

# ICES WKVME REPORT 2015

ICES ADVISORY COMMITTEE

ICES CM 2015/ACOM:62

## Report of the Workshop on Vulnerable Marine Ecosystem Database (WKVME)

10–11 December 2015

Peterborough, UK



**ICES**  
**CIEM**

International Council for  
the Exploration of the Sea

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Recommended format for purposes of citation:

ICES. 2016. Report of the Workshop on Vulnerable Marine Ecosystem Database (WKVME), 10–11 December 2015, Peterborough, UK. ICES CM 2015/ACOM:62. 42 pp.

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## Contents

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Executive summary .....	1
1 Opening of the meeting.....	2
2 Adoption of the agenda.....	3
3 Review the VME database with key data providers, focusing in particular on the VME indicator/VME habitat fields and finalise the database for use by WGDEC 2016 .....	4
3.1 Background.....	4
3.2 Changes to the VME Indicator list.....	5
3.3 Changes to VME Habitat Types and Subtypes.....	6
3.4 Other modifications to the VME database schema .....	6
4 Ingest the new data on VMEs resulting from the VME data call, undertake quality checks and finalise these new data for use by WGDEC 2016 .....	8
5 Undertake some development work on the ICES VME data portal.....	9
6 References .....	12
Annex 1: List of participants.....	13
Annex 2: Agenda.....	15
Annex 3: List of VME Indicators and VME Habitat Types/subtypes in use up to December 2015 .....	16
Annex 4: Updated list of VME Indicators and VME Habitat Types/subtypes .....	17
Annex 5: Revised list of deep-water VMEs and their characteristic taxa in NEAFC waters .....	19
Annex 6: Representative Taxa for new VME Indicators.....	26
Annex 7: Examples of VME data submissions highlighting common errors that can be made .....	27
Annex 8: Revised VME Database Schema .....	30



## **Executive summary**

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On the 10th December 2015, WKVME, chaired by Neil Golding (UK) and attended by eleven deep-sea and database experts, met at the JNCC Headquarters, Peterborough, to consider the terms of reference (ToR) listed in Section 2.

WKVME reviewed the current ICES Vulnerable Marine Ecosystem (VME) database, focusing on the current list of VME Indicators/Habitats and the associated lists of representative taxa. The group agreed a set of modifications, and then updated the database accordingly. A revised VME Database Schema was developed and implemented.

New data (633 records) submitted as part of the 2015 VME Data Call underwent a series of quality checks, and was ingested into the VME Database.

Development work was undertaken on the VME Data Portal and presented to the group, with a view to it being launched in 2016.

## **1 Opening of the meeting**

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WKVME began discussions at 09:30 hrs on 10th December at the JNCC Headquarters, Peterborough, UK. Following introductions (a list of workshop participants can be found in Annex 1), there were a number of short presentations introducing the VME database and highlighting current issues with the vocabulary and definitions; discussions around these issues followed.

## 2 Adoption of the agenda

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The Workshop on the Vulnerable Marine Ecosystem (VME) Database, chaired by Neil Golding, met in Peterborough, UK on 10th–11th December 2015 to:

- a) Review the VME database with key data providers, focusing in particular on the VME indicator/VME habitat fields and finalise the database for use by WGDEC 2016.
- b) Ingest the new data on VMEs resulting from the VME data call, undertake quality checks and finalise this new data for use by WGDEC 2016.
- c) Undertake some development work on the ICES VME data portal (as outlined in Section 5 of the WGDEC 2015 report) in order to make the VME database visible online using a 0.05 degree grid.

The draft agenda for the workshop can be found in Annex 2.

### **3 Review the VME database with key data providers, focusing in particular on the VME indicator/VME habitat fields and finalise the database for use by WGDEC 2016**

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#### **3.1 Background**

The Joint ICES/NAFO Working Group on Deep-water Ecology (WGDEC) have established a database which captures details on the distribution, abundance and quality of habitats considered to be VMEs, and of species considered to be indicators of VMEs. The database stores and makes available all known VME indicator records in the North Atlantic (covering deep-water areas inside and outside national jurisdiction) for use by ICES and the wider marine community. Development of the database commenced a number of years ago, and it is updated annually by WGDEC. The records come from a variety of sources, ranging from dedicated deep-sea research cruises equipped with high resolution seabed imagery through to fishing trawl and longline bycatch records that are submitted by ICES Member Countries. In addition significant portions of the data derive from data mining of published literature and historical records. The aim is to make these data accessible through a central online portal with mapping facilities.

The ICES VME database provides an essential resource for the some core work of WGDEC such as recommending bottom fishing closures within NEAFC (North East Atlantic Fisheries Commission) waters to protect VMEs. WGDEC also use this extensive database of VME records to respond to requests from the European Commission to provide new information on the locations of seabed habitats sensitive to particular fishing activities.

As the ICES VME database has expanded in size, so have the demands placed upon it. Recent WGDEC meetings have developed systems to weight the reliability and significance of VME indicator records, in order to formalise expert opinion and utilise as much relevant information as possible from each record. These systems have helped highlight where improvements could be made to the VME database (such as vocabulary/definitions). Addressing inconsistencies in the current list of VME Indicators and VME Habitat Types, as shown in Annex 3, was a priority for the Workshop participants. For example, the VME Indicator list operated a range of spatial scales, with observations of cold seeps and hydrothermal vents sitting alongside individual records of cup corals. There were also a number of VME Habitat Types which did not have VME Indicators associated with them, thereby creating difficulties in the ability of WGDEC to highlight the 'potential' occurrence of these VME habitats from data sources such as trawl bycatch.

The group agreed on a set of modifications to be made to the list of VME Indicators and VME Habitat Types based on a set of guiding principles agreed by the group:

- Any changes to the VME database should not affect its forward-thinking approach, and its ability to include new types of data as they develop/evolve;
- Ensuring the 'precautionary principle' is enshrined within decisions behind which VME habitats/species are accepted within the VME database;
- Use of the weighting system (currently under development) for VME indicator records within the database to reflect current scientific knowledge of their sensitivity/vulnerability.



- Each VME Habitat Type (as outlined in ICES, 2013) should be represented by at least one VME Indicator.

### 3.2 Changes to the VME Indicator list

In summary, the group discussed and agreed the following changes to the VME Indicator list:

- Oceanic ridges with hydrothermal vents/fields to be removed as a VME Indicator and will be moved to the VME Habitat Type field.
- Cold seeps to be removed as a VME Indicator and will be moved to the VME Habitat Type field
- Creation of a 'Chemosynthetic species (seeps and vents)' VME Indicator. Representative taxa are listed in Annex 6 (Lenaick, *pers comm*, Neat, *pers comm*).
- Hydroid to be removed as a VME Indicator, as this was considered too broad a category to be useful by the group.
- No change was made to the Stony coral indicator, although the group discussed that it could be useful to weight different coral species differently when used in the VME Indicator weighting system in future, with the weighting able to change as knowledge of the species evolved. This would require sufficient species level information being recorded in the database.
- The group noted that Gorgonian is now not a recognised taxonomic term. However, as many deep-sea biologists are familiar with this term, it was suggested that this VME Indicator was retained, but that a footnote in the VME database schema will capture which families are recognised as belonging to this VME Indicator.
- Sponge was retained as a VME indicator, although the group stressed the importance of distinguishing which taxa would be considered to constitute a VME, and to include taxa information in the VME database record.
- Stalked crinoids and Xenophyphores were added as VME Indicators within the Mud and sand emergent fauna VME Habitat Type, as listed in ICES (2013). The stalked sponge (*Hyalonema*) was also included in the aforementioned VME Habitat Type, with the corresponding VME Indicator being Sponge.
- The group discussed the fact that while there was a VME Habitat Type for Bryozoan patches (ICES, 2013), there was no VME Indicator listed. It was agreed to maintain the status quo, but potential VME indicators for this VME Habitat Type should be revisited in future.
- Lace coral was listed as a VME Indicator, and was originally included to represent the Stylasteridae. However, the group discussed that there was some confusion with other organisms such as *Reteporella*, a fragile bryozoan with a lace-like structure. As a point of clarification, this VME Indicator was renamed Stylasterids.
- The group noted that the Tube-dwelling anemones patches VME Habitat Type (ICES, 2013) did not have a VME Indicator associated with it, so the Anemones VME indicator was created.

A finalised list of VME indicators can be seen in Annex 4.

### 3.3 Changes to VME Habitat Types and Subtypes

In summary, the group discussed and agreed the following changes to the VME Habitat Types and Subtypes

- The Cold water coral reef VME Habitat Subtype *Lophelia pertusa* was expanded to include *Madrepora oculata* reef.
- The Hard and Soft-bottom coral garden VME Habitat Subtypes in the VME database were expanded to include the full range of subtypes listed in ICES (2013). For example, Hard-bottom gorgonian and black coral gardens.
- An additional VME Habitat Subtype was included in Hard-bottom coral gardens: Hard-bottom coral garden: Stylasterid corals on hard substrata.
- The VME Habitat Type known as Deep-sea sponge aggregations was simplified, with Glass sponge communities being subsumed within the two VME Habitat Subtypes, Soft-bottom sponge aggregations and hard-bottom sponge aggregations.
- A new VME Habitat Type was created for Hydrothermal vents/fields.
- A new VME Habitat Type was created for Cold seeps.
- The existing VME Habitat Type known as Tube-dwelling anemone patches was renamed Anemone aggregations, and split into two VME Habitat Subtypes, Soft-bottom anemone aggregations and hard-bottom anemone aggregations.

A finalised list of VME Habitat Types and Subtypes can be seen in Annex 4. Representative taxa are provided in Annex 5.

### 3.4 Other modifications to the VME database schema

The group discussed other improvements to the VME database. One of the key issues flagged by using the VME database records within some of the VME weighting system trials at WGDEC was the difference between VME indicator records and records of VME Habitat Types. The 'VME indicator' field should be completed if the record is of a VME indicator species, such as from a longline or trawl bycatch. These records would be the type considered under any 'VME record weighting system' developed by WGDEC. However, for *bona fide* records of VME habitats, such as from a ROV transect surveying a cold-water coral reef or a coral garden, the 'VME habitat type' field should be completed. This is because they should be considered in their own right as records of VMEs, and would not need further consideration in a VME indicator record weighting system. For newly submitted data, it is not necessary to complete the 'VME indicator' field in addition, and can be left blank. However, legacy data are permitted to have both fields populated. The group agreed that records with only the VME indicator field populated will be considered in a VME indicator record weighting system.

Following a review of the current VME database, the group agreed that for blank cells or cells with no data/information within the database, they should be populated with a 'null' value.

Finally, the group endorsed the creation of a 'VMEKey'. This new field within the database would be used to identify those records that come from the same area of habitat (for example, consecutive VME indicator records from an ROV transect over a cold-water coral reef). The VMEKey is a sequential number, with each block/patch of

habitat, given the same VMEKey. If each VME record comes from a separate habitat patch, or is unknown, then a different VMEKey would be assigned to each record. The VMEKey can be seen in Figure 3.1 below.

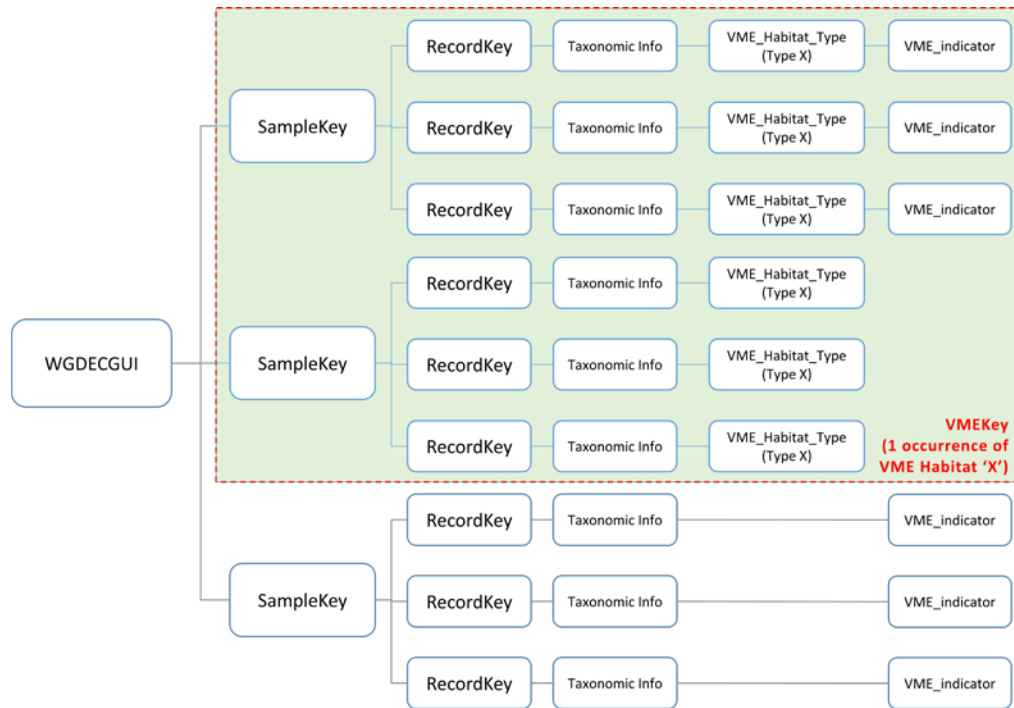


Figure 3.1. Overview of how the new VMEKey field joins database records together, based on whether a group of them represent a *bona fide* VME Habitat Type

Common errors observed with VME database submissions can be seen in Annex 7. An updated VME Database schema can be found in Annex 8.

#### **4 Ingest the new data on VMEs resulting from the VME data call, undertake quality checks and finalise these new data for use by WGDEC 2016**

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Following the VME data call, 633 VME indicator records were submitted by Russia. These were a combination of existing and new records to the VME database. The submitted records were quality checked and then ingested into the VME database for use at WGDEC 2016. No other datasets were received following the ICES VME data call.

## 5 Undertake some development work on the ICES VME data portal

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Carlos Pinto from the ICES DataCentre presented an update of progress with developing the VME data portal. Significant work has been undertaken to develop a central portal (hosted by the ICES DataCentre) to disseminate data on the distribution, abundance and quality of habitats and species considered to be indicators of VMEs across the North Atlantic. All VME indicator data have been gridded to a 0.05 degree grid (an identical grid size to that used by other ICES Working Groups such as WGSFD) and are presented via a map displayed on the web portal.

A demonstration of the VME data portal showing the VME data download page (Figure 5.1) (<http://vme.ices.dk/download.aspx>) and the mapping area of the VME portal (Figure 5.2) (<http://vme.ices.dk/map.aspx>) was presented to the group. Figure 5.3 shows a 'close-up' of an area around Rockall Bank.

Using the EMODnet Seabed Habitats Web Map Service (WMS), it has been possible to include the OSPAR threatened and/or declining habitats data with the ICES VME data portal, with the relevant layers being OSPARHabPoints2 & OSPARhabPolygons (<http://213.122.160.75/scripts/mapserv.exe?map=D:/Websites/MESHAtlantic/map/ME SHAtlanticWMS.map>).

Other layers which have been incorporated within the VME data portal include NEAFC bottom-fishing closures, WGDEC recommendations and ICES Advice, all from 2005 to present. The intention is to keep these layers updated in subsequent years to provide an auditable trail of which bottom fishing closures have been recommended, advised and which of these have then been implemented. Additional layers have also been included to help the user understand the context of the VME data presented, such as the NEAFC/NAFO areas and the latest NEAFC fishing areas.

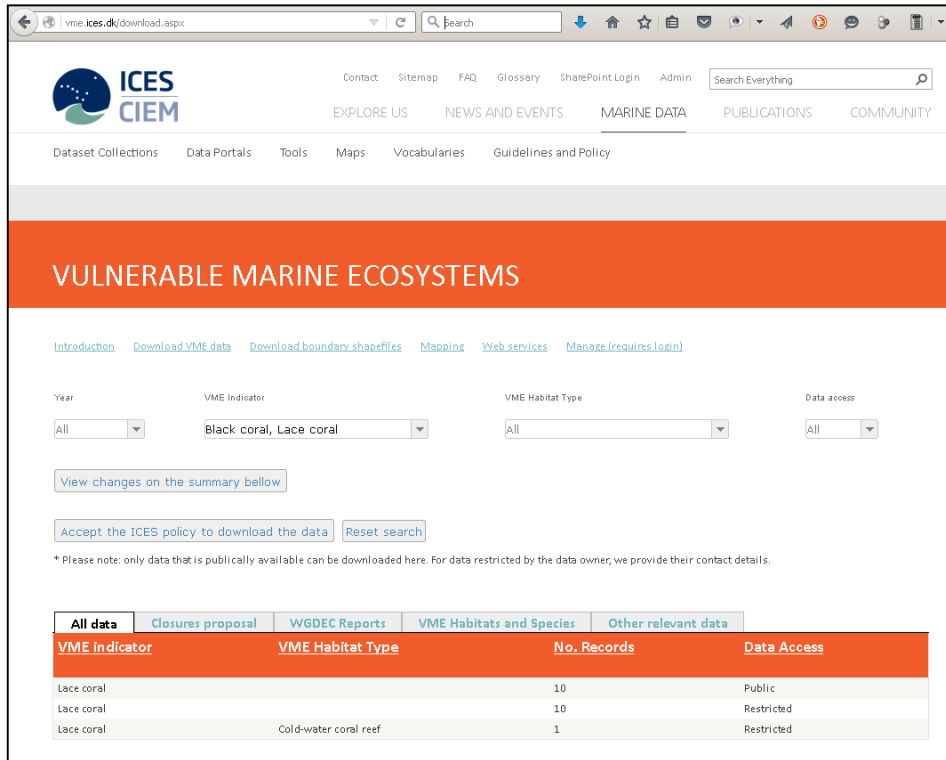


Figure 5.1. A screenshot of the data download section of the VME portal. Note that only publically available data will be permitted for download.

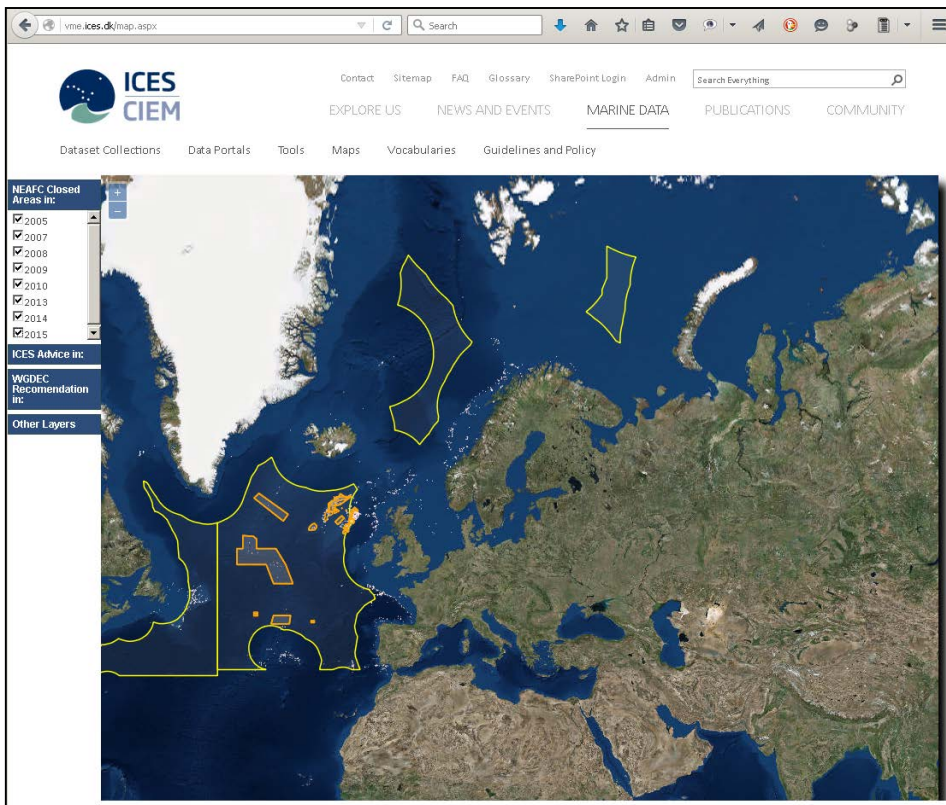


Figure 5.2. The mapping area of the VME data portal showing VME data and NEAFC closed areas.

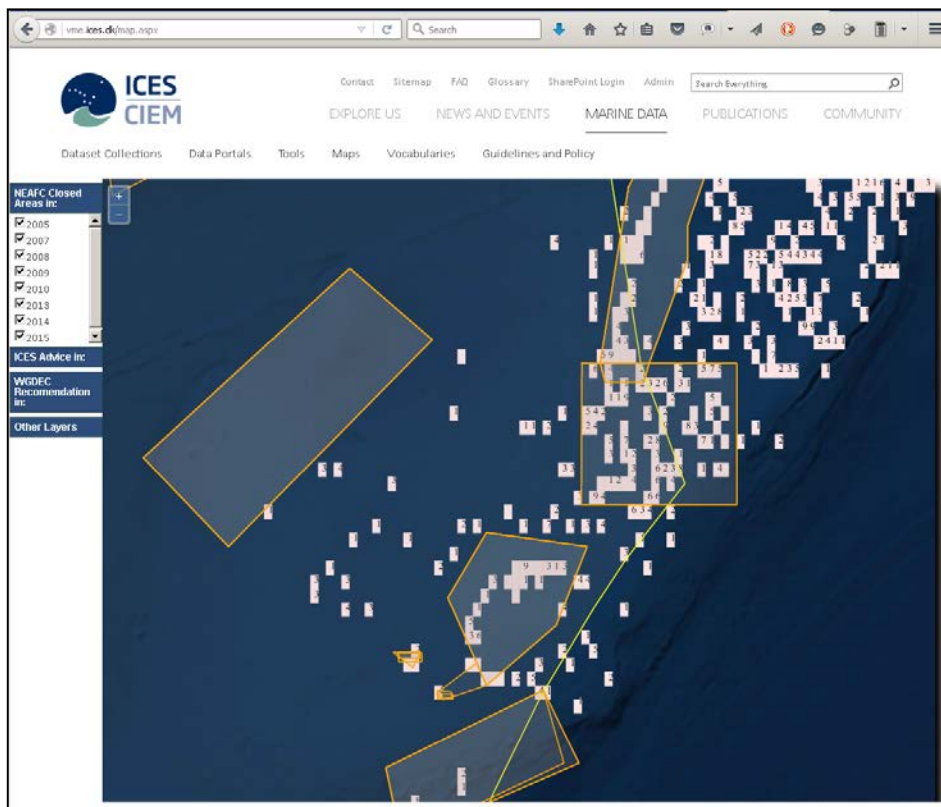


Figure 5.3. A ‘close-up’ of the area around Rockall Bank showing NEAFC closed areas and records of VME indicators.

Carlos highlighted the issue around ‘restricted’ datasets in the VME database. Following WGDEC 2014, almost 95% of the database records were classed as restricted. Through the efforts of the WGDEC members, approximately 60% of records within the database are now publically accessible. The Chair highlighted that it was essential that as many of these remaining records are made public, as restricted records have repercussions for how the data can be searched, queried and downloaded on the VME data portal.

## 6 References

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ICES. 2013. Report of the ICES\NAFO Joint Working Group on Deep-water Ecology (WGDEC), 11–15 March 2013, Floedevigen, Norway. ICES CM 2013/ACOM:28. 95 pp.



## Annex 1: List of participants

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## Annex 2: Agenda

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### Thursday 10th December 2015

TIME	AGENDA ITEM
09:00	Coffee
09:30	Introductions and finalise agenda (NG)
	A brief introduction to the ICES VME database (NG)
	Known database issues around vocabulary & definitions (LR)
12:30	Lunch
13:15	Brief review of new data submissions to the VME database (NG)
	Update on the ICES online VME Data Portal (C. Pinto)
	Group work updating VME database records / QA checks (ALL)
17:00	Close
19:30	Evening meal – location TBC

### Friday 11th December 2015

TIME	AGENDA ITEM
09:00	Coffee
09:30	Report back on VME d'base work achieved on 10th December. Discuss any issues and address (NG)
	Continue group work updating VME database records / QA checks (ALL)
12:30	Lunch
13:15	Groups report back on progress with database checking/QA (ALL)
	Continue group working to update VME database records / QA checks (ALL)
16:00	Final reporting back from groups on progress with database checking/QA (ALL)
16:30	Concluding remarks from workshop and close (NG)

### **Annex 3: List of VME Indicators and VME Habitat Types/subtypes in use up to December 2015**

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#### **List of VME indicators in use up to December 2015**

- Black coral
- Cold Seeps
- Cup coral
- Gorgonian
- Hydroid
- Lace coral
- Oceanic ridges with hydrothermal vents/fields
- Sea-pen
- Soft coral
- Sponge
- Stony coral

#### **List of VME Habitat Types in use up to December 2015**

This list was developed and reported at WGDEC 2013.

- Cold-water coral reef
- Coral Garden
- Deep-sea Sponge Aggregations
- Seapen fields
- Tube-dwelling anemone patches
- Mud and sand emergent fauna

#### **List of VME Habitat Subtypes in use up to December 2015**

This list was developed and reported at WGDEC 2013

- *Lophelia pertusa* reef
- *Solenosmilia variabilis* reef
- Hard-bottom coral garden
- Soft-bottom coral garden
- Ostur sponge aggregations
- Hard-bottom sponge aggregations
- Glass sponge communities

## Annex 4: Updated list of VME Indicators and VME Habitat Types/subtypes

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### List of VME indicators

- Black coral
- Cup coral
- Gorgonian
- Lace coral
- Sea-pen
- Soft coral
- Sponge
- Stony coral
- Anemones
- Xenophyophores
- Stalked crinoids
- Chemosynthetic species (seeps and vents)

### List of VME Habitat Types

- Cold-water coral reef
- Coral garden
- Deep-sea sponge aggregations
- Sea-pen fields
- Anemone aggregations
- Mud and sand emergent fauna
- Bryozoan patches
- Hydrothermal vents/fields
- Cold seeps

### List of VME Habitat Subtypes

- *Lophelia pertusa/Madrepora oculata* reef
- *Solenosmilia variabilis* reef
- Hard-bottom coral garden

Note that these records can be further classified as one of the following:

- Hard-bottom coral garden: Hard-bottom gorgonian and black coral gardens
- Hard-bottom coral garden: Colonial scleractinians on rocky outcrops
- Hard-bottom coral garden: Non-reefal scleractinian aggregations
- Hard-bottom coral garden: Stylasterid corals on hard substrata

- Soft-bottom coral garden

Note that these records can be further classified as one of the following:

- Soft-bottom coral garden: Soft-bottom gorgonian and black coral gardens
- Soft-bottom coral garden: Cup-coral fields
- Soft-bottom coral garden: Cauliflower Coral Fields
- Soft-bottom sponge aggregations
- Hard-bottom sponge aggregations
- Soft-bottom anemone aggregations
- Hard-bottom anemone aggregations

**Annex 5: Revised list of deep-water VMEs and their characteristic taxa in NEAFC waters**

Proposed VME habitat type (VME database field: "VME_HABITAT_TYPE")	Proposed VME habitat subtype (VME database field: "VME_HABITAT_SUBTYPE")	Representative Taxa	Corresponding VME Indicator (VME database field: "VME_Indicator")
Cold-water coral reef	<i>Lophelia pertusa</i> / <i>Madrepora oculata</i> reef	<i>Lophelia pertusa</i> <i>Madrepora oculata</i>	Stony coral
	<i>Solenosmilia variabilis</i> reef	<i>Solenosmilia variabilis</i>	Stony coral
Coral garden	Hard-bottom coral garden	(See below)	Black coral Gorgonian Stony coral Stylasterids
	Hard-bottom coral garden: Hard-bottom gorgonian <sup>1</sup> and black coral gardens	ACANTHOGORGIIDAE • <i>Acanthogorgia armata</i> ANTHOTHELIDAE CHRYSOGORGIIDAE CORALLIIDAE ISIDIDAE, KERATOISIDINAE • <i>Acanella arbuscula</i> • <i>Acanella</i> spp. • <i>Isidella</i> spp. • <i>Keratoisis</i> spp. • <i>Lepidisis</i> spp.	Gorgonian Soft coral Black coral

<sup>1</sup> Gorgonian is now not a recognised taxonomic term. However, as many deep-sea biologists are familiar with this term, this VME Indicator was retained.

Proposed VME habitat type (VME database field: "VME_HABITAT_TYPE")	Proposed VME habitat subtype (VME database field: "VME_HABITAT_SUBTYPE")	Representative Taxa	Corresponding VME Indicator (VME database field: "VME_Indicator")
		PARAGORGIIDAE <ul style="list-style-type: none"> <li>• <i>Paragorgia arborea</i></li> </ul> PLEXAURIDAE <ul style="list-style-type: none"> <li>• <i>Paramuricea biscaya</i></li> <li>• <i>Paramuricea placomus</i></li> <li>• <i>Paramuricea</i> spp.</li> <li>• <i>Swiftia pallida</i></li> </ul> PRIMNOIDAE <ul style="list-style-type: none"> <li>• <i>Callogorgia verticillata</i></li> <li>• <i>Primnoa resedaeformis</i></li> </ul> ALCYONIIDAE <ul style="list-style-type: none"> <li>• <i>Anthomastus grandiflorus</i></li> </ul> ANTIPATHIDAE <ul style="list-style-type: none"> <li>• <i>Stichopathes cf gravieri</i></li> </ul> LEIOPATHIDAE <ul style="list-style-type: none"> <li>• <i>Leiopathes</i> spp.</li> </ul> SCHIZOPATHIDAE <ul style="list-style-type: none"> <li>• <i>Bathypathes</i> spp.</li> <li>• <i>Parantipathes hirondelle</i></li> <li>• <i>Parantipathes</i> spp.</li> <li>• <i>Stauropathes arctica</i></li> </ul>	
	Hard-bottom coral garden: Colonial scleractinians on rocky outcrops	<i>Lophelia pertusa</i> <i>Madrepora oculata</i>	Stony coral
	Hard-bottom coral garden: Non-reefal scleractinian aggregations	<i>Enallopsammia rostrata</i> <i>Lophelia pertusa</i> <i>Madrepora oculata</i>	Stony coral



Proposed VME habitat type (VME database field: "VME_HABITAT_TYPE")	Proposed VME habitat subtype (VME database field: "VME_HABITAT_SUBTYPE")	Representative Taxa	Corresponding VME Indicator (VME database field: "VME_Indicator")
	Hard-bottom coral garden: Stylasterid corals on hard substrata	STYLASTERIDAE <ul style="list-style-type: none"> <li>• <i>Pliobothrus symmetricus</i></li> <li>• <i>Pliobothrus</i> spp.</li> <li>• <i>Stylaster</i> spp.</li> </ul>	Stylasterids
	Soft-bottom coral garden	(See below)	Gorgonian Soft coral Black coral Cup coral
	<b>Note</b> - you can also assign records to a more detailed subtype		
	Soft-bottom coral garden: Soft-bottom gorgonian <sup>1</sup> and black coral gardens	ALCYONIIDAE <ul style="list-style-type: none"> <li>• <i>Anthomastus grandiflorus</i></li> </ul> ANTIPATHIDAE <ul style="list-style-type: none"> <li>• <i>Stichopathes cf gravieri</i></li> </ul> CHRYSOGORGIIDAE <ul style="list-style-type: none"> <li>• <i>Radicipes gracilis</i></li> <li>• <i>Radicipes</i> spp.</li> </ul> ISIDIDAE <ul style="list-style-type: none"> <li>• <i>Acanella arbuscula</i></li> <li>• <i>Acanella</i> spp.</li> <li>• <i>Isidella</i> spp.</li> </ul>	Gorgonian Soft coral Black coral
	Soft-bottom coral garden: Cup coral fields	CARYOPHYLLIIDAE <ul style="list-style-type: none"> <li>• <i>Caryophyllia</i> spp.</li> <li>• <i>Stephanocyathus moseleyanus</i></li> </ul> FLABELLIDAE <ul style="list-style-type: none"> <li>• <i>Flabellum macandrewi</i></li> <li>• <i>Flabellum angulare</i></li> </ul>	Cup coral

Proposed VME habitat type (VME database field: "VME_HABITAT_TYPE")	Proposed VME habitat subtype (VME database field: "VME_HABITAT_SUBTYPE")	Representative Taxa	Corresponding VME Indicator (VME database field: "VME_Indicator")
		<ul style="list-style-type: none"> <li>• <i>Flabellum alabastrum</i></li> <li>• <i>Flabellum</i> spp.</li> </ul>	
	Soft-bottom coral garden: Cauliflower Coral Fields	NEPHTHEIDAE <ul style="list-style-type: none"> <li>• <i>Duva florida</i></li> <li>• <i>Drifa glomerata</i></li> <li>• <i>Gersemia</i> spp.</li> </ul>	Soft coral
Deep-sea sponge aggregations	Soft-bottom sponge aggregations	GEODIIDAE <ul style="list-style-type: none"> <li>• <i>Geodia barretti</i></li> <li>• <i>Geodia macandrewi</i></li> <li>• <i>Geodia atlantica</i></li> </ul> ANCORINIDAE <ul style="list-style-type: none"> <li>• <i>Stryphnus ponderosus</i></li> <li>• <i>Stelletta</i> spp.</li> </ul> PACHASTRELLIDAE <ul style="list-style-type: none"> <li>• <i>Thenea</i> spp.</li> </ul> ROSSELLIDAE <ul style="list-style-type: none"> <li>• <i>Caulophacus arcticus</i></li> </ul> PHERONEMATIDAE <ul style="list-style-type: none"> <li>• <i>Pheronema carpenteri</i></li> </ul>	Sponge <sup>2</sup>
	Hard-bottom sponge aggregations	AXINELLIDAE <ul style="list-style-type: none"> <li>• <i>Axinella infundibuliformis</i></li> <li>• <i>Phakellia</i> spp.</li> </ul>	Sponge <sup>2</sup>

<sup>2</sup> Data providers should ensure that only sponge records of species representative of deep-sea habitats are submitted (see representative taxa).

Proposed VME habitat type (VME database field: "VME_HABITAT_TYPE")	Proposed VME habitat subtype (VME database field: "VME_HABITAT_SUBTYPE")	Representative Taxa	Corresponding VME Indicator (VME database field: "VME_Indicator")
		MYCALIDAE POLYMASTIIDAE <ul style="list-style-type: none"> <li>• <i>Polymastia</i> spp.</li> </ul> TETILLIDAE ROSSELLIDAE <ul style="list-style-type: none"> <li>• <i>Caulophacus arcticus</i></li> </ul> PHERONEMATIDAE <ul style="list-style-type: none"> <li>• <i>Pheronema carpenteri</i></li> </ul>	
Sea-pen fields		ANTHOPTILIDAE <ul style="list-style-type: none"> <li>• <i>Anthoptilum murrayi</i></li> <li>• <i>Anthoptilum</i> spp.</li> </ul> PENNATULIDAE <ul style="list-style-type: none"> <li>• <i>Pennatula phosphorea</i></li> </ul> FUNICULINIDAE <ul style="list-style-type: none"> <li>• <i>Funiculina quadrangularis</i></li> </ul> HALIPTERIDAE <ul style="list-style-type: none"> <li>• <i>Halipterus</i> spp.</li> </ul> KOPHOBELEMNIDAE <ul style="list-style-type: none"> <li>• <i>Kophobelemmon stelliferum</i></li> </ul> PROTOPTILIDAE UMBELLULIDAE <ul style="list-style-type: none"> <li>• <i>Umbellula encrinus</i></li> <li>• <i>Umbellula huxleyi</i></li> <li>• <i>Umbellula lindahli</i></li> <li>• <i>Umbellula</i> spp.</li> </ul> VIRGULARIIDAE	Sea-pen

Proposed VME habitat type (VME database field: "VME_HABITAT_TYPE")	Proposed VME habitat subtype (VME database field: "VME_HABITAT_SUBTYPE")	Representative Taxa	Corresponding VME Indicator (VME database field: "VME_Indicator")
		<ul style="list-style-type: none"> <li>• <i>Virgularia mirabilis</i></li> </ul>	
Anemone aggregations	Soft-bottom anemone aggregations	CERIANTHIDAE	Anemones
	Hard-bottom anemone aggregations	ZOANTHARIA (Order)	Anemones
Mud and sand emergent fauna		BOURGETCRINIDAE ANTEDONTIDAE HYOCRINIDAE XENOPHYOPHORA <ul style="list-style-type: none"> <li>• <i>Syringammina fragilissima</i></li> <li>• <i>Reticulammina</i> spp.</li> </ul> HYALONEMA (Stalked sponge)	Stalked crinoids Xenophyophores Sponge <sup>3</sup>
Bryozoan patches			
Hydrothermal vents/fields		ACTINOSCYPHIIDAE ALVINOCARIDIDAE <ul style="list-style-type: none"> <li>• <i>Alvinocaris</i> spp.</li> </ul> ANTONBRUNNIDAE BYTHOGRAEIDAE GALATHEIDAE <ul style="list-style-type: none"> <li>• <i>Munidopsis</i> spp.</li> </ul> GERYONIDAE LUCINIDAE MYTILIDAE PORTUNIDAE SIBOGLINIDAE	Chemosynthetic species (seeps and vents)

Proposed VME habitat type (VME database field: "VME_HABITAT_TYPE")	Proposed VME habitat subtype (VME database field: "VME_HABITAT_SUBTYPE")	Representative Taxa	Corresponding VME Indicator (VME database field: "VME_Indicator")
		SOLEMYIDAE THYASIROIDAE • <i>Thyasira</i> spp. VESICOMYIDAE <b>Note</b> - additional representative species are detailed in Annex 6	
Cold Seeps		ACTINOSCYPHIIDAE ALVINOCARIDIDAE • <i>Alvinocaris</i> spp. ANTONBRUNNIDAE BYTHOGRAEIDAE GALATHEIDAE • <i>Munidopsis</i> spp. GERYONIDAE LUCINIDAE MYTILIDAE PORTUNIDAE SIBOGLINIDAE SOLEMYIDAE THYASIROIDAE • <i>Thyasira</i> spp. VESICOMYIDAE <b>Note</b> - additional representative species are detailed in Annex 6	Chemosynthetic species (seeps and vents)

## Annex 6: Representative Taxa for new VME Indicators

### Chemosynthetic species (seeps and vents)

PHYLUM	CLASS	ORDER	FAMILY	GENUS	SPECIES
Mollusca	Bivalvia	Lucinoida	Thyasiroidae	<i>Thyasira</i>	scotiae
Mollusca	Bivalvia	Heterodonta	Vesicomidae	<i>Isorropodom</i>	mackayi
Mollusca	Bivalvia	Heterodonta	Vesicomidae	<i>Abyssogena</i>	southwardae
Mollusca	Bivalvia	Pteriomorpha	Mytilidae	<i>Bathymodiolus</i>	azoricus
Mollusca	Bivalvia	Pteriomorpha	Mytilidae	<i>Bathymodiolus</i>	puteoserpentis
Mollusca	Bivalvia	Solemyoidea	Solemyidae	<i>Acharax</i>	gadirae
Mollusca	Bivalvia	Lucinoida	Thyasiroidae	<i>Thyasira</i>	vulcolutre
Mollusca	Bivalvia	Solemyoidea	Solemyidae	<i>Solemya</i>	elarraichensis
Mollusca	Bivalvia	Heterodonta	Vesicomidae	<i>Christineconcha</i>	regab
Mollusca	Bivalvia	Lucinoida	Lucinidae	<i>Lucinoma</i>	asapheus
Annelida	Polychaeta	Sabellida	Siboglinidae	<i>Sclerolinum</i>	contortum
Annelida	Polychaeta	Sabellida	Siboglinidae	<i>Oligobrachia</i>	webbi
Annelida	Polychaeta	Sabellida	Siboglinidae	<i>Siboglinum</i>	
Annelida	Polychaeta	Sabellida	Siboglinidae	<i>Polybrachia</i>	
Annelida	Polychaeta	Sabellida	Siboglinidae	<i>Spirobrachia</i>	tripeira
Annelida	Polychaeta	Sabellida	Siboglinidae	<i>Bobmarleya</i>	
Annelida	Polychaeta	Sabellida	Siboglinidae	<i>Lamellisabella</i>	denticulata
Annelida	Polychaeta	Phyllodocida	Antonbrunnidae	<i>Antonbrunnia</i>	sociabilis
Arthropoda	Crustacea	Decapoda	Alvinocarididae	<i>Alvinocaris</i>	markensis
Arthropoda	Crustacea	Decapoda	Alvinocarididae	<i>Alvinocaris</i>	williamsi
Arthropoda	Crustacea	Decapoda	Alvinocarididae	<i>Chorocaris</i>	chacei
Arthropoda	Crustacea	Decapoda	Alvinocarididae	<i>Mirocaris</i>	fortunata
Arthropoda	Crustacea	Decapoda	Alvinocarididae	<i>Rimicaris</i>	exoculata
Arthropoda	Crustacea	Decapoda	Galatheidae	<i>Munidopsis</i>	acutispina
Arthropoda	Crustacea	Decapoda	Galatheidae	<i>Munidopsis</i>	exuta
Arthropoda	Crustacea	Decapoda	Portunidae	<i>Bathynectes</i>	maravigna
Arthropoda	Crustacea	Decapoda	Geryonidae	<i>Chaceon</i>	affinis
Arthropoda	Crustacea	Decapoda	Bythograeidae	<i>Segonzacia</i>	mesatlantica
Cnidaria	Anthozoa	Actiniaria	Actinoscyphiidae	<i>Maractis</i>	rimicarivora

**Annex 7: Examples of VME data submissions highlighting common errors that can be made**

The tables below show a ‘subset’ of an example dataset; the first table is correct, and ready for inclusion with the VME database. You can see how the VMEKey is used to ‘group’ records from the same VME habitat type. These may have been observed along an ROV transect, with each row/record representing a still image or section of video from the transect. The second table highlights some common errors which have been encountered with data submitted for import within the database, and these are discussed below:

**Example data correct and ready for inclusion within the VME database:**

WGDECGUI	SAMPLEKEY	STATIONID	RECORDKEY	VME_INDICAT OR	VME_HABITAT_TYPE	VME_HABITAT_SUBTYPE	VMEKEY Y	GENERALTAXONDESCRIP OR
GB_WGDEC_2015_0 01	GBSurv23_Sam p1	Samp1_Tow0 01	2015_001_00 01	Black coral	Coral Garden	Hard-bottom coral garden	1	Anthothelidae
GB_WGDEC_2015_0 01	GBSurv23_Sam p1	Samp1_Tow0 01	2015_001_00 02	Gorgonian	Coral Garden	Hard-bottom coral garden	1	Crysogorgiidae
GB_WGDEC_2015_0 01	GBSurv23_Sam p2	Samp2_Tow0 01	2015_001_00 03	Stony coral	Cold-water coral reef		2	<i>Lophelia pertusa</i>
GB_WGDEC_2015_0 01	GBSurv23_Sam p3	Samp3_Tow0 01	2015_001_00 04	Stony coral				<i>Lophelia pertusa</i>
GB_WGDEC_2015_0 02	GBSurv34_Sam p1	Samp1_Tow0 01	2015_002_00 01	Soft coral				Neptheidae
GB_WGDEC_2015_0 02	GBSurv42_Sam p1	Samp1_Tow0 01	2015_002_00 02	Sponge				Phakellia
GB_WGDEC_2015_0 02	GBSurv42_Sam p2	Samp2_Tow0 01	2015_002_00 03	Cup coral				<i>Caryophyllia smithii</i>
GB_WGDEC_2015_0 02	GBSurv42_Sam p3	Samp3_Tow0 01	2015_002_00 04		Deep-sea Sponge Aggregations		3	Axinella

GB_WGDEC_2015_0 02	GBSurv42_Sam p6	Samp6_Tow0 01	2015_002_00 06		Deep-sea Sponge Aggregations	3	Polymastia
GB_WGDEC_2015_0 02	GBSurv42_Sam p6	Samp6_Tow0 01	2015_002_00 07		Deep-sea Sponge Aggregations	3	Phakellia
GB_WGDEC_2015_0 02	GBSurv52_Sam p2	Samp2_Tow0 03	2015_002_00 08	Sea-pen			<i>Umbellula lindahli</i>
GB_WGDEC_2015_0 02	GBSurv52_Sam p3	Samp3_Tow0 03	2015_002_00 09	Stony coral	Cold-water coral reef	4	<i>Lophelia pertusa</i>



**Example data which contain errors and requires correcting before inclusion within the VME database**

The first row of data does not contain a VMEKey, yet has been identified as a record of a VME\_Habitat\_Type. The converse is true for the second row; a VMEKey was included but no VME\_Habitat\_Type was recorded. The third row of data does not contain a unique RecordKey - instead shares a RecordKey with the previous record, which is incorrect. Finally, the fourth row does not include any species information, which is required for a record in the VME database.

WGDECGUI	SAMPLEKEY	STATIONID	RECORDKEY	VME_INDICATOR	VME_HABITAT_TYPE	VME_HABITAT_SUBTYPE	VMEKEY	GENERALTAXONDESCRIPTOR
GB_WGDEC_2015_002	GBSurv68_Samp1	Samp1_Tow006	2015_002_0010	Stony coral	Cold-water coral reef			Neptheidae
GB_WGDEC_2015_002	GBSurv68_Samp1	Samp1_Tow006	2015_002_0011	Sea-pen			5	Virgularia cf mirabilis
GB_WGDEC_2015_002	GBSurv68_Samp1	Samp1_Tow006	2015_002_0011	Anemones				Zoantharia
GB_WGDEC_2015_002	GBSurv68_Samp2	Samp2_Tow006	2015_002_0012	Sponge				

## Annex 8: Revised VME Database Schema

Note: in the 'Obligation' column, M stands for mandatory, O stands for optional and C stands for conditional (i.e. conditional on information being provided in the previous fields).

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
WGDECGUI	Text	M	Globally Unique ID for each dataset.	To be created by data supplier - Follow the format: 2-letter ICES country code_WGDEC_year of data provision_3 digit sequential number for each dataset submitted. For example, if GB submitted two datasets in 2015 the WGDECGUIs would be GB_WGDEC_2015_001 and GB_WGDEC_2015_002. Note that each submission can contain multiple surveys.
SampleKey	Text		Key for each discernible sampling/analysis event.	<p>A Sample key must be unique for each sampling event, but can be used across multiple records if all were originally contained within a single sampling event. A sampling event can be described as a single discernible analysed unit, for example:</p> <ul style="list-style-type: none"> <li>A single trawl;</li> <li>A single longline set</li> <li>A single photograph from a photographic tow;</li> <li>A segment of analysed video from a video tow;</li> <li>A video tow, if video is unanalysed;</li> <li>A sediment grab or core.</li> </ul> <p>To be created by data supplier. May be numeric, text or a combination of numbers and text, which may relate back to original data management convention for traceability.</p>
RecordKey	Text	M	Unique key for each record (row) within a submitted dataset.	To be created by data supplier. May be numeric, text or a combination of numbers and text, which may relate back to original data management convention for traceability. If no original data management key exists, this can be added as a

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
VME_Indicator	Text	C	Grouping of species/habitats used by WGDEC.	sequential numeric list (1,2,3, etc.) A VME indicator must be chosen if no <i>bona fide</i> VME habitat type is known to occur, e.g. a sponge from trawl bycatch. This field can also be used to record species records as additional detail for records of VME habitats. To do this, the VME indicator record(s) should be on a separate line from the VME habitat record, and should have the same VMEKey. VME indicators should match the list shown below. Choose from: Black coral Cup coral Gorgonian <sup>3</sup> Stylasterids Sea-pen Soft coral Sponge Stony coral Anemones

<sup>3</sup> Data providers should note that Gorgonian is now not a recognised taxonomic term. However, as many deep-sea biologists are familiar with this term, this VME Indicator was retained. The following families should be considered under this term:

- 1) Holaxonia (Suborder): Acanthogorgiidae, Plexauridae.
- 2) Calcaxonia (Suborder): Chrysogorgiidae, Isididae, Keratoisidinae, Primnoidae.
- 3) Scleraxonia (Suborder): Anthothelidae, Coralliidae, Paragorgiidae.

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
VME_HABITAT_TYPE	Text	C	VME habitat types used by WGDEC.	<p>Xenophyophores Stalked crinoids Chemosynthetic species (seeps and vents)</p> <p>A VME habitat type should be chosen if the record occurs within a <i>bona fide</i> VME habitat e.g. From an ROV transect surveying a cold-water coral reef.</p> <p>All datapoints representing the known extent of a VME habitat type along a transect or tow should be recorded within one line of the database (e.g. a video tow split into sections of cold-water coral reef; bathyal rock; cold-water coral reef, would represent two VME habitat records of cold-water coral reef in the database).</p> <p>Choose from:</p> <ul style="list-style-type: none"> <li>Cold-water coral reef</li> <li>Coral garden</li> <li>Deep-sea sponge aggregations</li> <li>Sea-pen fields</li> <li>Anemone aggregations</li> <li>Mud and sand emergent fauna</li> <li>Bryozoan patches</li> <li>Hydrothermal vents/fields</li> <li>Cold seeps</li> </ul>
VME_HABITAT_SUBTYPE	Text	O	VME subhabitat types used by WGDEC.	<p>If no VME_habitat_type is filled in, this field should be left blank. If VME_habitat_type is filled in, this field is optional.</p> <p>Choose from:</p> <ul style="list-style-type: none"> <li><i>Lophelia pertusa</i>/<i>Madrepora oculata</i> reef</li> </ul>

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
				<p><i>Solenosmilia variabilis</i> reef</p> <p>Hard-bottom coral garden</p> <p>Note that these records can be further classified as one of the following:</p> <p>Hard-bottom coral garden: Hard-bottom gorgonian and black coral gardens</p> <p>Hard-bottom coral garden: Colonial scleractinians on rocky outcrops</p> <p>Hard-bottom coral garden: Non-reefal scleractinian aggregations</p> <p>Hard-bottom coral garden: Stylasterid corals on hard substrata</p> <p>Soft-bottom coral garden</p> <p>Note that these records can be further classified as one of the following:</p> <p>Soft-bottom coral garden: Soft-bottom gorgonian and black coral gardens</p> <p>Soft-bottom coral garden: Cup-coral fields</p> <p>Soft-bottom coral garden: Cauliflower Coral Fields</p> <p>Soft-bottom sponge aggregations</p> <p>Hard-bottom sponge aggregations</p> <p>Soft-bottom anemone aggregations</p> <p>Hard-bottom anemone aggregations</p>
VMEKey	Double	C	Key to identify VME habitat and VME indicator records belonging to a single habitat patch.	Sequential number to identify records that come from the same block of habitat, e.g. Consecutive points on an ROV or video transect that are on the same coral reef. This is mandatory for any records of VME habitats. If each record comes from a separate habitat patch, or if this is not known, use a different number for each record.

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
				Also optional for records of VME indicator species, where it can be used to show that these come from a patch of VME habitat. See guidance on the VME_indicator field for more details.
Status	Text	M	Presence or absence of habitat or species.	Choose either "Present" or "Absent".
GeneralTaxonDescriptor	Text	M	Most detailed name of taxon (according to HighestTaxonomicResolution).	e.g. Porifera, <i>Lophelia pertusa</i> , soft coral
HighestTaxonomicResolution	Text	C	Highest taxonomic resolution described in GeneralTaxonDescriptor.	Only use if a scientific taxon name is given. E.g. order, species, genus.
Order	Text	C	Order of taxon, if known.	If not known, use "Null".
Genus	Text	C	Genus of taxon, if known.	If not known, use "Null".
Species	Text	C	Species of taxon, if known.	If not known, use "Null".
Dead_alive	Text	O	Indication of whether most of sample was dead or alive.	Choose either "Dead" or "Alive".
Number	Double	O	Number of individuals associated with the record.	If not known, use "Null".
Weight_kg	Double	O	Mass of indicator, in kg, associated with the record.	This is likely to be relevant to bycatch/ data. If not known or not relevant, use "Null". Do not include if the record is a VME habitat type.
Density	Double	O	Number of individuals per square metre (m <sup>2</sup> ).	If not known or not relevant, use "Null".
%Cover	Double	O	Percentage cover of indicator (relevant to underwater imagery data, e.g. ROV or drop down video).	If not known or not relevant, use "Null".
SACFOR	Text	O	Semi-quantitative abundance scale (relevant to underwater imagery data, e.g. ROV or drop down video).	If not known or not relevant, use "Null".
TaxonDeterminer	Text	M	Name of person and/or organization that identified the GeneralTaxonDescriptor.	Please add the name and select the organization from the list at <a href="http://vocab.ices.dk/?ref=EDMO">http://vocab.ices.dk/?ref=EDMO</a> . If the name of the person is

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
				not known, just select the organization.
TaxonDeterminationDate	Date	M	Date of identification of the GeneralTaxonDescriptor.	All dates must be supplied as text in the format YYYY-MM-DD (ISO date format).
ObsDate	Date	M	Date the species or habitat was recorded.	All dates must be supplied as text in the format YYYY-MM-DD (ISO date format).
ObsDateType	Text	M	A one or two character code that identifies the types of dates used in ObsDate. Explicitly stating the code avoids any ambiguity, which might lead to subtly different interpretations	Choose from: D - Dates specified to the nearest day. O - Dates specified to the nearest month Y - Dates specified to the nearest year ND - No date U - Unknown
StationID	Text	O	ID of the survey station, if known.	May be numeric, text or a combination of numbers and text.
SurveyKey	Text	M	Unique key for each dataset making up the country submission to WGDEC (e.g. representing actual separate surveys, data from different sources, museum collections, etc.). SurveyKey links to the Survey Key Metadata worksheet, where survey details are described in full.	Each SurveyKey must refer to a record in the SurveyKey Metadata worksheet.
SurveyMethod	Text	O	A description of the survey method(s) used.	Choose one or more from: Multibeam echosounder (unknown platform) Multibeam echosounder (vessel mounted) Multibeam echosounder (AUV mounted) Multibeam echosounder (ROV mounted) Single-beam echosounder Sidescan sonar (Unknown platform) Sidescan sonar (AUV mounted)

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
				Sub-bottom profiler Grab (please specify type from link above) Core (please specify type from link above) Trawl (please specify type from link above) Dredge (please specify type from link above) Longline Seabed imagery - towed camera system Seabed imagery - drop camera system Seabed imagery - ROV system This list is a subset of the ICES Sampler Type vocabulary. If your survey method is not listed, please select from: <a href="http://vocab.ices.dk/?ref=152">http://vocab.ices.dk/?ref=152</a>
VesselType	Text	M	Vessel type from which the sample was collected.	Choose from: Commercial Research Other
Ship	Text	O	Name of vessel on which sample was collected (for ROV or AUV, provide name of parent vessel).	If the survey was carried out using a research vessel, please select the vessel name from the list at <a href="http://vocab.ices.dk/?ref=315">http://vocab.ices.dk/?ref=315</a>
PlaceName	Text	O	Name of place in reference to the record collection.	Free text; e.g. "Rockall Bank"
StartLatitude	Double	C	Start latitude of the record, if line (if point, use MidLatitude and leave this blank).	Use World Geodetic System 1984 (WGS84) geographic coordinate system, and decimal degrees.
StartLongitude	Double	C	Start longitude of the record, if line (if point, use MidLongitude and leave this blank).	Use World Geodetic System 1984 (WGS84) geographic coordinate system, and decimal degrees.
EndLatitude	Double	C	End latitude of the record (if point, leave blank).	Use World Geodetic System 1984 (WGS84) geographic coordinate system, and decimal degrees.



FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
EndLongitude	Double	C	End longitude of the record (if point, leave blank).	Use World Geodetic System 1984 (WGS84) geographic coordinate system, and decimal degrees.
MidLatitude	Double	M	Midpoint latitude of the record if line (if point, use this field for position).	Use World Geodetic System 1984 (WGS84) geographic coordinate system, and decimal degrees.
MidLongitude	Double	M	Midpoint longitude of the record if line (if point, use this field for position).	Use World Geodetic System 1984 (WGS84) geographic coordinate system, and decimal degrees.
GeometryType	Text	M	Point or line.	Enter "point" or "line".
RecordPositionAccuracy	Integer	O	Accuracy of spatial position of record. For example, trawl bycatch of coral along a 5km trawl track would have a RecordPositionAccuracy of 5000 metres whereas an observation of a cold-water coral reef observed on an ROV/drop-camera frame transect may be have a RecordPositionAccuracy of 20 metres (the accuracy of the USBL positioning being used on the ROV/drop-frame)	Value in metres; e.g. "10" means the given position of the record is accurate to $\pm 10$ metres.
ShipPositionPrecision	Integer	O	An estimate of the precision of the lat/long provided by the spatial positioning systems of the vessel/ROV	Calculated or estimated precision of the vessel/ROV position in metres. Take into account whether position is determined from the ship position or from ROV. For example when two separate spatial reference systems are in use such as vessel position GPS ( $\pm 10$ m) and ROV USBL ( $\pm 20$ m) position, the precision of both the vessel and ROV systems should be added together to give a precision of $\pm 30$ m.
Reference	Text	M	A reference to the data source.	Complete citation for the data source e.g. "Mortensen <i>et al.</i> , 2006"
Filename	Text	O	Name of the excel or shape file submitted.	
ResponsibleOrganization	Text	M	Name of the organization responsible for the data.	Please select the organization from the list at <a href="http://vocab.ices.dk/?ref=EDMO">http://vocab.ices.dk/?ref=EDMO</a>

FIELD NAME	FIELD TYPE	OBLIGATION	DESCRIPTION	GUIDANCE
ResponsibleOrganizationRole	Text	M	Role of the responsible organization for the data.	Choose from: Owner (owns resource) Originator (created resource) Custodian (accepts responsibility for the data and maintains the resource)
PointOfContact	Text	M	Name of the point of contact for queries about the data.	Free text.
ContactE-mail	Text	M	E-mail address for the point of contact for the data.	Valid e-mail address
DataAccess	Text	M	Data access constraints.	e.g. "public" or "restricted". Please use "public" if you are content with the data being downloaded in its raw form from the ICES data portal. Alternatively, the data will not be downloadable if you select "restricted".
DepthUpper	Double	O	For transect data (video or trawl) indicate the shallowest depth in metres.	e.g. 110
DepthLower	Double	O	For transect data (video or trawl) indicate the deepest depth in metres.	e.g. 150
Comments	Text	O	Any other comments or information.	e.g. "sample was 60% live coral and 40% dead"