal zone in the RAC/SPA system, but is classified in the circalittoral zone in the EUNIS classification scheme. In the Maltese Islands, caves and tunnels in total darkness can occur in the infralittoral, circalittoral and bathyal zones.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A5 Sublittoral sediment (EUNIS Level 2)

A5.1 Sublittoral coarse sediment (EUNIS Level 3)

A5.14 Circalittoral coarse sediment (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	IV.2.4

RAC/SPA Name	Biocenosis of coarse sands and fine gravels under the influence of bottom currents (biocenosis found in areas under specific hydrodynamic conditions - straits - ; also found in the infralittoral)
RAC/SPA to EUNIS	<
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral coarse sediment

Description

Coarse sands, gravel and shingle under the influence of bottom currents characterised by the characteristic species *Branchiostoma lanceolatum.*

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Lower infralittoral and upper circalittoral
Depth range	- 30 to -100 m vertical distance relative to sea level
Water temperature	16-20°C
Currents and water movements	Influenced by bottom currents
Salinity	37-39%
Seabed composition	Coarse sands and fine gravels
Mapped locations	None

Key recognition features	This habitat can be recognised by the presence of the lancelet *Branchiostoma lanceolatum* on coarse sands and fine gravels
Habitat sensitivity	Sensitive to aquaculture activities and aquaculture activities, dumping of waste, litter pollution, and bottom fishing using nets and ling-lines.

Additional Notes

In the Maltese Islands this association is found in the infralittoral as well as in the upper circalittoral.

Key References

Connor et al. (2004); Borg and Schembri (unpubl. data 2013).

A5.3 Sublittoral mud (EUNIS Level 3)

A5.38 Mediterranean communities of muddy detritic bottoms (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	IV.2.1
RAC/SPA Name	Biocenosis of the muddy detritic bottom
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral mud

Description

Extensive areas of muddy bottom occur in the 25 NM Fisheries Management Zone around the Maltese Islands, with sediment mostly in the sandy mud and muddy sand categories together with some mud.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Circalittoral, Upper Bathyal
Depth range	- 40 to -200 m vertical distance relative to sea level
Water temperature	14-17°C
Currents and water movements	Influenced by bottom currents
Salinity	37-39%
Seabed composition	Mud with detritus
Mapped locations	None
Key recognition features	Muddy bottoms characterised by mobile benthic species such as red mullet (*Mullus barbatus*), red shrimp (*Parapenaeus longirostris*), octopus (*Octopus vulgaris*), squid (*Illex coindetti*), cuttlefish (*Sepia officinalis*), boarfish (*Capros aper*), longspine snipefish (*Macrorhamphosus scolopax*), skates and rays (*Raja* spp.), bogue (*Boops boops*) and scad (*Trachurus mediterraneus*). These conspicuous species are also accompanied by a rich infauna, which has, however, not been studied.
Habitat sensitivity	Sensitive to dumping of construction waste, aquaculture activities, litter pollution from dolphinfish FAD fisheries, trawl fisheries.

Key References

ICRAM (2005); L. Knittweis (pers. obs. 2012); Borg and Schembri (unpubl. data 2013).

A5.39 Mediterranean communities of coastal terrigenous muds (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	IV.1.1
RAC/SPA Name	Biocenosis of coastal terrigenous muds
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral mud

Description

Only some areas with bottoms of mud without sand occur in the 25 NM FMZ around the Maltese Islands; not studied.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A5.391 Facies of soft muds with [Turritella tricarinata communis] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.1.1.1

RAC/SPA Name	Facies of soft mud with *Turritella tricarinata*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS Relation	n/a
MSFD Classification	Shelf sublittoral mud

Description

This association is characterised by the presence of the gastropod *Turritella tricarinata*. It occurs in localised areas around the Maltese Islands; not studied.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A5.392 Facies of sticky muds with [Virgularia mirabilis] and [Pennatula phosphorea] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.1.1.2
RAC/SPA Name	Facies of sticky muds with *Virgularia mirabilis* and *Pennatula phosphorea*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS Relation	n/a
MSFD Classification	Shelf sublittoral mud

Description

This association is characterised by the soft corals *Virgularia mirabilis* and *Pennatula phosphorea* on muddy bottoms. *Virgularia mirabilis* occurs but *Pennatula phosphorea* has not been definitely recorded from Maltese waters. It is therefore not known if this biocoenosis occurs or not.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A5.393 Facies of sticky muds with [Alcyonium palmatum] and [Stichopus regalis] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.1.1.3
RAC/SPA Name	Facies of sticky muds with *Alcyonium palmatum* and *Stichopus regalis*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS Relation	n/a
MSFD Classification	Shelf sublittoral mud

Description

This association is characterised by the soft coral *Alcyonium palmatum* and the holothurian *Stichopus regalis* on muddy bottoms. Unidentified species of *Alcyonium* occur and individuals of *Stichopus regalis* are common on the same bottoms, so in all probability this biocoenosis occurs. Not studied.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A5.4 Sublittoral mixed sediments (EUNIS Level 3)

A5.46 Mediterranean animal communities of coastal detritic bottoms (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	IV.2.2
RAC/SPA Name	Biocenosis of the coastal detritic bottom
RAC/SPA to EUNIS	#
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral mixed sediment.

Description

Sublittoral mixed sediments can take various forms depending on nearly infralittoral habitats and coastal formations. This habitat is found in the infralittoral as well as the circalittoral zone in the Maltese Islands.

Additional Notes

In the EUNIS classification system the Level 3 description of this habitat (category A5.4) specifies that sublittoral mixed sediments are 'found from the extreme low water mark to deep offshore circalittoral habitats'. In the Maltese Islands these are deep water habitats found in the lower infralittoral or deeper; such habitats are not found in the upper infralittoral as the EUNIS description suggests.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A5.461 Facies with [Ophiura texturata[2]] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.2.2.8
RAC/SPA Name	Facies with *Ophiura texturata*[6]
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral mixed sediment.

Description

This association is characterised by a high abundance of the brittle star *Ophiura ophiura*. Around the Maltese Islands this habitat occurs in the lower infralittoral and the upper circalittoral on bottoms that have a substantial sand component.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Lower infralittoral and upper circalittoral
Depth range	From -30 m to -100 m vertical distance relative to sea level
Water temperature	14-18°C
Currents and water	Exposed to bottom currents

[6] The presently accepted name for this species is *Ophiura ophiura*.

movements	
Salinity	37-39%
Seabed composition	Mixed sediment containing substantial amounts of sand
Mapped locations	None
Key recognition features	Coastal mixed bottoms populated by the brittlestar *Ophiura ophiu*ra.
Habitat sensitivity	Sewage pollution, pollution from aquaculture developments, dumping of waste, littering and bottom fisheries using bottom set nets / bottom longlines.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A5.462 Facies with [Synascides] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.2.2.9
RAC/SPA Name	Facies with Synascides
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral mixed sediment.

Description

Deep-water colonial ascidians ('synascidies') occur but have not been studied. This biocoenosis probably occurs but needs confirmation.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A5.463 Facies with large [Bryozoa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.2.2.10
RAC/SPA Name	Facies with large Bryozoa
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral mixed sediment.

Description

Deep-water associations with large Bryozoa occur but have not been studied. This biocoenosis probably occurs but needs confirmation.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A5.47 Mediterranean communities of shelf-edge detritic bottoms (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	IV.2.3
RAC/SPA Name	Biocenosis of shelf-edge detritic bottom
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral mixed sediment.

Description

Such associations are present on detritic bottoms with an abundance of dead shells, bryozoans and coral skeletons. Found in the infralittoral as well as the circalittoral zone in the Maltese Islands.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Lower infralittoral and upper circalittoral
Depth range	From -30 m to -100 m vertical distance relative to sea level
Water temperature	14-18°C
Currents and water movements	May be exposed to bottom currents
Salinity	37-39%

Seabed composition	Mixed sediments with detritus
Mapped locations	None
Key recognition features	Detritic bottoms with abundance of dead shells, bryozoans and coral skeletons.
Habitat sensitivity	Sewage pollution, aquaculture activities, litter pollution, and bottom fisheries using bottom set nets / bottom longlines.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A5.471 Facies with [Neolampas rostellata] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.2.3.1
RAC/SPA Name	Facies with *Neolampas rostellata*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral mixed sediment.

Description

The echinoid *Neolampas rostellata* occurs on bottoms with a fair proportion of fine sand. However, it has never been encountered in high abundances; therefore this biocoenosis has not been confirmed to occur.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A5.472 Facies with [Leptometra phalangium] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.2.3.2
RAC/SPA Name	Facies with *Leptometra phalangium*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral mixed sediment.

Description

The crinoid *Leptometra phalangium* is known from muddy sand bottoms at depths of 100-250 m in the 25 NM Fisheries Management Zone around the Maltese Islands and may be especially abundant close to trawled bottoms. This association therefore occurs but has not been studied.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A5.5 Sublittoral macrophyte-dominated sediment (EUNIS Level 3)

A5.51 Maerl beds (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	IV.2.2.2

RAC/SPA Name	Maerl facies (*Lithothamnion coralloides* and *Phymatolithon calcareum*)
RAC/SPA to EUNIS	<
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral coarse sediment.

Description

The term 'maerl' refers to biogenic sediments characterised by accumulations of live and dead unattached coralline algae. Maerl is characterised by high densities of rhodoliths, which are nodules or unattached branched growths formed by coralline algae which can have morphologies varying from densely branched nodules to open branched thalli. In the Maltese Islands both *Lithothamnion coralloides* and *Phymatolithon calcareum* occur and are rhodolith-formers in local maerl beds, however, the main local rhodoliths formers are are *Lithothamnion minervae* (Basso) and *Lithothamnion coralloides* with *Phymatolithon calcareum* and other species (*Lithophyllum racemus, Mesophyllum alternans, Neogoniolithon brassica-florida* and *Peyssonnelia rosa-marina*) as minor components. The complex structure of maerl beds provides a unique and heterogeneous habitat which supports a high benthic biodiversity, including several rare and unusual species.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Lower infralittoral, circalittoral
Depth range	From -20 m to -100 m vertical distance relative to sea level
Water temperature	14-18℃
Currents and water movements	Exposed to moderate bottom currents
Salinity	37-39%

Seabed composition	Coarse sands and fine gravels
Mapped locations	North-eastern coast of Maltese Islands (is-Sikka l-Bajda)
Key recognition features	Accumulations of live and dead rhodoliths dominating the seafloor. Various rhodoliths shapes and developmental stages may be present. Easily recognisable.
Habitat sensitivity	Changes in sedimentation regime due to coastal development, bottom trawl fisheries, litter pollution, aquaculture activities and bottom fishing using nets and long lines.

Key References

Lanfranco et al. (1999); Schembri (1998); Connor et al. (2004); Sciberras et al. (2009).

A5.52H Association with [Peyssonnelia rosa-marina] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.2.2.3
RAC/SPA Name	Association with *Peyssonnelia rosa-marina*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral mixed sediment.

Description

This association found on coastal detritic bottoms is characterised by an abundance of the red alga *Peyssonnelia rosa-marina*. This species is not a coralline alga but belongs to the family

Peyssonneliaceae, however, it is heavily calcified and forms rhodoliths that are minor components of maerl and rhodolith beds but it is not known to dominate such habitats, locally. Therefore this biocoenosis probably does not occur.

Key References

Lanfranco et al. (1999); Schembri (1998); Connor et al. (2004); Sciberras et al. (2009).

A5.52I Association with [Arthrocladia villosa] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.2.2.4
RAC/SPA Name	Association with *Arthrocladia villosa*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral mixed sediment.

Description

This association of coastal detritic bottoms is characterised by an abundance of the brown alga *Arthrocladia villosa*. *Arthrocladia villosa* occurs locally, but it is not known to dominate the assemblages it forms part of. Therefore this biocoenosis probably does not occur.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A5.52J Association with [Osmundaria volubilis] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	IV.2.2.5

RAC/SPA Name	Association with *Osmundaria volubilis*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Shelf sublittoral mixed sediment.

Description

This association of coastal detritic bottoms is characterised by an abundance of the brown alga *Osmundaria volubilis*. This species is a common component of coarse circalittoral bottoms, especially those with rhodoliths or maerl, where the alga tends to occurs as sparsely-distributed individuals or as moderately dense stands. Since *O. volubilis* does not tend to dominate associations, this biocoenosis probably does not occur or at least needs confirmation.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

D. BATHYAL[7]

A6 Deep-sea bed (EUNIS Level 2)

A6.3 Deep-sea sand (EUNIS Level 3)

A6.31 Communities of bathyal detritic sands with [Grypheus vitreus] (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	V.2.1
RAC/SPA Name	Biocenosis of bathyal detritic sands with *Grypheus vitreus*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Upper bathyal sediment

Description

Communities characterised by detritic sand and the occurrence of the brachiopod *Grypheus vitreus*. This biocoenosis is known from the deep waters to the south of Malta but has not been characterised or studied. Although the EUNIS description refers to *Gripheus vitreus*, the correct name of the species is *Griphus vitreus*.

[7] EUNIS definition of the 'bathyal zone': the oceanic zone at depths of 200 - 2000m, lying to seaward of the shallower neritic zone, and landward of the deeper abyssal zone. The upper limit of the bathyal zone is marked by the edge of the continental shelf. In marine ecology, it is the region of the continental slope and rise. It may be geologically active, and includes trenches and submarine canyons, with under-water erosion producing avalanches. In accordance with this definition we thus consider the boundary between the circalittoral and the bathyal zones to be the 200 m depth contour.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A6.5 Deep-sea mud (EUNIS Level 3)

A6.51 Mediterranean communities of bathyal muds (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	V.1.1
RAC/SPA Name	Biocenosis of bathyal muds
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Upper bathyal sediment

Description

This biocoenosis is characterised by sediments with heterogeneous granulometry and thickness, an almost total absence of light and a constant homothermy of around 13° C. In the Maltese Islands bathyal muds are the predominant biocoenosis in bathyal waters. The habitat begins at depths of ca. 150 m (i.e. at the transitional zone between the lower circalittoral and the upper bathyal), but extends to depths beyond 200 m. The fauna is characterised by foraminifera, sponges, polychaetes, echinoderms and crustaceans.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Bathyal

Depth range	From -150/200 m to greater depths
Water temperature	13-14°C
Currents and water movements	Can be exposed to strong bottom currents on the continental slope / on the sides of canyons
Salinity	37-39%
Seabed composition	Mud (compact to fluid, in places with some sand)
Mapped locations	None
Key recognition features	Muddy sediment populated by characteristic mobile benthic species including for example Norway lobster (*Nephropos norvegicus*), giant red shrimp (*Aristaeomorpha foliacea*), hake (*Merluccius merluccius*), deep water rose shrimp (*Parapenaeus longirostris*), several species of grenadier (*Hymenocephalus italicus, Nezumia sclerorhynchus, Coelorhynchus coelorhynchus*), argentines (*Argentina sphyraena, Glossanodon leioglossus*), shortnose greeneye (*Chlorophthalmus agassizi*), and several species of cartilaginous fish such as blackmouth catshark (*Galeus melastomus*), small-spotted catshark (*Scyliorhinus canicula*), velvet belly lanternshark (*Etmopterus spinax*), and thornback ray (*Raja clavata*). These conspicuous species are accompanied by a rich infauna, which has, however, not been studied.
Habitat sensitivity	Sensitive to dumping of construction waste, litter pollution from dolphinfish FAD fisheries, and trawl fisheries.

Key References

ICRAM (2005); L. Knittweis (pers. obs. 2012); Borg and Schembri (unpubl. data 2013).

A6.511 Facies of sandy muds with [Thenea muricata] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	V.1.1.1.
RAC/SPA Name	Facies of sandy muds with *Thenea muricata*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Upper bathyal sediment

Description

The sponge *Thenea muricata*[8] occurs in sandy muds of deep water (>600m) to the south of Malta but this biocoenosis has not been characterised or studied.

Key References

Borg and Schembri (BENSPEFISH unpubl. data 2013); ICRAM (2005).

A6.512 Facies of fluid muds with [Brissopsis lyrifera] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	V.1.1.2
RAC/SPA Name	Facies of fluid muds with *Brissopsis lyrifera*
RAC/SPA to EUNIS	=

[8] EUNIS description erroneously lists *Thenea muricata* as being a mollusc.

Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Upper bathyal sediment

Description

This association is characterised by sandy muds, populated by the heart urchin *Brissopsis lyrifera*. Whilst the species *B. lyrifera* has been reported to occur in Maltese waters it appears to be rare and therefore it cannot be confirmed with certainty that this association occurs in Maltese waters.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

A6.513 Facies of soft muds with [Funiculina quadrangularis] and [Apporhais seressianus] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	V.1.1.3.
RAC/SPA Name	Facies of soft muds with *Funiculina quadrangularis* and *Apporhais seressianus*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Upper bathyal sediment

Description

This association is characterised by sandy muds populated by the gastropod *Apporhais* serresianus and the cnidarian *Funicularia quadrangularis*. The latter species occurs in many areas with deep water muddy bottoms around the Maltese Islands, particularly to the south of the islands. While *Apporhais seressianus* occurs in Maltese waters, it seems to be very rare and it is not known if it occurs in association with *Funiculina quadrangularis*. This biocoenosis in the form defined by EUNIS and RAC/SPA has yet to be confirmed for Maltese waters.

Key References

Borg and Schembri (BENSPEFISH unpubl. data 2013); ICRAM (2005).

A6.514 Facies of compact muds with [Isidella elongata] (EUNIS Level 5)

Habitat Classification

RAC/SPA Code	V.1.1.4.
RAC/SPA Name	Facies of compact muds with *Isidella elongate*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a
Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Lower bathyal sediment

Description

This association is characterised by the presence of the alcyonacean anthozoan *Isidella elongata* on compact muds, and found at the base of the continental slope and the bathyal plain. Based on the occurrence of *Isidella elongata*, this biocoenosis is known from the deep waters around the Maltese Islands but has not been characterised or studied.

Key References

Borg and Schembri (BENSPEFISH unpubl. data 2013); ICRAM (2005).

A6.6 Deep-sea bioherms (EUNIS Level 3)

A6.61 Communities of deep-sea corals (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	V.3.1.
RAC/SPA Name	Biocenosis of deep sea corals
RAC/SPA to EUNIS	>
Habitats Directive Code	1170
Habitats Directive Name	Reefs
Habitats Directive to EUNIS	>
MSFD Classification	Upper bathyal rock and biogenic reef

Description

Live associations of the framework-building corals *Lophelia pertusa* and *Madrepora oculata*, accompanied by the solitary coral *Desmophyllum dianthus,* antipatharians (*Leiopathes*), octocorals (the calcified gorgonacean *Corallium rubrum*) and yellow corals (*Dendrophyllia*) are known from depths of ca 390 m – 620 m from along an escarpment south of the Maltese Islands, extending from Malta to Linosa (now known as the South Malta Coral Province). Adding to the diversity of the biota are serpulids, cirripeds such as the large barnacle *Pachylasma giganteum*, bivalves, sponges and gastropods which feed on corals.

Characteristic Physical and Chemical Features

Aspect	Main Identification Criteria
Zone	Bathyal
Depth range	From -350 m to -800 m

Water temperature	13-14°C
Currents and water movements	Can be exposed to bottom currents
Salinity	37-39%
Seabed composition	Rocky
Mapped locations	South Malta Coral Province (located on a submarine escarpment)
Key recognition features	Presence of deep water coral reefs (also referred to as mounds, build-ups, bioherms) created by the frame building species *Lophelia* and *Madrepora*. A variety of co-occurring species are present, creating a highly diverse community. Easily recognisable.
Habitat sensitivity	Sensitive to fisheries, in particular entanglement with bottom longlines and bottom set nets.

Key References

Taviani et al. (2011); OSPAR (2004).

A6.62 Deep-sea sponge aggregations (EUNIS Level 4)

Habitat Classification

RAC/SPA Code	V.1.1.5.
RAC/SPA Name	Facies with *Pheronema grayi*
RAC/SPA to EUNIS	=
Habitats Directive Code	n/a

Habitats Directive Name	n/a
Habitats Directive to EUNIS	n/a
MSFD Classification	Lower bathyal rock and biogenic reef

Description

This association is characterised by aggregations of deep-sea sponges, in particular the presence of the sponge *Pheronema grayi*. This species has to date not been recorded from the Maltese Islands, but deep-sea sponge aggregations occur. The biocoenosis has not been characterised or studied; associations with *P. grayi* may or may not occur.

Key References

ICRAM (2005); Borg and Schembri (unpubl. data 2013).

IV. ASSESSMENT OF CONSERVATION STATUS

A. General Remarks

According to Article 1 of the Habitats Directive, the conservation status of a natural **habitat** will be taken as 'favourable' when:

- Its natural range and areas it covers within that range are stable or increasing;
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future;
- The conservation status of its typical species is favourable.

The same article defines a favourable conservation status for a **species** as a situation where:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future;
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Assessing the Favourable Conservation Status (FCS) of habitats and species is thus based on consideration of several distinctive parameters. For **habitats** these parameters are: habitat range, area occupied by a habitat, structure and function, future prospects. For **species** these parameters are: habitat range, population dynamics, availability of species habitat, and future prospects.

Since these criteria are stated in general terms in order to cover all habitats and species which fall under the Directive, it is necessary to develop more detailed criteria to assess favourable conservation status for each of the habitats protected under Annex I of the Habitats Directive. In the following sections such criteria are presented for (i) sandbanks, (ii) *Posidonia* beds, (iii) reefs, (iv) sea caves and (v) maerl beds[9]. Each section has been written as a stand alone document ; where common concepts apply, text may thus be repeated.

[9] Maerl beds are not listed in Annex I of the Habitats Directive but have been included at the specific request of the Malta Environment and Planning Authority.

B. Sandbanks (Habitat 1110)

According to the EU Habitat Interpretation manual (version EUR27), the Habitat's Directive Annex I Habitat 1110 'Sandbanks which are slightly covered by sea water all the time' can be defined as:

Sandbanks are elevated, elongated, rounded or irregular topographic features, permanently submerged and predominantly surrounded by deeper water. They consist mainly of sandy sediments, but larger grain sizes, including boulders and cobbles, or smaller grain sizes including mud may also be present on a sandbank. Banks where sandy sediments occur in a layer over hard substrata are classed as sandbanks if the associated biota are dependent on the sand rather than on the underlying hard substrata. 'Slightly covered by sea water all the time' means that above a sandbank the water depth is seldom more than 20 m below chart datum. Sandbanks can, however, extend beneath 20 m below chart datum. It can, therefore, be appropriate to include in designations such areas where they are part of the feature and host its biological assemblages.

In a separate section on 'Plants' associated with this habitat the EU Habitat Interpretation Manual goes on to specify that in the Mediterranean the marine angiosperm "Cymodocea nodosa*, together with photophilic species of epiphytes (more than 15 species, mainly small red algae of the Ceramiaceae family), associated with* Posidonia *beds*" may be found on sandbanks. It does however specify that **on many sandbanks macrophytes do not occur.**

Based on information received from MEPA, during the EU Marine Biogeographic Seminar held in June 2010 in Italy, at which the Commission and Member State representatives from the Mediterranean countries were present, all Member States indicated to the European Commission that the physical definition for this habitat, as given in the Interpretation Manual referred to above, cannot be applied to the Mediterranean Sea. It was instead concluded that the interpretation for this habitat would be based mainly on the vegetation section described for the Mediterranean as listed for this habitat in the Interpretation Manual. Consequently, at this meeting, Malta, together with the majority of the Member States present, indicated to the Commission that until a new official definition is published by the Commission, they shall interpret habitat type 1110 to constitute sandy bottoms hosting *Cymodocea nodosa*. Only a minority Member States opted not to use this approach but to base their interpretation on the information provided in the section 'Corresponding categories'.

It is however the opinion of the authors that it is not correct to simply classify all sandy bottoms hosting *Cymodocea nodosa* as sandbanks. In the Maltese Islands associations with the seagrass *Cymodocea nodosa* occur throughout the infralittoral from very shallow depths of less than 1 m down to about 45-48 m. *Cymodocea* may occur as a dense meadow or very sparsely and although usually rather short, the leaves may grow to lengths of 20-30 cm high in shallow waters. The plant may occur as almost monospecific stands or in association with other seagrasses (*Posidonia oceanica* and *Halophila stipulacea*) and/or macroalgae (for example, *Caulerpa racemosa* or *Caulerpa prolifera*).

Monitoring of *Cymodocea* beds could in theory follow the same approach as that outlined for *P. oceanica* beds below. However *Cymodocea nodosa* is a pioneering species, which is resilient to

disturbance and which may be found in dynamic environments such as shallow waters. Following disturbances *Cymodocea* can be found stabilising substrates and facilitating the accretion of sediments. If the environment is favourable, *Cymodocea* may subsequently be outcompeted by *Posidonia*, in fact the species typically only forms monospecific meadows in environments unfavourable to *Posidonia oceanica*. Due to the more dynamic nature of this species, the wide bathymetric range in which it is found and the variety of growth forms the species may take (clumps of individual shoots, sparse meadows, dense meadows, association with other seagrasses or macroalgae), it is virtually impossible to establish a long term monitoring programme to monitor 'all sandy bottoms hosting *Cymodocea nodosa*'.

Borg and Schembri (2002) have instead suggested that the sandbank habitat in the Maltese Islands should be interpreted as consisting of soft sediment types, broadly described as 'sands' but which includes clean fine to coarse sand as well as sand mixed with both finer and coarser material (gravelly sands, muddy sands, sand with occasional rhodoliths), permanently covered by shallow sea water, typically at depths of less than 20 m below chart datum.

Borg and Schembri (2002) further note that in the Maltese Islands this habitat type is likely to occur widely in large shallow bays, smaller embayments, creeks and the harbours. The types of assemblages associated with this habitat type would be determined primarily by the sediment type and by such other physical factors as shelter, depth, turbidity, salinity fluctuations and, for some impacted sites, the degree of nutrient enrichment. The biota is likely to be characterized by a burrowing infauna of worms, crustaceans, bivalve molluscs and echinoderms. An impoverished macro-epifauna of decapod crustaceans, prosobranch molluscs, echinoderms and benthic fish is also likely to occur. **If present,** vegetation such as the pioneering seagrasses *Cymodocea nodosa* and to a lesser extent *Halophila stipulacea*, as well as a few algae such as *Caulerpa prolifera* and *Caulerpa racemosa* may be found.

Finally, Borg and Schembri (2002) note that where coarse material such as shells, gravel or pebbles are present, an epibiota of attached species including encrusting and foliose algae, hydroids, bryozoans and tubicolous polychaetes is likely to develop. The reason is that heterogeneous sediments consisting of sand and coarser material have higher species richness than more homogeneous or finer sediments.

However this habitat has never been studied in detail in the Maltese Islands, so very limited information is available. In order to address this situation the fieldwork component of the present assignment will be used to characterise the biota found on two typical Maltese sandbanks. A detailed discussion of indicators suitable for an assessment of conservation status of Maltese sandbanks will be provided once the results of the fieldwork component are available.

C. Posidonia Beds (Habitat 1120)

1. Habitat Description

Posidonia oceanica is a large, slow-growing seagrass species endemic to the Mediterranean that forms extensive meadows in clear waters. Leaves of the seagrass can grow to a height of 1 m, and old leaves are shed throughout the year, but especially during autumn and winter. The highest meadow densities are found in shallow waters, decreasing exponentially as depth increases. *P. oceanica* forms extensive and persistent rhizomes, and in areas where there is significant sedimentation, vertical rhizome growth will lead to the formation of characteristic matte reefs. Whilst seagrass meadows can form on both sand and rock, muddy substrates are not suitable since the turbidity will be too high for plant growth and *P. oceanica* will not be able to attach itself. The degree of exposure to wave action may be a limiting factor for *P. oceanica* meadow growth in shallow waters; in sheltered waters seagrass meadows may extend until virtually the water surface, whereas on exposed, open coasts, meadows will usually start growing at depths of several metres below the surface.

According to the EU Habitat Interpretation manual (version EUR27), *Posidonia* meadows are defined as: *Meadows of Posidonia oceanica (Linnaeus) Delile characteristic of the infralittoral zone of the Mediterranean (depth: ranging from a few tens of centimetres to 30 - 40 metres, and exceptionally, slightly deeper). On hard or soft substrata, these meadows constitute one of the main climax communities. They can withstand relatively large variations in temperature and water movement, but are sensitive to low or fluctuating salinities, generally requiring a salinity of between 36% and 39%.*

Dense and healthy *Posidonia oceanica* meadows cover large areas of bottom off the Maltese coasts and extend to considerable depths, in places down to 43-44m (Borg & Schembri, 1995). However, at some sites where there is a strong anthropogenic influence, *P. oceanica* meadows have regressed or have been extirpated altogether (Borg & Schembri, 1995; Schembri, 1995).

Off the north and northeast coasts of Malta and Gozo, isolated patches of *P. oceanica* usually appear at the 3-4m depth contour, while continuous meadows usually become established at a depth of approximately 7-8m on soft sediment. Where submarine boulder fields occur on predominantly sedimentary bottoms or where there are rocky outcrops surrounded by sand, *P. oceanica* may also grow on rock, provided that a veneer of sediment is present. Continuous meadows in very shallow water (1-3 m) are only found in the more sheltered bays and inlets.

The Malta-Comino and Comino-Gozo Channels have particularly dense and healthy meadows. One of the deepest records of *P. oceanica* from the Maltese Islands (and also one of the deepest records for the whole of the Mediterranean) is off the south-western coast of Comino Island, where sparse meadows occur at a depth of ca 43-44m (Borg & Schembri, 1995).

In the Maltese Islands, *P. oceanica* meadows occur as two main subtypes: the continuous meadows and the reticulate or non-continuous meadows; the latter are meadows in which

seagrass meadows are intermixed with channels and areas of more or less bare sediment or bedrock. At both the upper and lower depth limits, reticulate meadows tend to break up into small patches of seagrass that intergrade with adjacent biotopes. Extensive patches of matte may also contain channels free of seagrass that elongate and finally amalgamate to form 'intermatte channels'. These channels may in turn contain layers of dead leaves and other decomposing organic debris. *P. oceanica* may also form other structures such as '*collines*', which are small hill-like patches of *P. oceanica*, surrounded by bare sand.

P. oceanica 'barrier reefs' occur at Mellieha Bay (Borg & Schembri, 1993) and Salina Bay. These reefs are characterised by a thick layer of matte (at least 1m), and healthy *P. oceanica* shoots forming extensive stands over considerable areas of the matte. Such reefs mostly occur where conditions for growth of *P. oceanica* are ideal and where vast areas of sandy sediments are readily available. In a fully developed reef, the matte usually originates close to the shore and extends out to sea. Depths across the surface of the reef remain relatively constant when compared with the depth profile of the uncolonised substratum. This is because the thickness of the matte makes up for any increase in depth of the actual bottom. Matte as high as 2.5 m has been recorded in several places. Generally, a reef also extends for a considerable distance parallel to the shore. A second type of *P. oceanica* reef does not originate close to the shoreline but at some distance away. Such reefs may grow up to the surface until the taller shoots die back because they are exposed to the air by wave action or sea level fluctuations. The dimensions of both types of reef can be such than they act as wave breakers protecting the inner regions of bays and coves.

P. oceanica meadows provide important ecological functions and have been shown to harbour a highly diverse biota. A conspicuous and complex epiphytic community composed of micro-algae and numerous species of invertebrates can be found on the leaves of *P. oceanica*. Sessile fauna found in seagrass meadows include hydroids, bryozoans, foraminifera, and the conspicuous fan mussel *Pinna nobilis*, as well as filter feeding polychaetes. The most abundant faunal groups present in seagrass meadows are however molluscs, polychaetes and crustaceans, followed by echinoderms (e.g. sea urchins, starfish, sea cucumbers). Many mobile species migrate from the rhizomes into the canopy at night. Many species of fish rely on seagrass meadows as a critical habitat where they shelter during their juvenile stage and in fact several species of commercial importance use *P. oceanica* meadows as nursery habitats.

It is suggested that for monitoring purposes only, continuous *P. oceanica* meadows as described above are considered. Reticulate or non-continuous meadows have a variable morphology and may not have clear cut boundaries and will be more difficult to monitor due to their patchy nature. As such they are not suitable habitats for the implementation of long term monitoring strategies.

Information on the location of seagrass meadows in the Maltese Islands is available from previous studies (GAS and MEPA, 2003; Borg et al., 2009). It is obviously not possible to consider every example of continuous seagrass meadow that occurs in the Maltese Islands. For reasons of practicality and resource availability, it is suggested that representative examples are instead selected for monitoring. It is further suggested that such representative examples are chosen to be located within existing marine SACs. Some Maltese SACs are subject to a variety of anthropogenic activities within or close to their boundaries, which include most of the range of such activities in the Maltese Islands that are expected to have an impact on the marine environment unless well

managed. Such activities include: coastal development, coastal tourism infrastructure, coastal and marine recreational activities including water sports and diving, boating, recreational and commercial fishing, effluent from sewage treatment plants, effluent from desalination plants, other effluents, bunkering, and aquaculture.

If the *P. oceanica* meadows to be monitored are selected carefully such that they are within proximity of the above potential stressors, then if monitoring reveals no adverse impact, this can be taken as indicative of the general condition, since other seagrass meadows would be less likely to be impacted as they are more remote from potential stressors.

All attributes outlined below will have inherent sources of variability which need to be taken into account when devising a monitoring strategy and, subsequently, when analysing and interpreting data. An in-depth discussion of such sources of variability lies outside the scope of the present assignment but an important generic issue which needs to be taken into account when designing a suitable monitoring strategy is seasonality. *P. oceanica* growth patterns and the presence of epiphytes, for instance, are all parameters which show strong seasonality. It is therefore suggested that monitoring is always carried out at the same time of the year, ideally during the summer months when prevailing weather conditions are the most suitable.

The following discussions assume the above restrictions and conditions.

2. Indictors of Conservation Status

2.1 Range

The natural range of a habitat can be described as the approximate spatial limits within which the habitat occurs. An important distinction is to be made between the actual, precise area or areas occupied by a habitat, which is a local parameter (see point 'b' below), and the natural range of the habitat, which is a regional parameter. The natural range of a habitat is a dynamic parameter since it is able to expand or decrease but such changes take place on a timescale of decades or longer and are usually only indirectly influenced by natural factors or human activities (e.g. the range of a shallow water habitat may expand or decrease due to warming of surface water, in turn related to the anthropogenic release of greenhouse gases); such phenomena are beyond the scope of the present assignment and will not be considered here.

According to EU Explanatory Notes and Guidelines for assessment and reporting under Article 17 of the Habitats Directive (Evans and Arvela, 2011), the following factors should be taken into account when estimating the Favourable Reference Range of a habitat:

- Current range status
- Potential extent of range taking into account physical and ecological conditions
- Historic range and causes of change
- Area required for viability of habitat

- Variability including genetics

Consequently, an assessment of range status should include the following steps:

a) Mapping the range of seagrass habitats and quantifying the area occupied by the habitat.

In the case of *P. oceanica* meadows, 'range' may be taken as a decrease or increase in the area of the seabed covered by continuous seagrass meadows in the Maltese Islands. Moreover, 'range' should be interpreted as both the horizontal (i.e. in the same narrow depth range) and the bathymetric boundaries of seagrass meadows. The indicator here would be a change in area as compared to a baseline; for the horizontal range select areas from the seagrass habitat survey carried out by GAS and MEPA (2003) could be used as a baseline reference for comparative purposes but with a repeat survey carried out to confirm the validity of the spatial distribution of seagrass in the selected areas.

It is suggested that remote high resolution seabed mapping is used to map the horizontal extent of *P. oceanica* meadows. In addition transects should be established along the depth gradient of the *P. oceanica* meadows, covering the bathymetric range of this habitat from deep to shallow water in order to monitor the vertical meadow extent. In order to monitor the change in abundance of *P. oceanica* with depth, the locations of the upper (shallow water) and lower (deep water) boundaries should be identified and shoot shoot density should be determined within random quadrats placed along the transects. 'Range' would then be monitored in terms of any changes in the meadow extent and shoot density along the bathymetric transect.

Monitoring the upper and lower range limits of *P. oceanica* meadows in such a manner will deliver robust indicators of meadow range since most adverse impacts will usually be detected near meadow boundaries and in shoot density values (for example changes in water clarity will affect the lower depth limit of meadows).

b) Reviewing any available information on both short and long term trends in the range of the habitat.

Trend directions should be classified as stable, increasing, decreasing or unknown with reference to suitable reference values (for instance annual change of ≥ 10-20% of habitat range).

As outlined above, in the case of *P. oceanica* meadows, range should be interpreted as both the horizontal and the bathymetric boundaries of the seagrass meadows and, possibly of some of the more characteristic associated biota such as the large conspicuous fan mussel *Pinna nobilis*. In order to accurately monitor trends it must be clear whether the 'meadow border' being monitored refers to the depth limit of individual shoots or to the depth limit of the meadow. If the latter is chosen, the meadow must be defined precisely. Due to the large variability in shoot density and percentage cover found in meadows as a result of natural patchiness it is suggested that shoot density changes are measured by carrying out shoot counts in permanent quadrats. This will allow

for the early detection of changes in range since the uncertainty introduced by natural meadow patchiness will have been eliminated.

The range of seagrass meadows will have to be monitored on an ongoing basis (i.e. at regular intervals) in order to detect changes as a result of adverse impacts. The suggested indicator of range trends is any change from baseline conditions as established during the baseline monitoring exercise.

2.2 Area

This parameter refers to the actual area occupied by a habitat; a habitat may have a patchy distribution within the natural range of the habitat.

According to EU Explanatory Notes and Guidelines for assessment and reporting under Article 17 of the Habitats Directive (Evans and Arvela, 2011), a Favourable Reference Area (FRA) refers to the total surface area in a given biogeographic region considered the minimum necessary to ensure the long-term viability of the habitat type. In addition the FRA must be at least the surface area when the Directive came into force, i.e. in 2004 in the case of the Maltese Islands.

An assessment of area status should include the following steps:

a) Mapping the current surface area of the habitat

The baseline mapping exercise for seagrass meadows as outlined above will provide the range status for these habitats in the Maltese Islands in general. The surface area of those continuous seagrass meadows selected for monitoring should subsequently be mapped in detail using the same methods as those outlined to map habitat range above.

b) Reviewing any available information on both short and long term trends in the surface area occupied by the habitat

Trend directions should be classified as stable, increasing, decreasing or unknown with reference to suitable reference values (for instance annual change of ≥ 10-20% of habitat range).

The indicative baseline information available for the *P. oceanica* meadows in the Maltese Islands, but with a repeat survey carried out to confirm the validity of the spatial distribution of the seagrass in the areas selected for monitoring, can be used to estimate if the area of this habitat has shown changes in spatial extent since 2003 (GAS and MEPA, 2003).

Changes in the horizontal extent of seagrass meadows determined by remote sensing could be estimated using GIS techniques. Changes in the bathymetric limits of the meadows selected for monitoring could be estimated by using permanent transects, and monitoring any changes along them using SCUBA diving.

Subsequent repeat benthic mapping of the same areas as for those monitored for the baseline (see step 1 above) will reveal any changes in the overall spatial extent of the monitored seagrass meadows.

2.3 Structure and Function

One of the key factors when assessing the status of habitats listed under Annex I is that the specific structure and functions which are necessary for the habitat's long-term maintenance exist, and are likely to continue to exist for the foreseeable future. This attribute thus refers to characteristic habitat structure as well as to associated characteristic species.

In order to evaluate this parameter, structures and functions need to be evaluated in light of:

a) Main pressures affecting habitats

Relevant examples of pressures affecting seagrass meadows in the Maltese Islands should be identified; pressure codes in line with the categories given in the standard list of the EC Reporting Guidelines should be given. Where relevant a pollution qualifier in line with EC Reporting Guidelines should in addition be identified.

Seagrass meadows are in particular sensitive to changes in water chemistry such as enrichment with organic matter and nutrients and in sedimentation dynamics. High levels of dissolved nutrients due to sewage pollution, fish-farm effluents, or agricultural runoff will accelerate the growth of epiphytic algae, which will in turn lead to excessive shading of seagrass leaves. In addition excessively high levels of organic matter may produce anoxia and high levels of hydrogen sulphide in sediments and ultimately lead to meadow regression. Coastal developments, dredging and land reclamation activities may in places change the sedimentation dynamics seagrass meadows are exposed to; dumping of dredged material will have an impact when there is spillage during transport, as will sediment-rich plumes from coastal developments. Whilst *P. oceanica* may be able to cope with small increases in the rate of sedimentation, it will be overwhelmed if the rate of sedimentation is too high; therefore meadows are sensitive to any changes in sedimentation regimes including those brought about by changes in current patterns, which may in turn be caused by coastal development at times far from the actual meadow. A further threat to seagrass meadows is the increase in salinity near desalinisation plants since *P. oceanica* is very sensitive to changes in salinity levels. Meadows in areas which are frequently visited by boats may be impacted by the mechanical damage to the seagrass caused by boat anchors. Chains attached to anchors/moorings may in addition form characteristic bare circles in *P. oceanica* meadows, which can persist for a considerable periods of time. In some cases the removal of considerable amounts of seagrass will alter current conditions, further enhancing meadow clearing. Bottom fishing, in particular bottom trawl fishing with the traditional 'gangmu' gear, may also cause the removal of *P. oceanica* shoots. Finally the proliferation of invasive algal species such as *Lophocladia lallemandii*, and *Caulerpa racemosa* may affect seagrass meadows. Although dense healthy meadows may not be impacted, they may enhance meadow decline at sites where other perturbations are already causing problems since these algae will compete for space and light with *P. oceanica* and may hinder meadow regeneration.

Pressures causing a gradual worsening of condition (including changes in water chemistry, sedimentation dynamics and the proliferation of invasive algal species) should be distinguished from pressures with obvious drastic impacts (e.g. mechanical damage caused by anchors, bottom fishing)

b) Current habitat condition

As is the case for biogenic reefs, the framework of a seagrass meadow is constructed by the habitat forming species, in this case the *P. oceanica* plants. Seagrass meadows can be thus be characterised in terms of the engineering species, the associated non-engineering algae and invertebrates, and the associated sessile / mobile fauna, including both invertebrates and fish. The current condition of seagrass meadows can be measured using indicators such as (i) the bathymetric range of the seagrass meadow being monitored, (ii) shoot density, (iii) leaf parameters, (iv) epiphyte biomass, (v) presence / absence of rare species of conspicuous associated species such as the fan mussel *Pinna nobilis.*

A decline in habitat condition can be inferred from changes taking place along upper and lower meadow limits; monitoring meadow borders, and possibly 'reticulation' (as the ratio of seabed covered with seagrass to that without within a non-continuous meadow) will provide robust indicators of stressors such as increased levels of eutrophication, siltation etc. Similarly a decrease in shoot density may be noted in seagrass meadows subject to increased environmental stress, including higher water column turbidity. Foliar parameters may also be altered in stressed conditions; low leaf area index values have been recorded in several stressed seagrass meadows in the Mediterranean. Increased epiphyte biomass levels will show increased levels of epiphyte growth, which in turn indicate increased levels of nutrients (for instance as a result of pollution from sewage/fish farm effluents or agricultural runoff) and thus a worsening of habitat condition. However care needs to be taken when interpreting the latter indicator since an important variable to consider when using epiphyte levels for monitoring purposes is the presence of grazers. In moderately polluted bays, grazer control of epiphyte biomass may in fact mask effects of nutrient enrichment. Interactions between seagrasses, grazers and epiphytes are complex and poorly understood.

A final consideration when designing a seagrass monitoring programmes is the fact that meadow parameters will have to be measured at the same depth in order to compare between one monitoring survey and another; as depth increases, meadow parameters (shoot density, epiphyte biomass etc.) as well as the hydrodynamic regime, change.

2.4 Future Prospects

Based on the definition of FCS for habitat types in Article 1 of the Habitats Directive, assessment of a habitat's conservation status needs to refer to its likely future prospects with regards to the habitat's range, the area covered and specific structures and functions. This attribute thus builds on the parameters assessed above.

In order to assess the future prospects, the following should be considered:

a) Main threats to habitat

The main threats to the habitat over the next two reporting periods (i.e. 12 years) should be identified based on assessment of trends, or if only limited data is available, based on expert opinion.

b) Likely future habitat range, area, condition

Based on the assessment of the main threats, the likely future habitat range, area and condition may be predicted using expert judgement, in order to project the likely future prospects of the habitat.

D. Reefs (Habitat 1170)

1. Habitat Description

Reefs are either rocky marine habitats where animal and plant communities grow on raised or protruding rock (**geogenic reefs**) or biological concretions where the structure is created by the biota themselves (**biogenic reefs**). They are generally sublittoral, but may extend as an unbroken transition to the littoral zone, where their upper reaches may be exposed to the air at low tide or, locally, due to sea-level fluctuation.

According to the EU Habitat Interpretation manual (version EUR27), reefs can be defined as: *Submarine, or exposed at low tide, rocky substrates and biogenic concretions, which arise from the seafloor in the sublittoral zone but may extend into the littoral zone where there is an uninterrupted zonation of plant and animal communities. These reefs generally support a zonation of benthic communities of algae and animal species including concretions, encrustations and corallogenic concretions.*

Reefs are very variable both in form (drop-offs, vertical rock walls, rock or boulder fields etc.) and in terms of the communities they support (attached algae, invertebrates, fish) and thus this Annex I category is in fact composed of a complex of different biotopes. Indeed, some reef biotopes have been included in Annex I of the Habitats Directive in their own right (e.g. *Posidonia* 'barrier reefs').

There is a far greater range and extent of rocky reefs than biogenic concretions. These range from vertical rock walls rising from the seabed to the surface and beyond (the underwater continuation of coastal cliffs), drop-offs (underwater cliffs) which may be sheer or stepped (Pirotta & Schembri, 1997a), rocky shoals (in Maltese: *sikka*) which are the equivalent of underwater hills or raised plateaus protruding from a more or less level bottom, and boulder fields. The common feature between these different forms is that a more or less vertical rock face arises from a level bottom that may be sedimentary or rocky, and that due to the steep gradient, the biotic assemblages present are characterised by attached algae and invertebrates, quite often showing a distinct zonation with photophilic species on the lighted upper reaches of the reef, and progressively sciaphilic ones in the darker lower regions. The situation may be much more complex since particular physiographic features such as the presence of crevices, ledges, patches of sediment and screes will support additional assemblages associated with these microhabitats. In addition, a high diversity of sessile and mobile fauna, as well as of fish is usually associated with rocky reefs.

In the context of the Maltese 25 nautical mile FMZ, species able to develop biogenic reefs are mainly encrusting coralline algae that are able to form raised layered structures on the substratum or to consolidate loose substratum material into a massive concretion. Other species such as bryozoans and vermetid gastropods may contribute to these structures. The seagrass *Posidonia oceanica* also gives rise to raised structures from the seabed composed of rhizomes, roots and sediment ('matte'); in special circumstances such raised structures form a platform rising almost to the surface, creating a lagoon like enclosed body of water between the platform and the shore. Such formations have been described as 'barrier reefs', which also occur in the Maltese Islands

(Pirotta & Schembri 1997b), although they are rare. These are considered under Annex I Habitat 1120, *Posidonia* beds (see above).

A review of the EUNIS classification system shows that a number of biotopes of the EUNIS classification constitute or are components of reefs as defined above.

It is obvious from the foregoing that it is not practical to consider all possible 'reef habitats' in the Maltese Islands. Therefore it is suggested that for geogenic reefs, only the following main types are considered:

1. The submarine part of emergent vertical rock faces (0-50m);
2. Drop-offs (to a depth of 50m);
3. The tops of rocky shoals;
4. Boulder fields (to a depth of 50m).

Only a limited number of invertebrate species are able to form biogenic concretions, and as a result biogenic reefs are more limited in distribution and extent compared to geogenic reefs.

The main types of Mediterranean bioconcretions include littoral bioconcretions formed by coralline algae, vermetid reefs, polychaete reefs, *Cladocora caespitosa* reefs, coralligene, bryozoan reefs, and deep water coral frameworks. Of these, polychaetes reefs (formed by *Ficopomatus enigmaticus* and *Sabellaria alveolata*) have not been recorded from the Maltese Islands, whereas although *Cladocora caespitosa* occurs, in the Maltese islands it does so only as individual colonies that do not coalesce to form a reef. So far, no true coralligene has been identified in Maltese waters, and what occurs is the pre-coralligenous which is transitional between sciaphilic assemblages dominated by erect algae and the true coralligene formed by frame-work building coralline algae. Bryozoan reefs have also not been recorded from the Maltese Islands.

Therefore three main types of biogenic reefs have been identified to occur locally:

1. Littoral crusts, rims and knobs formed by coralline algae;
2. Vermetid platforms (trottoirs);
3. Deep water coral frameworks (*Madrepora* and *Lophelia* reefs).

It is obviously not possible to consider every example of the above geogenic and biogenic reef types that occur in the Maltese Islands. For reasons of practicality and resource availability, it is suggested that representative examples of each be selected for monitoring. With the exception of deep water coral biogenic reefs, it is further suggested that such representative examples are chosen to be located within existing marine SACs. Some Maltese SACs are subject to a variety of anthropogenic activities within or close to their boundaries, which include most of the range of such activities in the Maltese Islands that are expected to have an impact on the marine environment unless well managed. Such activities include: coastal development and quarrying, coastal tourism infrastructure, coastal and marine recreational activities including water sports and diving, boating, recreational and commercial fishing, effluent from sewage treatment plants, effluent from desalination plants, bunkering areas and aquaculture.

If the reefs to be monitored are selected carefully such that they are within proximity of the above potential stressors, then if monitoring reveals no adverse impact, this can be taken as indicative of

the general condition, since other reefs would be less likely to be impacted as they are more remote from potential stressors.

All attributes outlined below will have inherent sources of variability which need to be taken into account when devising a monitoring strategy and, subsequently, when analysing and interpreting data. An in-depth discussion of such sources of variability lies outside the scope of the present assignment but an important generic issue which needs to be taken into account when designing a suitable monitoring strategy is seasonality. All marine communities, in particular communities found in shallower waters, exhibit seasonal changes. Examples of seasonal effects include variations in size-frequency distributions, changes in diversity and abundance of algal species etc. Since seasonal effects are not fully understood in the local context due to a lack of sufficient information, it is suggested that monitoring is always carried out at the same time of the year, ideally during summer months when prevailing weather conditions are the most suitable.

The following discussions assume the above restrictions and conditions.

2. Indicators of Conservation Status

2.1 Range

The natural range of a habitat can be described as the approximate spatial limits within which the habitat occurs. An important distinction is to be made with the actual, precise area or areas occupied by a habitat, which is a local parameter (see point b) below), and the natural range of the habitat, which is a regional parameter. The natural range of a habitat is a dynamic parameter since it is able to expand and decrease but such changes take place on a timescale of decades or longer and are usually only indirectly influenced by human activities (e.g. the range of a shallow water habitat may expand or decrease due to warming of surface water, in turn related to the anthropogenic release of greenhouse gases); such phenomena are beyond the scope of the present assignment and will not be considered here.

According to EU Explanatory Notes and Guidelines for assessment and reporting under Article 17 of the Habitats Directive (Evans and Arvela, 2011), the following factors should be taken into account when estimating the Favourable Reference Range of a habitat:

- Current range status
- Potential extent of range taking into account physical and ecological conditions
- Historic range and causes of change
- Area required for viability of habitat
- Variability including genetics (in the case of biogenic reefs only)

Consequently, an assessment of range status should include the following steps:

a) Mapping the range of reef habitats and quantifying the area occupied by the habitat.

i) Geogenic Reefs

In the case of the four types of geogenic reefs, this would be a one-off exercise since these reefs are geological features for which the concept of 'range' does not apply. Once the location of the four reef types in Maltese waters is established, monitoring will check if there is a diminishment of the area of the reefs (area is only likely to decrease due to natural or anthropogenic catastrophes, and not increase, since all geogenic reef types are large-scale geomorphological structures).

Given that the key characteristic of all reef types is a change of illumination with depth brought about in part by the attenuation of solar radiation by seawater and in part by the shading effect of the sloping substratum (since all reefs are 'protrusions'), it is suggested that permanent transects be established along the depth gradient of the reef (that is, from deep to shallow water) and the percentage cover of the dominant algae and plant-like animals (since biocoenoses in the EUNIS classification system are based on the dominant algae and in some cases, sponges, anthozoans, bryozoans and other sessile animals) be determined using quadrats along the transect. For reefs located in waters deeper than 30 m the use of video-transects and photographic quadrats is advisable. 'Range' would then be monitored in terms of any changes in the percentage cover of these key species along the bathymetric transect.

In the case of the top of rocky shoals, it will not be possible to establish a bathymetric line transect since the top of the shoal is likely to have only a gentle slope, so in this case, random quadrat counts of the more or less horizontal bedrock of the shoal top may be taken.

ii) Biogenic Reefs

In the case of biogenic reefs, 'range' may be taken as a decrease or increase in the length of shoreline, or area of the seabed covered by the reef and the indicator here would be a change in length/area as compared to a baseline. It is therefore necessary to establish such a baseline by mapping the spatial distribution of the three biogenic reef types in the Maltese Islands.

In the case of littoral crusts, rims and knobs formed by coralline algae and of vermetid platforms, these occur in the mediolittoral zone and uppermost infralittoral. Surveying these structures is a matter of mapping these structures along the shoreline of the islands, which can be done from the shore in the case of accessible shorelines or from a boat where shore access is difficult. Such surveys will need to be repeated at intervals, either all along the shore or at specified sections of shore, and the results compared to the baseline.

Deep water coral frameworks are found in the circalittoral zone or deeper (upper bathyal) waters. Mapping the extent of these bioconstructions in water of such depth (300-600m) requires sophisticated equipment and is expensive. Nonetheless, the distribution of living coral frameworks within the 25 NM FMZ is now fairly well known as a result of three oceanographic cruises in the area (MARCOS, 2007, MEDCOR 2009 and DECORS 2011; Taviani et al., 2011). The distribution map produces as a result of these cruises forms a baseline against which any future re-surveys of the area may be compared.

b) Reviewing any available information on both short and long term trends in the range of the habitat.

Trend directions should be classified as stable, increasing, decreasing or unknown with reference to suitable reference values (for instance annual change of ≥ 10-20% of habitat range).

i) Geogenic Reefs

'Range' is interpreted as above, that is, the bathymetric distribution of the key species defining the various assemblages along the bathymetric gradient as determined by transect counts along permanent transects on the four types of biogenic reefs.

For the species assemblages (the biotic component of the reef habitat) that occur on the geogenic structures, the suggested indicator of trends in range is any change from baseline conditions as established during a baseline monitoring exercise.

ii) Biogenic Reefs

In the case of biogenic reefs 'range' should be interpreted as both the horizontal and the vertical distribution of the key reef forming species and, possibly some of the more characteristic associated biota.

For littoral algal crusts bioconstructions and for vermetid platforms, the horizontal extent will be given by the baseline surveys outlined in (a) above; the vertical extent of the bioconstructions can be determined by estimating the abundance or cover of the constructor species along transects from the top of the reef to its lower extent. This may be done at selected stations along the coast.

Given that the deep water coral frameworks known from the Maltese Islands occur on the vertical faces of deep escarpments, cover needs to be estimated from video transects using an ROV.

Unlike geogenic reefs, the range of biogenic reefs will have to be monitored on an ongoing basis in order to detect changes as a result of adverse impacts. However as is the case for geogenic reefs, the suggested indicator of range trends is any change from baseline conditions as established during a baseline monitoring exercise.

2.2 Area

This parameter refers to the actual area occupied by a habitat; a habitat may have a patchy distribution within the natural range of a habitat.

According to EU Explanatory Notes and Guidelines for assessment and reporting under Article 17 of the Habitats Directive (Evans and Arvela, 2011), a Favourable Reference Area (FRA) refers to the total surface area in a given biogeographic region considered the minimum necessary to

ensure the long-term viability of the habitat type. In addition the FRA must be at least the surface area when the Directive came into force, i.e. in 2004 in the case of the Maltese Islands.

An assessment of area status should include the following steps:

a) Mapping the current surface area of the habitat

The baseline mapping exercise for the geogenic and biogenic reefs outlined above will provide the area status for these reef habitats in the Maltese Islands in general. Benthic mapping of defined areas of selected examples of each of the reef types will give the spatial extent of each main habitat type (biocoenoses) within the area mapped.

b) Reviewing any available information on both short and long term trends in the surface area occupied by the habitat

Trend directions should be classified as stable, increasing, decreasing or unknown with reference to suitable reference values (for instance annual change of ≥ 10-20% of habitat range).

In the absence of any quantitative data on the spatial extent of the different habitats that occur on geogenic reefs as well as on the extent of the distribution of most types of biogenic reefs in the Maltese Islands, expert judgement needs to be resorted to in order to determine if the area of such habitats has shown any changes since at least 2004.

Subsequent repeat benthic mapping of the same areas as for the baseline (see step 1 above) will reveal any changes in the spatial extent of the main biocoenoses.

2.3 Structure and Function

One of the key factors when assessing the status of habitats listed under Annex I is that the specific structure and functions which are necessary for the habitat's long-term maintenance exist, and are likely to continue to exist for the foreseeable future. This attribute thus refers to characteristic habitat structure as well as to associated characteristic species.

In order to evaluate this parameter, structures and functions need to be evaluated in light of:

a) Main pressures affecting habitats

Relevant examples of pressures affecting reef habitats in the Maltese Islands should be identified; pressure codes in line with the categories given in the standard list of the EC Reporting Guidelines should be given. Where relevant a pollution qualifier in line with EC Reporting Guidelines should in addition be identified.

i) Geogenic Reefs

In the case of geogenic reefs two main types of pressures should be distinguished in this context: (1) pressures which affect the physical structure of the reef (which are likely to be catastrophic events such as for instance a large tanker running aground on a shoal, or the collapse of part of a submarine rock face) or (2) those that will affect the species living on a reef (due to pressures such as fishing, anchoring, pollution etc.).

ii) Biogenic Reefs

Reefs which are the result of biogenic concretions deposited by reef-building organisms will be primarily affected by pressures which have an impact on these species. Pressures affecting biogenic reefs may be causing a gradual worsening of reef condition (for instance due to pollution), or in the case of adverse changes due to particular activities or disturbances (such as for instance from bottom fishing or anchoring), have more obvious impacts.

b) Current habitat condition

An important contributor to the structure a reef habitat is its species composition. The presence or absence as well as the relative abundance of characterising species will allow inferences to be made about the current condition of the habitat. The current condition of the habitat can thus be monitored using indicators such as (i) number of algal species, (ii) number of fauna species associated with the habitat, (iii) presence / absence of rare species of algae or fauna, (iv) total coverage of macro-algae, (v) coverage of specific species of algae, and (vi) coverage of key faunal species where applicable.

i) Geogenic Reefs

Once baseline quadrat studies of the percentage cover of the dominant algae and plant-like animals have been made (see above under ‘Range’), it will be possible to determine the chief species assemblages (biocoenoses) that occur on each type of reef.

The most cost-effective indicator of condition of these habitats would be the percentage cover of the habitat-defining species, and their relative abundance within the quadrats. Since these species are the dominant species found on the reef (in terms of size and abundance), any changes in their populations would be expected to have repercussions on the associated species.

Monitoring the dominants is far easier (in terms of cost and time) than monitoring any other of the potential indicators listed above and would not involve extensive laboratory work or require detailed taxonomic knowledge.

ii) Biogenic Reefs

The framework of biogenic reefs is constructed by the relevant reef-forming species; the biocenoses of biogenic reefs and can be characterised in terms of the engineering species, the associated non-engineering algae and invertebrates, and the associated mobile fauna, including both invertebrates and fish. It is suggested that monitoring of the population structure and condition

of the reef-forming species and of selected associated species is carried out in the same manner as that outlined for the biotic components of geogenic reefs, Again, for deep-water coral reefs, remote methods, such as photographic quadrats or video transects will need to be used.

When designing the appropriate monitoring plan, particular emphasis should be placed on selecting those species which form an important structural element of the biocenosis, and which are thus indicative of the structural integrity of the biogenic reef habitat being monitored. In order to monitor such characteristic species adequately, indicators should include estimates of population size (density / cover indices) and population structure (size / age frequency distributions).

Monitoring of cryptic and endobiotic species, in particular at depth, will require destructive as well as expensive sampling techniques. Taking this into consideration monitoring such species is discouraged at this point in time.

2.4 Future Prospects

Based on the definition of FCS for habitat types in Article 1 of the Habitats Directive, assessment of a habitat's conservation status needs to refer to its likely future prospects with regards to the habitat's range, the area covered and specific structures and functions. This attribute thus builds on the parameters assessed above.

In order to assess the future prospects, the following should be considered:

a) Main threats to habitat

The main threats to the habitat over the next two reporting periods (i.e. 12 years) should be identified based on assessment of trends, or if only limited data is available, based on expert opinion.

b) Likely future habitat range, area, condition

Based on the assessment of the main threats, the likely future habitat range, area and condition may be predicted using expert judgement, in order to project the likely future prospects of the habitat.

E. Sea Caves (Habitat 8330)

1. Habitat Description

Both submerged and partially submerged (= emergent) caves are common in the Maltese Islands. In addition, other cave-like environments present include tunnels (caves open at both ends), deep overhangs (concavities that penetrate a considerable distance into the rock) and clefts (large, deeply-penetrating irregular fissures in the rock). Where boulder fields with multiple layers of massive boulders are present, the spaces between the boulders also give rise to a cave-like environment, although these last are not regarded as caves. They can vary in size, from small caves measuring only a few metres to extensive tunnel systems extending into the rock.

According to the EU Habitat Interpretation manual (version EUR27), partially submerged caves can be defined as: *Caves situated under the sea or open to it, including partially submerged sea caves. Their bottoms and sides harbour communities of marine invertebrates and algae.*

Locally, some caves arise by the direct action of the sea on the limestone rock at sea-level, where the force of the waves develops fissures in the rock into clefts, which eventually become caves and tunnels. This effect is enhanced if the water carries abrasive suspended material. Other caves originated on land due to karst-fluvial processes and then became totally or partially submerged due to changes in sea-level or due to tectonic movement. Some such caves continue above sea-level as terrestrial caves, and some may have freshwater seepages that give rise to a distinct halocline inside them (e.g. Ghar Harq Hamiem). Some caves are formed by a combination of processes, both terrestrial and marine.

Biotic communities found in marine caves vary depending on the size and structure of caves, the degree to which they are submerged, the geology of the cave and the degree of exposure to waves / currents and sediment scour. In general, there are three distinct zones in the deeper (in the sense of penetration into the rock) marine caves[10]: an outer section where some light penetrates and allows the growth of photophilic algae at the mouth and progressively more sciaphilic species further inwards from the mouth; a middle section dominated by sessile invertebrates (sponges, corals, tubicolous polychaetes, bryozoans, hydroids, brachiopods, foraminifera) with a few sciaphilic algae, almost all encrusting corallines; and a completely dark inner section largely devoid of sessile organisms. This pattern results from the strong environmental gradients that exist, especially in light intensity and turbulence, as one proceeds inwards from the cave mouth. The spatial extent of these three life-zones depends on a number of physiographic features, including depth (below sea-level) of the cave, aspect of the mouth, size and configuration of the mouth, depth (penetration into the rock) of the cave. Other factors that may also determine the type of biotic assemblages present include temperature, the presence of haloclines, the presence of side-branches, ledges and other geomorphological features in the cave itself, and the nature of the cave floor, which may be rock or may be covered with sediment that in

[10] Marine caves are here taken to mean either fully submerged caves or the submerged part of emergent caves. The terrestrial and supralittoral to mediolittoral component of emergent caves is not considered.

turn may be coarse to very fine. The floor of local partially submerged caves tends to be strewn with pebbles, cobbles and small boulders, resulting from roof-falls.

A further distinction which can be made is between cave biotopes which contain short-lived species and biotopes which contain long-lived species. The former will be found in caves subject to scouring (by suspended sediment,), which are often smaller caves still in the process of being formed, whilst the latter will be found in cave systems which have remained undisturbed for extended periods.

Caves are thus complex habitats with a variety of biotopes. One of the most scientifically interesting features of caves in relatively shallow water is that the sciaphilic assemblages that live in them consist predominantly of the same species as the circalittoral assemblages found in deeper waters (beyond 40-50m depth). In a sense therefore, the very steep light gradients present in caves allow normally circalittoral species to occur within the infralittoral zone where they are accessible using normal SCUBA techniques.

It is obvious from the foregoing that it is not practical to consider the entire range of structural and ecological variation of marine caves that exist in the Maltese Islands. Moreover it may be difficult to decide at which point a large crevice or an overhang can be considered to form a marine cave.

It is suggested that sites which have well developed gradations in community composition from the entrance to the inner parts of the cave should be given priority when selecting cave monitoring sites. Long-lived species present in such undisturbed cave systems are more suitable targets for long term monitoring than short-lived species found in marine caves subject to stronger wave action and scouring. Caves which such less well developed assemblages may contain ephemeral species undergoing succession; one species may be superseded by another in the time period between monitoring events due to natural ecological processes. It is thus suggested that the following types of marine caves are monitored:

1. Submerged marine caves with a well developed marine cave system
2. Partially submerged marine caves with a well developed marine cave system

It is obviously not possible to consider every example of the above types of marine caves that occur in the Maltese Islands. For reasons of practicality and resource availability, it is suggested that representative examples of each be selected for monitoring. It is further suggested that such representative examples are chosen to be located within existing marine SACs. Some Maltese SACs are subject to a variety of anthropogenic activities within or close to their boundaries, which include most of the range of such activities in the Maltese Islands that are expected to have an impact on the marine environment unless well managed. Such activities include: coastal development and quarrying, coastal tourism infrastructure, coastal and marine recreational activities including water sports and diving, boating, recreational and commercial fishing, effluent from sewage treatment plants, effluent from desalination plants, bunkering areas and aquaculture. Moreover, representative examples should be chosen to be located close to SCUBA diving sites since this activity is likely to impact marine cave habitats.

If the caves to be monitored are selected carefully such that they are within proximity of the above potential stressors, then if monitoring reveals no adverse impact, this can be taken as indicative of the general condition, since other caves would be less likely to be impacted as they are more remote from potential stressors.

All attributes outlined below will have inherent sources of variability which need to be taken into account when devising a monitoring strategy and, subsequently, when analysing and interpreting data. An in-depth discussion of such sources of variability lies outside the scope of the present assignment but an important generic issue which needs to be taken into account when designing a suitable monitoring strategy is seasonality. Although marine caves are less likely to show strong seasonal changes than other marine habitats, some seasonal changes in the biotic assemblages at the entrance of marine caves as well as seasonal changes in community structure following settlement and recruitment of biota may occur. Since seasonal effects are not fully understood in the local context due to a lack of sufficient information it is suggested that monitoring is always carried out at the same time of the year, ideally during the summer months when prevailing weather conditions are the most suitable.

The following discussions assume the above restrictions and conditions.

2. Indictors of Conservation Status

2.1 Range

The natural range of a habitat can be described as the approximate spatial limits within which the habitat occurs. An important distinction is to be made between the actual, precise area or areas occupied by a habitat, which is a local parameter (see point ‘b’ below), and the natural range of the habitat, which is a regional parameter. The natural range of a habitat is a dynamic parameter since it can expand and decrease but such changes take place on a timescale of decades or longer and are usually only indirectly influenced by human activities (e.g. the range of a shallow water habitat may expand or decrease due to warming of surface water, in turn related to the anthropogenic release of greenhouse gases); such phenomena are beyond the scope of the present assignment and will not be considered here.

According to EU Explanatory Notes and Guidelines for assessment and reporting under Article 17 of the Habitats Directive (Evans and Arvela, 2011), the following factors should be taken into account when estimating the Favourable Reference Range of a habitat:

- Current range status
- Potential extent of range taking into account physical and ecological conditions
- Historic range and causes of change
- Area required for viability of habitat
- Variability including genetics of biotic components

Consequently, an assessment of range status should include the following steps:

a) Mapping the range of marine cave habitats and quantifying the area occupied by the habitat.

In the case of marine caves, this would be a one-off exercise since these caves are geological features for which the concept of 'range' does not apply.

Once the location of the two cave types in Maltese waters is established, monitoring will help check if there is a diminishment of the area of the caves. Area is likely to increase as a result of erosion, and decrease as a result of collapse; both phenomena are important in the Maltese Islands due to the abundance of soft rocks. Dimensions such as depth (relative to sea-level), floor width, wall height and wall bearings measured across the floor will be useful measurements. Moreover, measures of cross-section at pre-determined points will serve as useful baseline reference measurements for future surveys.

Given that the key characteristic of marine caves is a change of illumination with increased penetration into the rock, it is suggested that permanent transects be established along the penetration gradient of the cave (that is, from the cave entrance to the inner parts of the cave) and the percentage cover of selected dominant algae and sessile animals be determined using quadrats along the transect.

Note that, for emergent caves, two transects may need to be established, one in the 'mediolittoral' of the cave and one in the 'infralittoral', if the biota close to the air/water interface is to be monitored as well as the submerged biota.

The use of video-transects and/or photographic quadrats is advisable in order to have a permanent record of characteristic features and species which can be referred to in future monitoring surveys. For caves located in waters deeper than 30 m the use of such techniques will be a necessity.

'Range' would then be monitored in terms of any changes in the percentage cover of the monitored species along the transects.

b) Reviewing any available information on both short and long term trends in the range of the habitat.

Trend directions should be classified as stable, increasing, decreasing or unknown with reference to suitable reference values (for instance annual change of ≥ 10-20% of habitat range).

The total number of existing marine caves is unlikely to change significantly over time. However anthropogenic activity (e.g. coastal development) and natural events (e.g. cliff erosion, storms) may lead to the creation / loss of marine caves so periodic monitoring will be necessary.

Habitat 'range', as interpreted above, is the distribution of the selected indicator species defining the three key zones found along the light penetration gradient as determined by transect counts along permanent transects in the two types of marine caves.

For the species assemblages (the biotic component of the cave habitat) that occur in marine caves, the suggested indicator of trends in range is any change from baseline conditions as established during a baseline monitoring exercise.

2.2 Area

This parameter refers to the actual area occupied by a habitat; a habitat may have a patchy distribution within the natural range of a habitat.

According to EU Explanatory Notes and Guidelines for assessment and reporting under Article 17 of the Habitats Directive (Evans and Arvela, 2011), a Favourable Reference Area (FRA) refers to the total surface area in a given biogeographic region considered the minimum necessary to ensure the long-term viability of the habitat type. In addition, the FRA must be at least the surface area when the Directive came into force, i.e. in 2004 in the case of the Maltese Islands.

An assessment of area status should include the following steps:

a) Mapping the current surface area of the habitat

The baseline mapping exercise for the marine caves outlined above will provide the area status for these cave habitats in the Maltese Islands in general. Mapping of the biotic assemblages of defined areas of selected examples of each of the marine cave types will give the spatial extent of the main biocoenoses within the area mapped.

b) Reviewing any available information on both short and long term trends in the surface area occupied by the habitat

Trend directions should be classified as stable, increasing, decreasing or unknown with reference to suitable reference values (for instance annual change of ≥ 10-20% of habitat range).

In the absence of any quantitative data on the spatial extent of the different biocoenoses that occur in marine caves as well as on the extent of the distribution of marine caves in the Maltese Islands, expert judgement needs to be resorted to in order to determine if the area of such habitats has shown any changes since at least 2004.

Subsequent repeat benthic mapping of the same areas as for the baseline (see step 1 above) will reveal any changes in the spatial extent of the main biocoenoses.

2.3 Structure and Function

One of the key factors when assessing the status of habitats listed under Annex I is that the specific structure and functions which are necessary for the habitat's long-term maintenance exist, and are likely to continue to exist for the foreseeable future. This attribute thus refers to characteristic habitat structure as well as to associated characteristic species.

In order to evaluate this parameter, structures and functions need to be evaluated in light of:

a) Main pressures affecting habitats

Relevant examples of pressures affecting marine cave habitats in the Maltese Islands should be identified; pressure codes in line with the categories given in the standard list of the EC Reporting Guidelines should be given. Where relevant, a pollution qualifier in line with EC Reporting Guidelines should in addition be identified.

In the case of marine caves, two main types of pressures should be distinguished in this context: (1) pressures which affect the physical structure of the cave (which are likely to be catastrophic events, such as the collapse of part of a cave roof or of a submarine rock face); (2) those that will affect the species living in a marine cave (due to pressures such as SCUBA diving, pollution, sedimentation, fishing (e.g. illegal red coral harvesting) etc.).

b) Current habitat condition

An important contributor to the structure of marine cave habitats is the species composition. In the outer part of marine caves where light penetrates, photophilic algae will be present. These species will gradually be replaced by sciaphilic species such as coralline algae as the amount of ambient light gradually diminishes. Deeper into the cave, sessile invertebrates will begin to dominate until in the innermost parts of the cave which will be in total darkness such sessile organisms will be very sparse.

The presence or absence, the relative abundance, and zonation of characterising species will allow inferences to be made about the current condition of the habitat. The current condition of the habitat can thus be monitored using indicators such as (i) the ratio of selected groups of flora to selected groups of fauna present in the different cave zones, (ii) the ratio of total abundance of species of fleshy and coralline algae present, (iii) presence / absence and or coverage of selected indicator species (see EUNIS habitat categories A4.712 – A4.715).

Once baseline quadrat studies of the dominant biota have been made (see above under 'Range'), it will be possible to determine the chief species assemblages (biocoenoses) that occur in each of the three main cave zones.

The most cost-effective indicator of condition of these habitats would be the percentage cover of the habitat-defining species, and their relative abundance within the quadrats. Since these species are the dominant species found in the cave (in terms of size and abundance), any changes in their populations would be expected to have repercussions on the associated species.

Monitoring selected indicator species is far easier (in terms of cost and time) than monitoring any other of the potential indicators listed above and would not involve extensive laboratory work or require detailed taxonomic knowledge.

2.4 Future Prospects

Based on the definition of FCS for habitat types in Article 1 of the Habitats Directive, assessment of a habitat's conservation status needs to refer to its likely future prospects with regards to the habitat's range, the area covered and specific structures and functions. This attribute thus builds on the parameters assessed above.

In order to assess the future prospects, the following should be considered:

a) Main threats to habitat

The main threats to the habitat over the next two reporting periods (i.e. 12 years) should be identified based on assessment of trends, or if only limited data is available, based on expert opinion.

b) Likely future habitat range, area, condition

Based on the assessment of the main threats, the likely future habitat range, area and condition may be predicted using expert judgement, in order to project the likely future prospects of the habitat.

F. Maerl Beds

1. Habitat Description

The term ‘maerl’ refers to biogenic sediments characterised by accumulations of live and dead unattached coralline algae in the form of rhodoliths. The rhodolith-forming algae can take the form of nodules in which a central inorganic core (a piece of gravel or a dead shell) becomes encrusted by the coralline alga that completely covers the core and then forms multiple layers around it, or else the rhodoliths may be formed entirely of the coralline alga and have no core. Rhodliths can therefore have morphologies ranging from unbranched encrustations to densely branched thalli to open branched thalli, with many intermediate forms.

In the Maltese Islands the main local rhodolith formers in maerl beds are *Lithothamnion minervae* and *Lithothamnion coralloides* with other species (*Phymatolithon calcareum*, *Lithophyllum racemus*, *Mesophyllum alternans, Neogoniolithon brassica-florida* and *Peyssonnelia rosa-marina*) as minor components. The complex structure of maerl beds provides a unique and heterogeneous habitat which supports a high benthic diversity, including several rare and unusual species.

Depending on the proportion of rhodoliths covering the bottom, rhodolith-containing sediments may form rhodolith beds or maerl beds. Rhodoliths are dense and carpet the bottom with interlocking rhodoliths in ‘maerl beds’, whilst on ‘rhodolith bottoms’ rhodoliths are sparse. In the latter habitat, rhodoliths may form local accumulations or may be dispersed as single rhodoliths amongst other sediment components. The precise composition of rhodolith bottoms will vary from place to place and may do so gradually, without clear cut boundaries. Apart from the same rhodolith-forming species listed for ‘maerl beds’, a variety of other species completely coat large sediment granules such as pebbles to formed ‘cored rhodoliths’ in which the volume of the core is much more than the volume of the algal encrustations; such encrusting species include: *Lithophyllum incrustans*, *Lithothamnion valens*, *Mesophyllum alternans* and *Sporolithon ptychoides*.

Maerl is a habitat that requires light for the coralline algae to be able to photosynthesise, albeit in quite low intensities. As a result, in the Maltese Islands it occurs transitionally between the lower infralittoral and the upper circalittoral depth zones, at depths of app. 40 – 110 m. Another key prerequisite for maerl beds to form is sufficient currents and water motion to prevent rhodolith burial.

Maerl beds can thus be defined as: *Seabeds populated by species of calcareous rhodophytes (mostly Corallinaceae but also Peyssonneliacea) in the form of biogenic structures called rhodoliths, which are unattached branched, twig-like or nodular growths. In maerl beds the rhodoliths, form extensive carpets on sediments such as sands, muddy mixed sediments or fine gravels in areas with sufficient water movement to prevent rhodolith burial. Maerl beds are generally composed of living and dead rhodoliths in varying proportions which are present in sufficient quantities that rhodoliths are the most conspicuous component of the superficial sediment; the depth at which maerl wtih live rhodoliths occurs is limited by light since coralline algae require light to photosynthesise.*

Maerl beds can build up over millennia and often have a high benthic species diversity and productivity, with some species confined to the maerl habitat or rarely found elsewhere. They are ecologically highly significant since dense rhodolith beds provide an important habitat for a variety of marine flora and fauna which live amongst, or are attached to, the nodules or which burrow in the sediments underneath the upper living rhodoliths layer. Maerl habitats thus provide numerous ecological niches for epibenthic, epiphytic, cryptic and infaunal species. In particular, maerl beds may be critical habitats for commercially exploited species since they act as nursery areas for juvenile stages of commercial species of fish, crustaceans and molluscs.

It is suggested that for monitoring purposes only circalittoral 'maerl beds' as described above are considered. Rhodolith beds will have variable concentrations of rhodoliths and may not have clear cut boundaries, and may change in the time period between one monitoring event and another due to natural factors, such as storms, particularly in shallow water. As such they are not suitable habitats for the implementation of long term monitoring strategies.

Although rhodolith-bottoms have been found in several locations around the Maltese Islands, only one true maerl bed (found at 'is-Sikka l-Bajda', located off the north-eastern coast of Malta) has been to date been mapped and studied in detail (Sciberras et al, 2009). Sciberras et al. (2009) determined the spatial extent, the physical characteristics as well as the taxonomic and functional diversity of this maerl habitat.

All attributes outlined below will have inherent sources of variability which need to be taken into account when devising a monitoring strategy and, subsequently, when analysing and interpreting data. An in-depth discussion of such sources of variability lies outside the scope of the present assignment but an important generic issue which needs to be taken into account when designing a suitable monitoring strategy is seasonality. All marine communities, in particular communities found in coastal waters, exhibit seasonal changes. An example of such a seasonal effect which Sciberras et al. (2009) found in the maerl bed off is-Sikka l-Bajda is the composition of macro-invertebrate assemblages, which differed significantly across seasons. Since seasonal effects are not fully understood in the local context due to a lack of sufficient information, it is suggested that monitoring is always carried out at the same time of the year, ideally during the summer months when prevailing weather conditions are the most suitable.

The following discussions assume the above restrictions and conditions.

2. Indictors of Conservation Status

2.1 Range

The natural range of a habitat can be described as the approximate spatial limits within which the habitat occurs. An important distinction is to be made between the actual, precise area or areas occupied by a habitat, which is a local parameter (see point 'b' below), and the natural range of the habitat, which is a regional parameter. The natural range of a habitat is a dynamic parameter since

it is able to expand and decrease but such changes take place on a timescale of decades or longer and are usually only indirectly influenced by human activities (e.g. the range of a shallow water habitat may expand or decrease due to warming of surface water, in turn related to the anthropogenic release of greenhouse gases); such phenomena are beyond the scope of the present assignment and will not be considered here.

According to EU Explanatory Notes and Guidelines for assessment and reporting under Article 17 of the Habitats Directive (Evans and Arvela, 2011), the following factors should be taken into account when estimating the Favourable Reference Range of a habitat:

- Current range status
- Potential extent of range taking into account physical and ecological conditions
- Historic range and causes of change
- Area required for viability of habitat
- Variability including genetics of the main rhodolith forming species

Consequently, an assessment of range status should include the following steps:

a) Mapping the range of maerl habitats and quantifying the area occupied by the habitat.

In the case of maerl beds, 'range' may be taken as a decrease or increase in the area of the seabed covered by the maerl bed and the indicator here would be a change in area as compared to a baseline. The extent of the maerl bed should be determined by mapping the presence of maerl either on a grid (with the size of the grid squares varying depending on the size of the maerl bed) or along a series of transects placed over the habitat. It is however important to note that maerl beds are dynamic habitats and that as such minor boundary changes will occur on a continuous basis due to natural seabed dynamics.

Whist indicative baseline information exists for the maerl bed at is-Sikka l-Bajda, it will be necessary to establish the boundaries of any additional potential maerl beds in the Maltese Islands by mapping their spatial distribution (in particular the maerl bed found off the south-eastern coast of Malta, which has not yet been fully characterised). Moreover the aim of Sciberras et al. (2009) was not to create a precise map of the boundaries of the maerl bed studies and indeed the study used 12 transects set 1 nautical mile apart with stations along each transect set 0.5 nautical miles apart. In order to monitor whether the area of the seabed covered by the maerl bed is increasing or decreasing a more detailed map would be required.

The suggested methodology to map and subsequently monitor the extent of the maerl bed is a combination of underwater video surveying using an ROV, taking Van Veen grab samples and taking underwater photographs at pre-determined stations along a series of permanent transects. The use of remote surveying techniques is necessary since in the Maltese Islands maerl beds may extend too deep to be able to carry out surveys by SCUBA diving without employing special techniques. Alternatively the use of multibeam echosounder techniques could be explored, although such technology is likely to be more expensive to use (see Micallef et al. 2012 for an

application of benthic habitat mapping using high-resolution multibeam data to the Maltese Islands).

b) Reviewing any available information on both short and long term trends in the range of the habitat.

Trend directions should be classified as stable, increasing, decreasing or unknown with reference to suitable reference values (for instance annual change of ≥ 10-20% of habitat range).

In the case of maerl beds, range should be interpreted as both the horizontal and bathymetric distribution of the key rhodolith-forming species and, possibly, some of the more characteristic associated biota. However, the most indicative parameter of 'range' is bathymetric range. It is thus suggested that bathymetric transects are extablished and that the composition of the live rhodolith to sediment ratio is quantified. Based on a predetermined cut-off point (for instance 55% : 45% live rhodoliths : sediment) the maerl bed range could be established. Monitoring would subsequently establish if there are any changes where the shallow cut-off (in effect where the maerl bed starts) and the deep cut-off (in effect where the bed ends) occur. The philosophy behind this is that any changes in the marine environment (increased turbidity, for example) will be reflected in a change in these boundaries.

Since the amount of light reaching maerl beds is a key factor in determining maerl bed range it is suggested that water column turbidity is included in any monitoring programme. This parameter can easily be measured by using a Secchi disc to estimate the degree of light penetration.

The range of maerl beds will have to be monitored on an ongoing basis in order to detect changes as a result of adverse impacts. The suggested indicator of range trends is any change from baseline conditions as established during baseline monitoring exercise.

2.2 Area

This parameter refers to the actual area occupied by a habitat; a habitat may have a patchy distribution within the natural range of a habitat.

According to EU Explanatory Notes and Guidelines for assessment and reporting under Article 17 of the Habitats Directive (Evans and Arvela, 2011), a Favourable Reference Area (FRA) refers to the total surface area in a given biogeographic region considered the minimum necessary to ensure the long-term viability of the habitat type. In addition the FRA must be at least the surface area when the Directive came into force, i.e. in 2004 in the case of the Maltese Islands.

An assessment of area status should include the following steps:

a) Mapping the current surface area of the habitat

The baseline mapping exercise for maerl beds as outlined above will provide the area status for these habitats in the Maltese Islands in general.

b) Reviewing any available information on both short and long term trends in the surface area occupied by the habitat

Trend directions should be classified as stable, increasing, decreasing or unknown with reference to suitable reference values (for instance annual change of ≥ 10-20% of habitat range).

The indicative baseline information available for the maerl bed at is-Sikka l-Bajda can be used to estimate if the area of this habitat has shown changes in spatial extent since 1996-1998. Information on the extent of rhodoliths located off the south-eastern coast of Malta is available from Dimech et al. (2004). However in the absence of quantitative data on the precise spatial extent of the maerl bed in the southeast of Malta, expert judgement needs to be resorted to in order to determine if the area of such habitats has shown any changes since at least 2004.

Subsequent repeat benthic mapping of the same areas as for those monitored for the baseline (see step 1 above) will reveal any changes in the spatial extent of the monitored maerl beds.

2.3 Structure and Function

One of the key factors when assessing the status of habitats listed under Annex I is that the specific structure and functions which are necessary for the habitat's long-term maintenance exist, and are likely to continue to exist for the foreseeable future. This attribute thus refers to characteristic habitat structure as well as to associated characteristic species.

In order to evaluate this parameter, structures and functions need to be evaluated in light of:

a) Main pressures affecting habitats

Relevant examples of pressures affecting maerl habitats in the Maltese Islands should be identified; pressure codes in line with the categories given in the standard list of the EC Reporting Guidelines should be given. Where relevant a pollution qualifier in line with EC Reporting Guidelines should in addition be identified.

Maerl beds are particularly sensitive to increases in suspended sediment and smothering, which will prevent light reaching the rhodophytes and thus hinder photosynthesis. Moreover maerl beds are vulnerable to physical disturbances since rhodoliths grow very slowly; the impact of damage due to physical disturbances such as bottom fishing for example are long lasting since maerl beds will only recover very slowly (if at all). Whilst increased turbidity of the water column is likely to result in a gradual worsening of maerl bed condition, adverse changes due to particular activities or disturbances (such as for instance from trawl fishing), will have more obvious impacts.

b) Current habitat condition

As is the case for biogenic reefs, the framework of a maerl bed is constructed by the habitat forming species, in this case non-attached rhodophytes. Maerl beds can be thus be characterised in terms of the engineering species, the associated non-engineering algae and invertebrates, and the associated mobile fauna, including both invertebrates and fish. An important contributor to the structure a maerl bed is the composition of associated species. The presence or absence as well as the relative abundance of selected indicator species will allow inferences to be made about the current condition of the habitat.

The current condition of maerl habitats can thus be monitored using indicators such as (i) number of rhodolith-forming rhodophyte species and their relative abundance, (ii) number of fauna species associated with the habitat, (iii) presence / absence of rare species of algae or fauna, (iv) total coverage of macro-algae, (v) coverage of specific species of algae, and (vi) coverage of key faunal species where applicable.

An additional parameter to consider when assessing the habitat condition of a maerl bed is whether the presence / absence as well as the relative proportions of live and dead rhodoliths. In particular, the three dimensional structure of maerl beds, including the depth distribution of live and dead rhodoliths, may serve as a useful indicator of maerl bed condition.

Since maerl beds are sensitive habitats it is important to minimise damage as much as possible, in particular if small maerl beds are being monitored.

2.4 Future Prospects

Based on the definition of FCS for habitat types in Article 1 of the Habitats Directive, assessment of a habitat's conservation status needs to refer to its likely future prospects with regards to the habitat's range, the area covered and specific structures and functions. This attribute thus builds on the parameters assessed above.

In order to assess the future prospects of each of the parameters:

a) Main threats to habitat

The main threats to the habitat over the next two reporting periods (i.e. 12 years) should be identified based on assessment of trends, or if only limited data is available, based on expert opinion.

b) Likely future habitat range, area, condition

Based on the assessment of the main threats, the likely future habitat range, area and condition may be predicted using expert judgement, in order to project the likely future prospects of the habitat.

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VI. APPENDIX I – HABITAT CROSS-REFERENCING TABLES

Only habitats relevant to the Maltese Islands for which habitat descriptions are provided in the manual and for which corresponding categories were identified in the EUNIS classification system are listed in the cross-referencing tables of Appendix I; new habitat categories proposed for inclusion due to their local importance are not considered.

A. Mediolittoral

EUNIS	RAC/SPA	Habitats Directive	MSFD
A1.13 Mediterranean and Black Sea communities of upper mediolittoral rock	II.4.1 Biocenosis of upper mediolittoral rock	n/a	Littoral rock and biogenic reef
A1.131 Association with [Bangia atropurpurea]	II.4.1.1 Association with Bangia atropurpurea	n/a	Littoral rock and biogenic reef
A1.132 Association with [Porphyra leucosticta]	II.4.1.2 Association with Poryphera leucosticta	n/a	Littoral rock and biogenic reef
A1.134 Association with [Lithophyllum papillosum] and [Polysiphonia] spp.	II.4.1.4 Association with Lithophyllum papillosum and Polysiphonia spp.	1170 Reefs	Littoral rock and biogenic reef
A1.14 Mediterranean and Black Sea communities of lower mediolittoral rock very exposed to wave action	II.4.2 Biocenosis of lower mediolittoral rock	n/a	Littoral rock and biogenic reef
A1.141 Association with [Lithophyllum byssoides]	II.4.2.1 & II.4.2.2 Association with Lithophyllum lichenoides & Association with Lithophyllum	1170 Reefs	Littoral rock and biogenic reef

	byssoides		
A1.23 Mediterranean communities of lower mediolittoral rock moderately exposed to wave action	II.4.2 Biocenosis of lower mediolittoral rock	1170 Reefs	Littoral rock and biogenic reef
A1.231 Association with [Ceramium ciliatum] and [Corallina elongata]	II.4.2.4 Association with Ceramim cilatum and Corallina elongata	n/a	Littoral rock and biogenic reef
A1.232 [Neogoniolithon brassica-florida] concretion	II.4.2.8 Neogoniolithon brassica-florida concretion	n/a	Littoral rock and biogenic reef
A1.233 Association with [Gelidium] spp	II.4.2.9 Association with Gelidium spp.	n/a	Littoral rock and biogenic reef
A1.234 Pools and lagoons sometimes associated with [Vermetus] spp. (infralittoral enclave)	II.4.2.10 Pools and lagoons sometimes associated with vermetids	1170 Reefs	Littoral rock and biogenic reef
A1.34 Mediterranean communities of lower mediolittoral rock sheltered from wave action	II.4.2 Biocenosis of lower mediolittoral rock	n/a	Littoral rock and biogenic reef
A1.341 Association with [Enteromorpha compressa]	II.4.2.6 Association with Enteromorpha compressa		Littoral rock and biogenic reef
A1.44 Communities of littoral caves and overhangs	II.4.3 Mediolittoral caves	8330 Submerged or partially submerged sea caves	Littoral rock and biogenic reef
A1.448 Faunal crusts on wave-surged littoral cave walls	II.4.3.1 Association with Phymatolithon lenormandii and Hildebrandia rubra	8330 Submerged or partially submerged sea caves	Littoral rock and biogenic reef
A2.13	II.3.1		

Mediterranean communities of mediolittoral coarse detritic bottoms	Biocenosis of mediolittoral coarse detritic bottoms	n/a	Littoral sediment
A2.131 Facies of banks of dead leaves of [Posidonia oceanica] and other phanerogams	II.3.1.1 Facies of banks of dead leaves of Posidonia oceanica and other phanerogams	n/a	Littoral sediment
A2.2 Littoral sand and muddy sand	II.1.1 Biocenosis of muddy sands and mud	n/a	Littoral sediment
A2.25 Mediterranean and Pontic communities of mediolittoral sands	II.2.1 Biocenosis of mediolittoral sands	n/a	Littoral sediment
A2.251 Facies with [Ophelia bicornis]	II.2.1.1 Facies with Ophelia bicornis	n/a	Littoral sediment

B. Infralittoral

EUNIS	RAC/SPA	Habitats Directive	MSFD
A3.13 Mediterranean and Pontic communities of infralittoral algae very exposed to wave action	III.6.1 Biocenosis of infralittoral algae	n/a	Shallow sublittoral rock and biogenic reef
A3.131 Overgrazing facies with incrustant algaes and sea urchins	III.6.1.1 Overgrazed facies with enrusting algae and sea urchins	n/a	Shallow sublittoral rock and biogenic reef
A3.132 Association with [Cystoseira amentacea] (var. [amentacea], var. [stricta], var. [spicata])	III.6.1.2 Association with *Cystoseira amentacea*	n/a	Shallow sublittoral rock and biogenic reef
A3.133 Facies with [Vermetus] spp.	III.6.1.3 Facies with vermetids	1170 Reefs	Shallow sublittoral rock and biogenic reef
A3.134 Mediterranean and Pontic facies with [Mytilus galloprovincialis]	III.6.1.4 Facies with *Mytilus galloprovincialis*	n/a	Shallow sublittoral rock and biogenic reef
A3.135 Association with [Corallina elongata] and [Herposiphonia secunda]	III.6.1.5 Association with *Corallina elongata* and *Herposiphonia secunda*	n/a	Shallow sublittoral rock and biogenic reef
A3.137 Association with [Schottera nicaeensis]	III.6.1.29 Association with *Schottera nicaeensis*	n/a	Shallow sublittoral rock and biogenic reef
A3.23 Mediterranean and Pontic communities	III.6.1 Biocenosis of infralittoral algae	n/a	Shallow sublittoral rock and biogenic

of infralittoral algae moderately exposed to wave action			reef
A3.231 Association with [Codium vermilara] and [Rhodymenia ardissonei]	III.6.1.7 Association with *Codium vermilaria* and *Rhodymenia ardissonei*	n/a	Shallow sublittoral rock and biogenic reef
A3.232 Association with [Dasycladus vermicularis]	III.6.1.8 Association with *Dasycladus vermicularis*	n/a	Shallow sublittoral rock and biogenic reef
A3.237 Mediterranean and Pontic Association with [Ceramium rubrum]	III.6.1.13 Association with *Ceramium rubrum*	n/a	Shallow sublittoral rock and biogenic reef
A3.238 Facies with [Cladocora caespitosa]	III.6.1.14 Facies with *Cladocora caespitosa*	n/a	Shallow sublittoral rock and biogenic reef
A3.239 Association with [Cystoseira brachycarpa]	III.6.1.15 Association with *Cystoseira brachycarpa*	n/a	Shallow sublittoral rock and biogenic reef
A3.23A Mediterranean and Pontic Association with [Cystoseira crinita]	III.6.1.16 Association with *Cystoseira crinita*	n/a	Shallow sublittoral rock and biogenic reef
A3.23B Association with [Cystoseira crinitophylla]	III.6.1.17 Association with *Cystoseira crinitophylla*	n/a	Shallow sublittoral rock and biogenic reef
A3.23D Association with [Cystoseira spinosa]	III.6.1.19 Association with *Cystoseira spinosa*	n/a	Shallow sublittoral rock and biogenic reef
A3.23E Association with [Sargassum vulgaris]	III.6.1.20 Association with *Sargassum vulgare*	n/a	Shallow sublittoral rock and biogenic reef
A3.23F Association with [Dictyopteris polypodioides]	III.6.1.21 Association with *Dictyopteris polypodioides*	n/a	Shallow sublittoral rock and biogenic reef

A3.23G Association with [Calpomenia sinuosa]	III.6.1.22 Association with *Calpomenia sinuosa*	n/a	Shallow sublittoral rock and biogenic reef
A3.23H Association with [Rhodymenia ardissonei] and [Rhodophyllis divaricata]	III.6.1.30 Association with *Rhodymenia petiolata* and *Rhodophyllis divaricata*	n/a	Shallow sublittoral rock and biogenic reef
A3.23I Facies with [Astroides calycularis]	III.6.1.31 Facies with *Astroides calycularis*	n/a	Shallow sublittoral rock and biogenic reef
A3.23J Association with [Flabellia petiolata] and [Peyssonnelia squamaria]	III.6.1.32 Association with *Flabellia petiolata* and *Peyssonnelia squamaria*	n/a	Shallow sublittoral rock and biogenic reef
A3.23K Association with [Halymenia floresia] and [Halarachnion ligatatum]	III.6.1.33 Association with *Halymenia floresia* and *Halarachnion ligulatum*	n/a	Shallow sublittoral rock and biogenic reef
A3.23L Association with [Peyssonnelia rubra] and [Peyssonnelia] spp.	III.6.1.34 Association with *Peyssonnelia rubra* and *Peyssonnelia* spp.	n/a	Shallow sublittoral rock and biogenic reef
A3.331 Association with [Stypocaulon scoparium] (=[Halopteris scoparia])	III.6.1.23 Association with *Stypocaulon scoparium* (= *Halopteris scoparia*)	n/a	Shallow sublittoral rock and biogenic reef
A3.333 Association with [Cystoseira compressa]	III.6.1.25 Association with *Cystoseira compressa*	n/a	Shallow sublittoral rock and biogenic reef
A3.334 Association with [Pterocladiella capillacea] and [Ulva laetevirens]	III.6.1.26 Association with *Pterocladiella capillacea* and *Ulva laetevirens*		Shallow sublittoral rock and biogenic reef
A3.335 Facies with large	III.6.1.27 Facies with large	n/a	Shallow sublittoral

Hydrozoa	Hydrozoa		rock and biogenic reef
A3.336 Association with [Pterothamnion crispum] and [Compsothamnion thuyoides]	III.6.1.28 Association with *Pterothamnion crispum* and *Compsothamnion thuyoides*	n/a	Shallow sublittoral rock and biogenic reef
A5.13 Infralittoral coarse sediment	III.3.1, III.3.2, III.4.1 Biocenosis of coarse sands and fine gravels mixed by the waves; Biocenosis of coarse sands and fine gravels under the influence of bottom currents; Biocenosis of infralittoral stones and pebb;es	n/a	Shallow sublittoral coarse sediment
A5.139 Facies with [Gouania wildenowi]	III.4.1.1 Facies with *Gouania wildenowi*	n/a	Shallow sublittoral coarse sediment
A5.235 Mediterranean communities of fine sands in very shallow waters	III.2.1 Biocenosis of fine sands in very shallow waters	n/a	Shallow sublittoral sand
A5.2351 Facies with [Lentidium mediterraneum]	III.2.1.1 Facies with *Lentidium mediterraneaum*	n/a	Shallow sublittoral sand
A5.236 Mediterranean communities of well sorted fine sands	III.2.2 Biocenosis of well-sorted fine sands	n/a	Shallow sublittoral sand
A5.28 Mediterranean communities of superficial muddy sands in sheltered waters	III.2.3 Biocenosis of superficial muddy sands in sheltered waters	n/a	Shallow sublittoral mixed sediment
A5.283 Facies with [Loripes lacteus], [Tapes]	III.2.3.3 Facies with *Loripes lacteus* and *Tapes*	n/a	Shallow sublittoral mixed sediment

spp.	spp.		
A5.284 Association with [Caulerpa prolifera] on superficial muddy sands in sheltered waters	III.2.3.6 Association with *Caulerpa prolifera* on superficially muddy sands in sheltered waters	n/a	Shallow sublittoral mixed sediment
A5.515 Association with rhodolithes in coarse sands and fine gravels under the influence of bottom currents	III.3.2.2 Association with rhodoliths	n/a	Shallow sublittoral mixed sediment
A5.52A Association with [Gracilaria] spp.	III.1.1.5 Association with *Gracilaria* spp.	n/a	Shallow sublittoral mixed sediment
A5.52D Association with [Ulva laetevirens] and [Enteromorpha linza]	III.1.1.9 Association with *Ulva laetevirens* and *Enteromorpha linza*	n/a	Shallow sublittoral mixed sediment
A5.53131 Association with [Cymodocea nodosa] on well sorted fine sands	III.2.2.1 Association with *Cymodocea nodosa* on well-sorted fine sands		Shallow sublittoral sand
A5.53132 Association with [Cymodocea nodosa] on superficial muddy sands in sheltered waters	III.2.3.4 Association with *Cymodocea nodosa* on superficially muddy sands in sheltered waters		Shallow sublittoral mixed sediment
A5.5322 Mediterranean [Halophila] beds	III.2.2.2 Association with *Halophila stipulacea*	n/a	Shallow sublittoral sand
A5.5342 Tethyan marine [Ruppia] communities	III.1.1.1 Association with *Ruppia cirrhosa* and/or *Ruppia maritima*	n/a	Shallow sublittoral mixed sediment
A5.535 [Posidonia] beds	III.5.1 Biocenosis of *Posidonia oceanica* meadows	1120 *Posidonia* beds (*Posidonia oceanica*)	Shallow sublittoral sand

A5.5352 Ecomorphosis of "barrier-reef" [Posidonia oceanica] meadows	III.5.1.2 Ecomorphosis of 'barrier reef' meadows	1120 *Posidonia* beds (*Posidonia oceanica*)	Shallow sublittoral sand
A5.5353 Facies of dead "mattes" of [Posidonia oceanica] without much epiflora	III.5.1.3 Ecomorphosis of dead matte without much epiflora	1120 *Posidonia* beds (*Posidonia oceanica*)	Shallow sublittoral sand
A5.5354 Association with [Caulerpa prolifera] on [Posidonia] beds	III.5.1.4 Association with *Caulerpa prolifera*	1120 *Posidonia* beds (*Posidonia oceanica*)	Shallow sublittoral sand

C. Circalittoral

EUNIS	RAC/SPA	Habitats Directive	MSFD
A4.26 Mediterranean coralligenous communities moderately exposed to hydrodynamic action	IV.3.1 Coralligenous biocenosis	1170 Reefs	Shelf sublittoral rock and biogenic reef
A4.261 Association with [Cystoseira zosteroides]	IV.3.1.1 Association with *Cystoseira zosteroides*	n/a	Shelf sublittoral rock and biogenic reef
A4.263 Association with [Cystoseira dubia]	IV.3.1.3 Association with *Cystoseira dubia*	n/a	Shelf sublittoral rock and biogenic reef
A4.264 Association with [Cystoseira corniculata]	IV.3.1.4 Association with *Cystoseira corniculata*	n/a	Shelf sublittoral rock and biogenic reef
A4.265 Association with [Sargassum] spp.	IV.3.1.5 Association with *Sargassum* spp. (indigenous)	n/a	Shelf sublittoral rock and biogenic reef
A4.266 Association with [Mesophyllum lichenoides]	IV.3.1.6 Association with *Mesophyllum lichenoides*	1170 Reefs	Shelf sublittoral rock and biogenic reef
A4.267 Algal bioconcretion with [Lithophyllum frondosum] and [Halimeda tuna]	IV.3.1.7 Association with *Lithophyllum frondosum* and *Halimeda tuna*	1170 Reefs	Shelf sublittoral rock and biogenic reef
A4.268 Association with [Laminaria ochroleuca]	IV.3.1.8 Association with Laminaria ochroleuca		Shelf sublittoral rock and biogenic reef
A4.269 Facies with [Eunicella cavolinii]	IV.3.1.10 Facies with *Eunicella cavolinii*	n/a	Shelf sublittoral rock and biogenic reef
A4.26A	IV.3.1.11		

Facies with [Eunicella singularis]	Facies with *Eunicella singularis*	n/a	Shelf sublittoral rock and biogenic reef
A4.26B Facies with [Paramuricea clavata]	IV.3.1.13 Facies with *Paramuricea clavata*	n/a	Shelf sublittoral rock and biogenic reef
A4.26C Facies with [Parazoanthus axinellae]	IV.3.1.14 Facies with *Parazoanthus axinellae*	n/a	Shelf sublittoral rock and biogenic reef
A4.26D Coralligenous platforms	IV.3.1.15 Coralligenous platforms	1170 Reefs	Shelf sublittoral rock and biogenic reef
A4.27 Faunal communities on deep moderate energy circalittoral rock	IV.3.3 Biocenosis of shelf-edge rock	n/a	Shelf sublittoral rock and biogenic reef
A4.32 Mediterranean coralligenous communities sheltered from hydrodynamic action	IV.3.1 Coralligenous biocenosis	1170 Reefs	Shelf sublittoral rock and biogenic reef
A4.321 Association with [Rodriguezella strafforelli]	IV.3.1.9 Association with *Rodriguezella strafforelli*	n/a	Shelf sublittoral rock and biogenic reef
A4.322 Facies with [Lophogorgia sarmentosa]	IV.3.1.12 Facies with *Lophogaria sarmentosa* (ex *Lophogaria ceratophyta*)	n/a	Shelf sublittoral rock and biogenic reef
A4.71 Communities of circalittoral caves and overhangs	IV.3.2 Semi-dark caves (also in enclave in upper stages)	8330 Submerged or partially submerged sea caves	Semi dark caves (also in enclave in upper stages)
A4.712 Caves and overhangs with [Parazoanthus axinellae]	IV.3.2.1 Facies with *Parazoanthus axinellae*	8330 Submerged or partially submerged sea caves	Semi dark caves (also in enclave in upper stages)
A4.713	IV.3.2.2	8330	

Caves and overhangs with [Corallium rubrum]	Facies with *Corallium rubbrum*	Submerged or partially submerged sea caves	Semi dark caves (also in enclave in upper stages)
A4.714 Caves and overhangs with [Leptopsammia pruvoti]	IV.3.2.3 Facies with *Leptopsammia pruvoti*	8330 Submerged or partially submerged sea caves	Semi dark caves (also in enclave in upper stages)
A4.715	V.3.2 Caves and ducts in total darkness (including caves withoutlight or water movement at upper levels)	8330 Submerged or partially submerged sea caves	Semi dark caves (also in enclave in upper stages)
A5.14 Circalittoral coarse sediment	IV.2.4 Biocenosis of coarse sands and fine gravels under the influence of bottom currents (biocenosis found in areas under specific hydrodunamic conditions - straits - ; also found in the infralittoral	n/a	Shelf sublittoral coarse sediment
A5.38 Mediterranean communities of muddy detritic bottoms	IV.2.1 Biocenosis of the muddy detritic bottom	n/a	Shelf sublittoral mud
A5.39 Mediterranean communities of coastal terrigenous muds	IV.1.1 Biocenosis of coastal terrigenous muds	n/a	Shelf sublittoral mud
A5.391 Facies of soft muds with [Turritella tricarinata communis]	IV.1.1.1 Facies of soft mud with *Turritella tricarinata*	n/a	Shelf sublittoral mud
A5.392 Facies of sticky muds with [Virgularia mirabilis]	IV.1.1.2 Facies of sticky muds with *Virgularia mirabilis* and	n/a	Shelf sublittoral mud

and [Pennatula phosphorea]	*Pennatula phosphorea*		
A5.393 Facies of sticky muds with [Alcyonium palmatum] and [Stichopus regalis]	IV.1.1.3 Facies of sticky muds with *Alcyonium palmatum* and *Stichopus regalis*	n/a	Shelf sublittoral mud
A5.46 Mediterranean animal communities of coastal detritic bottoms	IV.2.2 Biocenosis of the coastal detritic bottom	n/a	Shelf sublittoral mixed sediment
A5.461 Facies with [Ophiura texturata]	IV.2.2.8 Facies with *Ophiura texturata*	n/a	Shelf sublittoral mixed sediment
A5.462 Facies with Synascidies	IV.2.2.9 Facies with Synascides	n/a	Shelf sublittoral mixed sediment
A5.463 Facies with large Bryozoa	IV.2.2.10 Facies with large Bryozoa	n/a	Shelf sublittoral mixed sediment
A5.47 Mediterranean communities of shelf-edge detritic bottoms	IV.2.3 Biocenosis of shelf-edge detritic bottom	n/a	Shelf sublittoral mixed sediment
A5.471 Facies with [Neolampas rostellata]	IV.2.3.1 Facies with *Neolampas rostellata*	n/a	Shelf sublittoral mixed sediment
A5.472 Facies with [Leptometra phalangium]	IV.2.3.2 Facies with *Leptometra phalangium*	n/a	Shelf sublittoral mixed sediment
A5.51 Maerl beds	IV.2.2.2 Maerl facies (*Lithothamnion coralloides* and *Phymatholithon calcareum*)	n/a	Shelf sublittoral coarse sediment
A5.516 Association with rhodolithes on coastal detritic bottoms	IV.2.2.1 Association with rhodoliths		Shelf sublittoral mixed sediment

A5.52H Association with [Peyssonnelia rosa-marina]	IV.2.2.3 Association with *Peyssonnelia rosa-marina*	n/a	Shelf sublittoral mixed sediment
A5.52I Association with [Arthrocladia villosa]	IV.2.2.4 Association with *Arthrocladia villosa*	n/a	Shelf sublittoral mixed sediment
A5.52J Association with [Osmundaria volubilis]	IV.2.2.5 Association with *Osmundaria volubilis*	n/a	Shelf sublittoral mixed sediment

D. Bathyal

EUNIS	RAC/SPA	Habitats Directive	MSFD
A6.31 Communities of bathyal detritic sands with [Grypheus vitreus]	V.2.1 Biocenosis of bathyal detritic sands with Grypheus vitreus	n/a	Upper bathyal sediment
A6.51 Mediterranean communities of bathyal muds	V.1.1. Biocenosis of bathyal muds	n/a	Upper bathyal sediment
A6.511 Facies of sandy muds with [Thenea muricata]	V.1.1.1. Facies of sandy muds with *Thenea muricata*	n/a	Upper bathyal sediment
A6.512 Facies of fluid muds with [Brissopsis lyrifera]	V.1.1.2 Facies of flud muds with *Brissopsis lyrifera*	n/a	Upper bathyal sediment
A6.513 Facies of soft muds with [Funiculina quadrangularis] and [Apporhais seressianus]	V.1.1.3. Facies of soft muds with *Funiculina quadrangularis* and *Apporhais seressianus*	n/a	Upper bathyal sediment
A6.514 Facies of compact muds with [Isidella elongata]	V.1.1.4. Facies of compact muds with *Isidella elongata*	n/a	Lower bathyal sediment
A6.61 Communities of deep-sea corals	V.3.1. Biocenosis of deep sea corals	1170 Reefs	Upper / lower bathyal rock and biogenic reef
A6.621 Facies with [Pheronema grayi]	V.1.1.5. Facies with Pheronema grayi	n/a	Lower bathyal rock and biogenic reef

VII. APPENDIX II – INDICATOR SUMMARY TABLES

A. Sandbanks – Indicator Summary Table

To be provided after completion of fieldwork assignment.

B. Posidonia Beds – Indicator Sumary Table

Factor	Aspect	Method of Assessment	Comment
Range	Mapping range of habitat and quantifying occupied area	- Remote high resolution seabed mapping to be used to map and monitor the horizontal extent of *P. oceanica* meadows - Transects to be established along the depth gradient of *P. oceanica* to monitor vertical meadow extent - Shoot density to be determined withing quadrats placed along transects	- Monitoring to focus on upper and lower range limits of seagrass meadows - Baseline information available from GAS and MEPA (2003)
	Reviewing available information on trends	- Trend directions to be classified as stable, increasing, decreasing or unknown based on suitable reference values (e.g. annual change of ≥ 10-20% of habitat range) - Suggested indicator of range for *Posidonia* beds is any change from baseline conditions - Shoot density changes may best be monitored in permanent quadrats due to natural meadow patchiness	- Both changes in the range of *Posidonia* and of some of the more characteristic associated species may be monitored - 'Meadow border' must be clearly defined
Area	Mapping current surface area	- Baseline mapping of range to provide area status in general - Benthic mapping of selected examples to give spatial extent of main biocoenosis within mapped area	
	Reviewing available information on trends	- Trend directions to be classified as stable, increasing, decreasing or unknown based on suitable reference values (e.g. annual change of ≥ 10-20% of habitat surface area) - Subsequent repeat benthic mapping to reveal changes in spatial extent of *Posidonia* beds	- Survey carried out by GAS and MEPA (2003) could be used as a baseline reference for comparative purposes
Structure and Function	Main pressures affecting habitat	- Pressures affecting habitat to be identified and classified in line with standard EU reporting guidelines - Pressures causing a gradual worsening of condition (including changes in water chemistry, sedimentation dynamics and the proliferation of invasive algal	- Where relevant a polluter qualifier in line with EU reporting guidelines should be identified

		species) to be distinguished from pressures with obvious drastic impacts (e.g. mechanical damage caused by anchors, bottom fishing)	
	Current habitat condition	- The current condition of seagrass meadows can be measured using indicators such as (i) the bathymetric range of the seagrass meadows being monitored, (ii) shoot density, (iii) seagrass leaf area index (to be estimated based on counts of leaf number per shoot, leaf length, leaf width), (iv) percent cover, (vi) epiphyte biomass, (vii) presence / absence of selected conspicuous associated species	- Presence of grazers to be taken into account when monitoring epiphyte biomass - Meadow parameters to me measured at constant depth to enable comparison between sampling events
Future Prospects	Main threats	- To be identified based on assessment of trends of main threats affecting habitat	- Expert judgment may be required if only limited data is available
	Likely future trends	- Likely future habitat range, area and condition of habitat to be predicted based on assessment of the main threats	

C. Reefs – Indicator Sumary Table

Factor	Aspect	Method of Assessment	Comment
Range	Mapping range of habitat and quantifying occupied area	<u>Geogenic Reefs</u> - Baseline survey to establish habitat location in Maltese Islands - Selection of representative reefs to be monitored. - Establish permanent transects along depth gradient of reef and determine % cover of selected dominant biota using quadrats - Subsequent monitoring in terms of any changes in % cover of monitored species to establish if range is increasing / decreasing along bathymetric transect <u>Biogenic Reefs</u> - Baseline survey to establish habitat location in Maltese Islands - Map extent of three biogenic reef types - Selection of representative examples of each reef type to be monitored - Subsequent monitoring of change in size of biogenic reef compared to baseline to establish if range is increasing / decreasing	<u>Geogenic Reefs</u> - Top of rocky shoals to be monitored using random quadrat counts <u>Biogenic Reefs</u> - Deep water coral will require mapping / monitoring using remote sophisticated equipment
	Reviewing available information on trends	- Trend directions to be classified as stable, increasing, decreasing or unknown based on suitable reference values (e.g. annual change of ≥ 10-20% of habitat range) <u>Geogenic Reefs</u> - Suggested indicator of range for biotic component of reef habitat is any change from baseline conditions <u>Biogenic Reefs</u> - Suggested indicator of range for biotic component of reef habitat is	<u>Geogenic Reefs</u> - Geogenic reefs are geological features; occasional monitoring suffices <u>Biogenic Reefs</u> - Range of biogenic reefs

		any change from baseline conditions	to be monitored on ongoing basis to detect changes due to adverse impacts
Area	Mapping current surface area	- Baseline mapping of range to provide area status in general - Benthic mapping of selected examples to give spatial extent of main biocoenosis within mapped area	
	Reviewing available information on trends	- Trend directions to be classified as stable, increasing, decreasing or unknown based on suitable reference values (e.g. annual change of ≥ 10-20% of habitat surface area) - Subsequent repeat benthic mapping to reveal changes in spatial extent of main biocoenoses	- Expert judgment may be required to determine trends in habitat area since 2004
Structure and Function	Main pressures affecting habitat	- Pressures affecting habitat to be identified and classified in line with standard EU reporting guidelines <u>Geogenic Reefs</u> - Distinction should be made between (1) pressures affecting physical structure (2) pressures affecting species living on reef <u>Biogenic Reefs</u> - Pressures will primarily affect reef-building organisms - Pressures causing a gradual worsening of condition to be distinguished from pressures with obvious impacts	- Where relevant a polluter qualifier in line with EU reporting guidelines should be identified
	Current habitat condition	- Current condition of habitat can be monitored using indicators such as (i) number of algal species, (ii) number of fauna species associated with the habitat, (iii) presence / absence of rare species of algae or fauna, (iv) total coverage of macro-algae, (v) coverage of specific species of algae, and (vi) coverage of key faunal species	

		where applicable. <u>Geogenic Reefs</u> - Based on a determination of the chief biocoenoses occurring on a reef, determine cost effective indicator to monitor habitat defining dominant species - Suggested indicator is % cover of habitat-defining species and their relative abundance within quadrats <u>Biogenic Reefs</u> - Monitoring to emphasize those species which form an important structural element of the biocenosis and which thus indicate the structural integrity of the biogenic reef being monitored	<u>Geogenic Reefs</u> - Monitoring dominants is easier and cheaper than monitoring other species / indicators <u>Biogenic Reefs</u> - Monitoring of cryptic and endobiotic species will require expensive and destructive sampling and is thus not advisable
Future Prospects	Main threats	- To be identified based on assessment of trends of main threats affecting habitat	- Expert judgment may be required if only limited data is available
	Likely future trends	- Likely future habitat range, area and condition of habitat to be predicted based on assessment of the main threats	

D. Sea Caves – Indicator Sumary Table

Factor	Aspect	Method of Assessment	Comment
Range	Mapping range of habitat and quantifying occupied area	- Baseline survey to establish habitat location in Maltese Islands - Dimensions such as depth, floor width, wall height, wall bearings across floor to be measured - Establish permanent transects along light penetration gradient of cave - Monitor % cover of selected dominant algae and sessile fauna using quadrats along transect - Subsequent monitoring in terms of any changes in % cover of key species to establish if range is increasing / decreasing along transects	- For emergent caves two transects may be needed : one in the mediolittoral and one in the infralittoral - Use of video-transects and photographic quadrats advisable to keep permanent records and avoid distructive sampling - Use of video-transects and photographic quadrats necessary for caves beyond 30 m depth
	Reviewing available information on trends	- Trend directions to be classified as stable, increasing, decreasing or unknown based on suitable reference values (e.g. annual change of ≥ 10-20% of habitat range) - Suggested indicator of range for marine caves is distribution of the selected indicator species found along the light penetration gradient as determined by quadrat counts along permanent transects - Change from baseline conditions to be monitored	- Total number of caves unlikely to change but periodic monitoring necessary
Area	Mapping current surface area	- Baseline mapping of range to provide area status in general - Benthic mapping of selected examples to give spatial extent of main biocoenosis within mapped area	

	Reviewing available information on trends	- Trend directions to be classified as stable, increasing, decreasing or unknown based on suitable reference values (e.g. annual change of ≥ 10-20% of habitat surface area) - Subsequent repeat benthic mapping to reveal changes in spatial extent of marine caves	- Expert judgment may be required to determine trends in habitat area since 2004
Structure and Function	Main pressures affecting habitat	- Pressures affecting habitat to be identified and classified in line with standard EU reporting guidelines - Two main types of pressures to be distinguished: (1) pressure affecting physical structure of cave; (2) pressure affecting species living in marine cave	- Where relevant a polluter qualifier in line with EU reporting guidelines should be identified
	Current habitat condition	- The current condition of seagrass meadows can be measured using indicators such as i) the ratio of selected groups of flora to selected groups of fauna present in the different cave zones, (ii) the ratio of total abundance of species of fleshy and coralline algae present, (iii) presence / absence and or coverage of selected indicator species. - Percentage cover / relative abundance of habitat defining species to be monitored	- Dominant biota to be classified into three main cave zones (species found in ample light, limited light, total darkness)
Future Prospects	Main threats	- To be identified based on assessment of trends of main threats affecting habitat	- Expert judgment may be required if only limited data is available
	Likely future trends	- Likely future habitat range, area and condition of habitat to be predicted based on assessment of the main threats	

E. Maerl Beds – Indicator Sumary Table

Factor	Aspect	Method of Assessment	Comment
Range	Mapping range of habitat and quantifying occupied area	- Baseline survey to establish habitat location in Maltese Islands - Presence of maerl to be established either on grid or along series of transects - Combination of underwater videos, Van Veen grab samples and photographs to be taken along permanent transects - Use of multibeam echosounder techniques could be explored	- Distinction between rhodolith associations and maerl beds needs to be made - Some baseline information available for maerl bed to north-east of Malta ; maerl bed off south-eastern coast yet to be mapped
	Reviewing available information on trends	- Trend directions to be classified as stable, increasing, decreasing or unknown based on suitable reference values (e.g. annual change of ≥ 10-20% of habitat range) - Suggested indicator of range for maerl beds is horizontal and bathymetric distribution of key rhodolith-forming species - Bathymetric transects to be established and ratio of live rhodoliths:sediment to be compared to pre-established cut-off point - Change from baseline conditions (esp. in boundaries of maerl bed) to be monitored	- Total number of caves unlikely to change frequently but periodic monitoring necessary
Area	Mapping current surface area	- Baseline mapping of range to provide area status in general	
	Reviewing available information on trends	- Trend directions to be classified as stable, increasing, decreasing or unknown based on suitable reference values (e.g. annual change of ≥ 10-20% of habitat surface area) - Subsequent repeat benthic mapping to reveal changes in	- Expert judgment may be required to determine trends in habitat area since 2004 - For maerl at is-

		spatial extent of maerl beds	Sikka l-Bajda baseline information dating back to 1996-1998 is available.
Structure and Function	Main pressures affecting habitat	- Pressures affecting habitat to be identified and classified in line with standard EU reporting guidelines - Maerl beds are particularly sensitive to (1) increases in water column turbidity and (2) physical disturbances	- Where relevant a polluter qualifier in line with EU reporting guidelines should be identified
	Current habitat condition	- The current condition of maerl habitats can be monitored using indicators such as (i) number of rhodolith-forming rhodophyte species and their relative abundance, (ii) number of fauna species associated with the habitat, (iii) presence / absence of rare species of algae or fauna, (iv) total coverage of macro-algae, (v) coverage of specific species of algae, and (vi) coverage of key faunal species where applicable - Presence / absence and relative proportions of live and dead rhodoliths to be monitored	- Sampling damage to be minimised as much as possible since maerl beds are sensitive habitats, especially if small beds are monitored.
Future Prospects	Main threats	- To be identified based on assessment of trends of main threats affecting habitat	- Expert judgment may be required if only limited data is available
	Likely future trends	- Likely future habitat range, area and condition of habitat to be predicted based on assessment of the main threats	

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