

## World Register of marine Cave Species (WoRCS) 1st Editor Workshop

Flanders Marine Institute (Vlaams Instituut voor de Zee - VLIZ)  
InnovOcean site, Ostend, Belgium  
22-25 February 2016

### REPORT

#### Participants

WoRCS Editor Group: Vasilis Gerovasileiou, Nicolas Bailly, Alejandro Martínez, Fernando Álvarez, Geoff Boxshall, William F. Humphreys, Damià Jaume, Thomas M. Iliffe

WoRMS Data Management Team (DMT): Stefanie Dekeyzer (for Leen Vandepitte), Wim Decock, Bart Vanhoorne

Marine Regions Data Management Team: Francisco Souza Dias, Nathalie De Hauwere, (Wednesday morning only)



*Fig.1. From left to right: Alejandro Martínez, Fernando Álvarez, William F. Humphreys, Thomas M. Iliffe, Damià Jaume, Vasilis Gerovasileiou, Nicolas Bailly, Geoff Boxshall, Stefanie Dekeyzer, Wim Decock.*

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## **Objectives of the workshop**

(i) *Main aim of the workshop: to build the Editorial Team of the WoRCS.*

Aim of the Workshop  
***Building the Editorial Team***

- As the core of a network to be extended
- As a steering group selecting priorities in a well circumscribed scope
- As the interface between the WoRCS network and WoRMS
- As addressing a few technical issues

*As having fun together working on a natural science topic we like most*

Fig.2. Slide extracted from presentation 22Mon\_1300\_ShortHistory\_WorkshopAim\_VG

(ii) *To delimitate the scope of the WoRCS.*

(iii) *To list the targeted data and compile a standard glossary based on existing terminology for the categorization of data.*

(iv) *To plan the compiling of a gazetteer of caves with geo-coordinates.*

(v) *To set long-term strategic plan and work plan for 2016-2017 (including a paper publication plan).*

## **Outline**

[Presentation 24Wed\_1630\_WorkshopReport\_VG]

1. WoRCS rationale, background and aim
2. Delimitation of the scope of the WoRCS
3. List of targeted data and associated vocabulary
4. List of current and potential new editors
5. Plans for compiling a gazetteer of caves with geo-coordinates
6. WoRCS governance and policies (including data exchange)
7. Strategic plan (5 years)
8. Work plan for 2016-2017
9. References
10. Non reported presentations
11. Annexes

## **Sponsor and acknowledgments**

The initiative was supported by LifeWatch, the E-Science European Infrastructure for Biodiversity and Ecosystem Research, through grants allocated by LifeWatch Belgium to the World Register of Marine Species (WoRMS) developed and maintained in VLIZ.

LifeWatch is a distributed virtual laboratory which is being used for different aspects of biodiversity research. The taxonomic backbone of LifeWatch aims at bringing together taxonomic and species-related data and at filling the gaps in our knowledge. In addition, it gives support to taxonomic experts by providing them logistic and financial support for

meetings and workshops related to expanding the content and enhancing the quality of taxonomic databases.

LifeWatch Belgium provided the funds to VLIZ to host the workshop through a competitive grant mechanism. LifeWatchGreece provided the staff time for the global workshop organization: V. Gerovasileiou and N. Bailly. VLIZ provided the staff time for the workshop organization on site: W. Decock, L. Vandepitte, S. Dekeyzer, B. Vanhoorne; and Nathalie Keersebilck who are greatly acknowledged by the WoRCS founding editors.

## **Agenda**

See Annexes, section 11.1.

# 1. WoRCS rationale and background

## 1.1. Rationale

Scientific exploration of underwater cave environments over recent decades has led to outstanding discoveries of novel taxa, increasing our knowledge on biodiversity. Marine and anchialine caves are widely acknowledged as biodiversity reservoirs, harboring unique faunal elements including among crustaceans for example, all members of the class Remipedia, order Mictacea, and families Macromaxillocarididae and Speleoithonidae, representing relict lineages that will facilitate our understanding of the evolutionary history of encompassing taxa. For example, remipedes have recently been shown to be a sister group to hexapods, while the evolutionary relationships of many other anchialine taxa are still under study.

Furthermore, a number of obligate cave-dwelling taxa show relict Tethyan distributions, extending across the Caribbean, Eastern Atlantic, Mediterranean, and Indian Ocean. Marine caves represent extreme environments due to their lack of light, paucity of organic nutrients, and low levels of dissolved oxygen. In such habitats, chemoautotrophic bacteria have been shown to form the base of the food web, while other unique behavioral and physiological adaptations have been documented. Furthermore, anchialine caves are characterized by stratified water masses harboring various ecological groups of biota, dwelling respectively in the overlying freshwater layer, in the pycnocline, or in the underlying marine water.

Nevertheless, marine cave biological research has been limited to only a few areas of the world and relevant information remain fragmented in isolated publications and databases. This fragmentation makes assessing the conservation status of marine cave species especially problematic, and this issue is urgent given the stresses resulting from development in the coastal zone worldwide.

## 1.2. History

The proposal for launching a World Register of Marine Cave Species (WoRCS) originated from a question of V. Gerovasileiou who has conducted research in marine caves to N. Bailly as a taxonomic editor in WoRMS (for fishes) while they both worked for LifeWatch Greece in the Hellenic Centre for Marine Research (HCMR).

The proposal was presented to the WoRMS Steering Committee during its meeting at HCMR in Crete (8th June 2015). The SC agreed in principle to supporting this initiative. A proposal submitted to the LifeWatch Belgium grant mechanism for organizing WoRMS editor workshops was accepted in October 2015.

A pre-workshop meeting was attended by five of the eight WoRCS founding editors during the Third International Symposium on Anchialine Ecosystems hosted by the Universidad Autónoma de Yucatán UADY, Mérida, México, in November 2015. The aim of the meeting was to refine the agenda and plan preparatory work for the “Editor workshop”.



*Fig.3. Five of the eight WoRCS founding editors at the Third International Symposium on Anchialine Ecosystems, UADY, Mérida, México, November 2015. From left to right: William F. HUMPHREYS, Thomas M. ILIFFE, Alejandro MARTÍNEZ, Vasilis GEROVASILEIOU, Fernando ÁLVAREZ*

The 1st Editor Workshop of the WoRCS was held from 22 to 25 February, at the Vlaams Instituut voor de Zee (VLIZ), Oostende, Belgium.

### Short history of the idea

- ☑ **March 2015:** LifeWatchGreece, HCMR, Crete, Greece
- ☑ **June 2015:** Proposal for launching WoRCS to the WoRMS Steering Committee during its meeting at HCMR in Crete, Greece.
- ☑ **September 2015:** Application for WoRCS editor workshop to LifeWatch
- ☑ **October 2015:** Application acceptance
- ☑ **November 2015:** Pre-workshop meeting in Merida, Mexico (3<sup>rd</sup> International Symposium on Anchialine Ecosystems)
- ☑ **February 2016:** First Editor Workshop of WoRCS in Flanders Marine Institute (VLIZ), Oostende, Belgium

*Fig.4. Slide extracted from presentation 22Mon\_1300\_ShortHistory\_WorkshopAim\_VG*

## 2. Delimitation of the scope of the World Register of Marine Cave Species (WoRCS)

[Presentations 22Mon\_1600\_WoRCSAim\_VG, 22Mon\_1630\_TargetedData\_List\_VG]

### 2.1. Aim

The World Register of marine Cave Species (WoRCS) aims to create a comprehensive taxonomic and ecological database of species known from marine and anchialine cave environments worldwide. The assembled data will form a Thematic Species Database (TSD) of WoRMS. The cave-related information will be managed by the WoRCS thematic editors in collaboration with the taxonomic editors of WoRMS, who manage the taxonomic content. The creation of this database will allow for an accurate assessment of the diversity and distribution of such faunas, and will provide information vital for evidence-based conservation.

It has been emphasized during the workshop that data encoding should be primarily scientific question and conservation wise driven.

### 2.2. Type of caves

There is a long-lasting discussion among specialists in order to characterize the different type of caves comprising anchialine ecosystems. Although a consensual definition was published (Stock *et al.* 1986), it has not been completely endorsed by the community, including some of its authors. In particular, defining what an anchialine cave is seems rather complex as there is an uninterrupted continuum of variations between strictly submarine and purely freshwater caves. The essential point here is to reach a consensus about whether WoRCS should include data on inland freshwater caves and their species. It should be noted that WoRMS provides facilities to do so, and already manages a number of freshwater species, so there is no limitation from WoRMS' point of view.

Although the debate continued during the workshop, it was decided to adopt a pragmatic approach, and to be as most inclusive as possible, especially regarding opportunistic digitization and dissemination of any available data. This means that editors will integrate data based on their responsible expertise. If data are obviously outside the marine / brackish / anchialine scope of WoRCS, data may still be integrated, but various levels of filtering out data for users' queries will be progressively implemented in Marine Regions and WoRMS as necessary.

Data from purely freshwater underground ecosystems have been already integrated during the workshop because they were readily available from one of the editors. These data may be interesting / necessary to explain the underground biodiversity around anchialine caves, and were endorsed during the workshop. The only restriction concerns the validation of the integration of species in WoRCS context (i.e., validation of the occurrence in a cave covered

by WoRCS scope). Including purely freshwater species may increase significantly the amount of data in WoRCS. Those WoRCS editors responsible for taxonomic groups may not have the possibility of spending time for such quality control (QC) activities. It is recommended then that these data remain under the responsibility of the editor who provided them, including finding a way to organize appropriate quality control. It is anticipated that when data from FADA (Freshwater Animal Diversity Assessment; Balian et al. 2008) are more complete and disseminated (incl. possibly through Aphia), this issue could be addressed in a more efficient way. We explicitly give priority here to saving legacy data, rather than constraining the scope, expecting that filter implementation will help to narrow down users' queries. Finally, it is also anticipated that the definition of anchialine cave could be refined through thorough analyses using aggregated data in WoRCS.

### 2.3. Taxonomic scope

The taxonomic scope of WoRCS covers primarily Protozoa (especially Foraminifera) and Animalia. Data entry on other kingdoms (e.g. Bacteria, Chromista, and Plantae) may be considered upon an opportunistic basis (e.g., for bacterial mats).

Data associated with taxon at supra-species ranks will not be added to WoRCS until there is good evidence for the possible species identification. However, these data may be valuable, and a mechanism specific to WoRCS will be elaborated, e.g., through data files uploaded in IMIS as sources.

### 2.4. Occurrence status scope

There was a discussion if all epigeal accidental visitors should be included in the taxonomic scope, especially in anchialine caves that are connected to freshwater systems where the water flow could be the only responsible for such occurrences (e.g., for cadavers). This may significantly increase the number of species to document in WoRCS, beyond the Editorial Team capacities. The same responsible expertise approach as exposed in the subsection 'Type of caves' above should be used.

It could be also summarized like: keep the facts that are ecologically significant. The weakness of this approach is that for rarely reported species, we would eliminate them while in the end, with the accumulation of reports, we could extract some ecological signal. On the other hand, we are rather using published information, whereby those papers summarizing these rare reports would be recorded in WoRCS.

### 2.5. Geographic scope

WoRCS aims at including data from all around the world. The discussions during the workshop highlighted and regretted the difference of scientific research efforts in the various regions of the world. A consequence might be an apparent WoRCS incompleteness in the end. WoRCS has obviously a role of promotion of research in understudied regions and will conduct a progressive geographic gap analysis as suggested during the pre-workshop.

### 3. List of targeted data and associated vocabulary

[Presentations 22Mon\_1630\_TargetedData\_List\_VG, 23Tue\_0900\_Terminology\_NB]

WoRCS will incorporate data on the biodiversity of marine caves and anchialine ecosystems of the world. In order to uniformly handle information within WoRCS, the editors compiled a list of targeted descriptors and a standard glossary based on existing terminology.

#### 3.1. Species known to occur in marine cave or anchialine ecosystems of the world

#### 3.2. Ecological categorization of these species

##### 3.2.1. Species salinity preference (multichoice)

- *Freshwater*: species occurring at a salinity range of 0-0.5 ppt.
- *Halocline*: species preferably occurring at the halocline, probably using the organic matter and bacteria accumulated at that area.
- *Brackishwater*: species occurring at a salinity range of 0.5-30 ppt.
- *Saltwater*: species occurring at salinities higher than 30 ppt.

##### 3.2.2. Terms for cave ecological categories of taxa (after Culver & White 2012)

- *Stygobionts (sensu lato)*: obligatory aquatic cavernicoles only surviving in caves or similar subterranean habitats and usually showing a significant or total loss of vision and pigmentation. The term is used in a general sense to refer to cave exclusive species.
- *Stygophiles*: facultative aquatic cavernicoles that can live and complete their life cycle within caves, but can also be found in suitable habitats outside caves. They usually present certain degree of adaptation to the subterranean realm (e.g., reduction of eyes and pigmentation).
- *Stygoxenes*: aquatic animals which occur in caves, but, periodically return to the surface for food, e.g., certain mysids or fish.
- *Accidental*: aquatic organisms that enter a cave by chance (e.g., swept in by tidal currents or become disoriented and lost), but can only survive there for short periods of time.
- *Undetermined*: species with unknown ecological category.

##### 3.2.3. Terms for light zones (after Culver & White 2012)

- *Daylight zone (LI)*: species that occur in unshaded anchialine pools, totally exposed to sunlight.
- *Cave entrance (CE)*: species that occur within the cave area that receives enough sunlight to permit the growth of algae.
- *Semidark or Twilight zone (SD)*: species that occur within the cave area that receives limited sunlight, not enough to permit the growth of algae.
- *Dark zone (DZ)*: species that occur within the cave area that has no light.

##### 3.2.4. Microhabitats, e.g. pools in caves, other physico-chemoclines (free text)

### 3.3. Geographical distribution in cave environments

*Species records will be georeferenced using the coordinates from the Gazetteer of marine and anchialine caves.*

### 3.4. Type of subterranean environment

*Distinction between records from freshwater, anchialine and fully marine caves involves consideration of hydrographic data, especially salinity regimes (e.g., freshwater, pycnocline, marine water).*

#### 3.4.1. Water regime (multichoice)

*Water regimes of a specific locality are based on the presence of specific types of water bodies.*

- *Marine:* a locality is categorized as hosting marine water body when it contains a significant amount of water coming from the sea and mixing with comparatively short residence time.
- *Freshwater:* a locality is categorized as hosting fresh water body when it contains a significant amount of freshwater, either coming from the surface or from the groundwater aquifer.
- *Anchialine:* a locality is categorized as hosting an anchialine water body when it contains a significant amount of water with marine origin and but restricted exposure to open air, as well as negligible exchange with the open marine waters by diffusion with contiguous marine water bodies.

#### 3.4.2. Access point

- *Cave entrance:* A natural underground or underwater hollow place with an opening that is more or less horizontal. For cavers, a cave is any natural hole, vertical (also known as potholes), horizontal, or a combination of both, which can be penetrated by humans (Romero 2009).
- *Borehole / Well / artificial features:* artificial entrance to the subterranean realm.
- *Pool:* water-filled depression that can have different origins, it can be superficial or connected to the groundwater.
- *Spring:* location where groundwater naturally emerges.

#### 3.4.3. Local term

- *Ocean blue hole:* in the Bahamas or Belize, a flooded sinkhole with a circular entrance extending beneath the seafloor.
- *Inland blue hole:* in the Bahamas or Belize, a flooded sinkhole with a circular entrance located inland from the coastline.
- *Cenote:* in certain regions of Central America with Mayan influence, an inland sinkhole with a circular entrance.
- *Grieta:* in the Galápagos and Cuba, a vertical, seawater-flooded fissure formed by tectonic processes.



- *Jameos*: in the Canary Islands, a window into a lava tube formed either by collapse, incomplete closure of the roof of the cave, or by explosions during the formation of the cavity.
- *Casimba/Tanque*: in Cuba, a sinkhole with a circular entrance above the sea level.
- *Vrulja*: in Croatia, underground permanent streams discharging under the sea level.
- *Lava tube*: is a natural conduit formed by flowing lava which drained beneath the hardened surface of a lava flow.

#### 3.4.4. Rock type (from Field et al. 1999)

- *Limestone*: a sedimentary rock composed principally of calcium carbonate.
- *Volcanic*: rocks formed from magma from an erupting volcano.
- *Other*: rocks other than limestone or volcanic in nature.

#### 3.4.5. Oxygen concentration (from Sket 1996; multichoice)

- *Normoxic*: water bodies with dissolved oxygen concentrations of 8.0-2.0 ml/l.
- *Hypoxic ("oligoxic")*: water bodies with dissolved oxygen concentrations of 2.0-0.0 ml/l.
- *Anoxic*: water bodies with dissolved oxygen concentrations of 0.0 ml/l.

#### 3.4.6. Cave morphology (from Field et al. 1999 and Palmer 1991)

- *Blind cave*: a cave consisting of a comparatively short passageway that ends as a cul-de-sac.
- *Tunnel*: a cave consisting of a comparatively short passageway that opens to entrances at both ends.
- *Pit*: a vertical cave with negligible horizontal passages.
- *Complex morphology*: a cave consisting of arrays of intersecting passageways that form distinctive patterns.
- *Artificial*: a subterranean void created by humans (e.g., mines, tunnels, tombs, etc.).

#### 3.4.7. Submersion level (multichoice)

- *Submerged*: a cave is categorized as submerge when at least some of its passageways extend below the water table.
- *Semi-submerged*: a cave is categorized as semi-submerge when at least some of its passageways extend at the level of the water table.
- *Intertidal*: a cave is categorized as intertidal when at least some of its passageways are directly exposed and affected to the coastal tides.

#### 3.4.8. Total length (number)

#### 3.4.9. Maximum depth inside the cave (number)

#### 3.4.10. Minimum depth inside the cave (number)

#### 3.4.11. Position of the entrance from sea level (number)

- *Maximum depth for submarine entrances.*

3.4.12. Remarks (free text to mention exceptions, additions, or other general comments)

### 3.5. Other types of data

- Editors must signal synonyms not in WoRMS yet to the respective taxonomic editors.
- Tickbox for Non-Indigenous Species (link to the World Register of Introduced Marine Species).
- Tickbox for deep-sea species (link to the World Register of Deep-Sea Species).
- Photographs (use the terms of usage defined by WoRMS).
- Clickable pdf describing caves that will be in marine regions: to be managed as other references, but be sure that the link is in Marine Regions.
- Maps and schemes of the caves: we will create a protected repository within the Google Drive reserved to editors only. Images in publications may have other copyrights than the entire pdf when used alone. Reconsider the question to disseminate those next annual meeting.
- Linking to molecular and phylogenetic databases.
- Information regarding the conservation status: IUCN categories are automatically updated directly from IUCN RedList database by WoRMS. However, national threat statuses are not recorded. Editors are recommended to signal website or publications listing the national threat statuses to the DMT for linking or batch uploading.

## 4. List of current and potential new editors

[Presentation 24Wed\_1330\_EditorialTeam\_VG]

See in section 6 subsection Governance for the description of the Editor Group

### 4.1. Founding and current Thematic Editors of WoRCS

With their roles, types of cave, geographic areas, taxonomic groups.

<b>Vasilis GEROVASILEIOU</b>	Coordinator/networking Thematic Editor, Marine caves Mediterranean Sea Sessile Fauna Porifera, Anthozoa, Brachiopoda, Echinodermata, Ascidiacea
<b>Nicolas BAILLY</b>	Thematic Editor, Data management Arctic, Southern Ocean Chaetognatha, Pisces
<b>Geoff BOXSHALL</b>	Thematic Editor, Anchialine caves World Crustacea

<b>Thomas M. ILIFFE</b>	Thematic Editor, Marine caves, Anchialine caves North America, Caribbean Sea, Bahamas, Bermuda Crustacea
<b>Alejandro MARTÍNEZ</b>	Thematic Editor, Marine caves, Anchialine caves Atlantic Oceanic Islands, Africa, Cuba Meiobenthic groups, Annelida, Priapulida, Platyhelminthes
<b>Fernando ÁLVAREZ</b>	Thematic Editor, Anchialine caves Central America, South America Arthropoda
<b>William F. HUMPHREYS</b>	Thematic Editor, Anchialine caves Australasia Fauna
<b>Damià JAUME</b>	Thematic Editor, Anchialine caves Mediterranean Sea Crustacea



*Fig.5. From front left clockwise: Thomas M. Iliffe, Nicolas Bailly, Vasilis Gerovasileiou, Fernando Álvarez, William F. Humphreys, Geoff Boxshall, Damià Jaume, Alejandro Martínez.*

#### 4.2. Editors who accepted to join the team after the workshop

With their roles, types of cave, geographic areas, taxonomic groups.

<b>Guilherme MURICY</b>	Thematic Editor, Marine caves South America Porifera
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**Peter van HENGSTUM**      Thematic Editor, Marine caves, Anchialine caves  
North America  
Protozoa, mainly Foraminifera

#### 4.3. Expanding the network of Thematic Editors

During the workshop the founding editors of the WoRCS highlighted the need to expand the network of Thematic Editors in order to cover underrepresented areas (i.e. South-West Asia, South-East Asia, East Asia, Central and South Africa / Madagascar, North Pacific) and taxonomic groups. On this basis, a list of potential editors that will be contacted by the founding editors of WoRCS was created during the workshop.

### 5. Plans for compiling a gazetteer of caves with geo-coordinates

During the workshop, Francisco Souza Dias introduced the Marine Regions initiative, the general principles, the various resources, the query interface, the GIS/mapping possibilities, and the data encoding interface. Nathalie De Hauwere helped to answer questions about the integration of caves in the Marine Regions Gazetteer (MRG). The results of discussion are integrated in different places of the section.

#### 5.1. Gazetteer

In order to generate occurrence data to be eventually served to OBIS and GBIF, the WoRCS Editor Group will establish a gazetteer for the marine caves and other access points to the anchialine systems of the world. The presence records of species could be georeferenced and constitute an important dataset for the biogeographical and climate change studies on marine caves. Layers for cave occurrence mapping could thus be created.

The cave data will be integrated in the MRG, which already has a 'Cave' object type (<http://www.marineregions.org> and <http://marineregions.org/gazetteer.php?p=search>). Keeping one object type was preferred to having two separated object types, namely Marine cave and Anchialine cave. This later information will be added as a new descriptor (subsection 3.4.1).

During the workshop, 12 additional descriptors and their attributes were elaborated for the description of caves (see section 3.4). To avoid to impose too many changes in the MRG just for a subset, these descriptors will be concatenated in the Note field with standard tags in the cave object type items. These cave descriptors will be searchable under the WoRCS interface at least.

During the pre-workshop, the editors agreed that creating such a gazetteer constitutes a challenging initiative that should be coordinated by one of the editors. T. Iliffe volunteered, and roles were detailed during the workshop as below. The WoRCS Editor Group will study

the possibility to publish the gazetteer as a separate product, including under a form of an electronic atlas and/or a mobile phone application.

## 5.2. Gazetteer compilation

A. Martínez and V. Gerovasileiou will assemble their cave data under the MRG template augmented with the 12 descriptors listed in section 3.4 above for cave description ([https://drive.google.com/open?id=0B3dn4Uj8m1\\_T0t5dW1OT1N2NTg](https://drive.google.com/open?id=0B3dn4Uj8m1_T0t5dW1OT1N2NTg)). T. Iliffe will ask the agreement from the QRSS society in Mexico (<https://caves.org/project/qrss/qrss.htm>) to import their list in the gazetteer (see menu items on the left for several lists).

N. Bailly will set up a database to integrate these files for quality control and keeping the capacity to extend cave features as a structured dataset (compared to the semi-structured notes in one text field in MRG). The link with MRG will be ensured by the MRGID (Marine Regions Geographic Identifier: <http://marineregions.org/mrgid.php>).

Finally, the filled MRG template will be given to the DMT:

[http://marineregions.org/files/MarineGazetteer\\_inputfile.xlsx](http://marineregions.org/files/MarineGazetteer_inputfile.xlsx).

Note that a minimum of 100 records is required for uploading efficiently in bulk.

At least two data fields are mandatory for each cave: (i) name or code, and (ii) coordinates or a locality, with a given precision according to the policies on localization of caves developed in section 6. It is suggested to start with caves with species records, as a minimum, and then create an additional but optional list for other caves.

The citation for the article-published gazetteer will be:

Iliffe, T.M.; Martínez, A.; Gerovasileiou, V.; Boxshall, G.; Álvarez, F.; Humphreys, W.F.; Jaume, D.; Bailly, N.; + MR and/or WoRMS DMT relevant members, YEAR. Gazetteer of the Marine and Anchialine Caves of the World. Biodiversity Data Journal, yyy.

The citation for the digital gazetteer as in Marine Regions, if necessary, could be:

Iliffe, T.M.; Martínez, A.; Gerovasileiou, V.; Boxshall, G.; Álvarez, F.; Humphreys, W.F.; Jaume, D.; Bailly, N.; Claus, S., De Hauwere, N., Souza Dias, F.; Oset García, P.; Vanhoorne, B.; Hernandez, F. YEAR. Gazetteer of the Marine and Anchialine Caves of the World. In: Marine Regions (S. Claus, N. De Hauwere, B. Vanhoorne, F. Souza Dias, P. Oset García, F. Hernandez, and J. Mees, eds. MarineRegions.org. Oostende (Belgium): Flanders Marine Institute. Accessed at <http://www.marineregions.org> on DATE).

## 5.3. Mapping

T. Iliffe will coordinate the mapping: he showed an initiative from ESRI, the story maps (<http://storymaps.arcgis.com/en/>), that builds maps with different points of view. Examples on Remipedia (Remipedia World Locations) created by B. Szukalski (ESRI) are reserved to the Editor Group (not advertised to public yet): four scenarios are proposed Story Map Basic,

Story Map Tour, Story Map Journal, Story Map Series. The Editor Group will select one scenario for further tests.

This option is complementary to the mapping functionalities proposed by WoRMS/MarineRegions, like enabling overlays with OBIS occurrences (see World Porifera Database, <http://www.marinespecies.org/porifera/>; distribution maps per species, e.g., <http://www.marinespecies.org/porifera/porifera.php?p=taxdetails&id=133445>) for *Crambe crambe*.

## 6. WoRCS governance and policies (including data exchange)

[Presentation 24Wed\_1400\_Policies\_NB]

### 6.1. Governance

#### 6.1.1. Constitution of the Editorial Team

The **WoRCS Editorial Team** is composed of Thematic Editors. Twelve of these editors constitutes the Editor Group that manages WoRCS, covering a broad taxonomic and geographical range.

The **WoRCS Editor Group** will manage the membership in the team and in the group on consensus basis from any proposal or suggestion. No rules have been formally established for acceptance and exclusion of members. In case of difficulties, WoRCS will follow the current rules and practices in WoRMS, and will seek for advice from the WoRMS Steering Committee.

The WoRCS Editor Group will select priorities for development of new tools in consultation with the WoRMS DMT and for data encoding. It will organize meetings, teleconferences (on demand by any of the Editor Group) and workshops. In particular, an annual meeting will be organized to follow the yearly progress and to establish a working plan for the coming year (see below for a detailed list of points to be yearly discussed).

Currently, at the date of the workshop, only eight Thematic Editors are in the Editor Group who are the WoRCS founding editors (listed as Participants at the beginning of the document). At the time of the workshop, we were looking for four more (see section 4). At the time of the report, two colleagues accepted already to join the Editor Group.

All other Thematic Editors will support the overall initiative, provide/validate data and will be able to replace temporarily members of the Editor Group who won't be able to attend an annual meeting, or who will definitely step away from the Editor Group.

#### 6.1.2. Ownership, IPR, licensing and related issues

WoRCS will follow WoRMS rules.

Like all editors in WoRMS, WoRCS editors are strongly recommended to sign the WoRMS Terms of References, see the text in annex section 11.3:

[http://www.marinespecies.org/docs/agreements/WoRMS\\_Terms\\_of\\_Reference.pdf](http://www.marinespecies.org/docs/agreements/WoRMS_Terms_of_Reference.pdf)).

### 6.1.3. Annual meetings: a template agenda

This integrates how the annual work plan was discussed for 2016-2017, and other discussions on the strategic plan.

#### Check the progress of the previous annual work plan and list the achievements

- List taxonomic group and geographic areas achieved
- General statistics evolution
- List of publications
- Status of network activities
- Addressing past issues

#### Establish the plans for the next annual work plan

- Recommend the priorities for data encoding, esp. in relation with ongoing project (Data encoding plans: (a) by taxonomic group, (b) by geographic area, (c) on WoRCS in general)
- Publication plan
- Search for new editors (completing the geographic and taxonomic coverage), post-docs (preparing the future), and students (batch data encoding) with respect to the progress and projects
- Review the funding opportunities for increasing and improving the data content, incl. proposals where data management can be integrated and funded as project tasks (e.g., to complete data for a taxon and or a geographic area)
- Review outreach plans: webpages, representation in conferences, flyers, educative products and activities
- Decide on the next annual meeting

### 6.2. WoRCS specific policies

The few policies listed below are not limitative and can be extended by the Editor Group as needed.

#### 6.2.1. Dissemination of datasets

Unless restrictions of usage are mentioned, data that were publicly published by any media mean are considered to be potentially integrated in WoRCS and disseminated through WoRCS / WoRMS / Marine Regions, and along signed agreements with Third Parties if any.

However, it is suggested that a case by case approach is always possible to take into account complex situations.

#### 6.2.2. Different accuracy for cave locations for different users

The dissemination of precise location of cave entrance has to be carefully evaluated case by case for possible conservation, privacy, and human security issues (esp. regarding amateur and touristic diving).

General principle regarding cave coordinates: published coordinates of caves are stored in the Gazetteer as they are presented in the relevant publications. Previously unpublished coordinates are recorded in decimal degrees with only three decimals unless more restrictive constraints are notified, e.g., by owner of the cave, touristic exploitation companies, natural park managers, authors of papers (scientific, magazine, newspaper, etc.), administrative regulations at any level, etc.

### 6.2.3. Data exchanges between WoRCS and editors' databases

[Presentation 24Wed\_1100\_DataExchange\_NB]

When editors will continue to maintain a separated database on their own with data that they provide to WoRCS, each editor will have to solve IPR issue separately with the WoRMS DMT. The usual issue of how to maintain the primary sources alive was raised. One possibility is to use the connection with WoRMS as a leverage for fund raising, and to participate to projects.

Technical issues may be raised, and may require the development of web services on the provider side, and client software on WoRMS side. This must be discussed on case by case basis. However, to facilitate further data exchanges, it is important that the personal databases keep the unique ids used in WoRMS and Marine Regions.

These questions were asked by F. Alvarez for the UNAM collection database, especially how to create deep cross-links with WoRCS.

### 6.2.4. Illustrations (photos, drawings, schemas, etc.)

General principle regarding photographs by WoRMS: Default usage of the Creative Commons [Attribution-Noncommercial-Share Alike 4.0](https://creativecommons.org/licenses/by-nc-sa/4.0/) License.

## 7. Strategic plan (5 years)

[Presentation 25Thu\_0900\_StrategicPlan\_5years\_NB\_VG]

- Elaborate scientific questions: every year, a list of driving scientific questions will be reviewed by the Editor Group on the basis of communication with the Editorial Team during the year. These questions will be used for setting priorities for data encoding. However, data should be hypothesis-free encoded as much as possible, and then datasets can be assembled for answering scientific questions.
- Encode data: all data currently held by the eight founding editors will be integrated in WoRCS. Records of species will be progressively linked to ecological, morphological, genetic and phylogenetic traits.
- Complete coverage: taxonomic and geographic coverage by editors will be completed through the expansion of the Editorial Team (i.e., all taxa are monitored by an editor, as well as all areas with caves). Every year, the Editor Group will discuss data



encoding plans: (a) Gazetteer (b) by taxonomic group, (c) by geographic area, (d) on WoRCS in general.

- Convene annual meetings: Annual meetings may be organized back to back with other meetings/conferences, at least at the beginning of the initiative.
- Engage WoRCS in research: raise the standing of WoRCS in the biospeleology and marine biology scientific communities, increase citations in scientific papers, engage the scientific community to develop common projects on marine and anchialine caves, especially in areas rarely or not studied yet.
- Initiate a fellowship programme: engage young researchers in projects that would make use of WoRCS data in such a way that there is always a pool of colleagues who could take over the management of WoRCS.
- Develop educative, citizen science and conservation activities: create products (maps, guides, courses) for public at large, engage volunteers to encode data, develop tools for MPA managers and conservationist community.
- Develop funding partnership and funding mechanisms: during the workshop the Editors created a list of potential partners to be contacted. In particular, each time that a project about caves is funded, a work package or module or deliverable about WoRCS should be included to pay students for data encoding, or to facilitate new types of data, or new links to other e-infrastructures or new data tools.
- Create or participate to learned societies: e.g., Formal Society for anchialine studies and Expert group on anchialine studies in Biospeleology Society.

## 8. Work plan for 2016-2017

[Presentations 25Thu\_0930\_WorkPlan\_1year\_NB\_VG, 23Tue\_1630-1\_EncodingPlans\_NB]

- 8.1. During the workshop, the group elaborated a worksheet crossing taxa and areas. Editors were assigned as responsible to monitor the progress the data encoding of a taxon or an area or a taxon in an area. See section 8.4 for some detailed plans.
- 8.2. Gazetteer
  - A. Martínez to adapt the MRG template with new descriptors
  - Enter first cave names + locality to get a MRGID
  - Then link descriptors with MRGID, and upload as a batch file
  - Caves will be assigned to the WoRCS context in Marine Regions
- 8.3. Mapping
  - Everybody select one story map of preference and send the choice to T. Iliffe for further development (see section 5).
- 8.4. Species
  - During the workshop, more than 1,300 species were assigned to the WoRCS context by W. Decock as batch files from datasets provided by D. Jaume, A. Martínez, W.

Humphrey, T. Iliffe, and V. Gerovasileiou, or manually through the Aphia interface (G. Boxshall and N. Bailly).

- V. Gerovasileiou to adapt the WoRMS species template with new descriptors.
- Circulate templates through the WoRCS mailing list
- Data from Mexico to be integrated (F. Álvarez with UNAM IT)
- Integrate data from the Mediterranean Sea (V. Gerovasileiou, A. Martínez, D. Jaume)
- Priority groups and responsible Editors: Remipedia, Thermosbaenacea, Atyidae and Thaumatoctyprididae (T. Iliffe); Copepoda (G. Boxshall); Chaetognatha (N. Bailly).
- T. Iliffe has volunteers and students ready to start: think about which data could be encoded soon.

#### 8.5. Caves

- T. Iliffe suggested to prioritize caves with a high number of (endemics) species, which provides more potentialities for scientific and conservation exposures.

#### 8.6. Paper publication plan

[24Wed\_1430\_Papers\_PublicationPlan\_VG]

- For each paper to be published, specify that data were extracted from or will be uploaded in WoRCS.
- RIO journal for the description of the initiative (<http://riojournal.com/about>)
- Extended abstract in the proceedings of the Symposium for Anchialine Ecosystems
- W. Humphrey will investigate publishing in Subterranean Biology where T. Iliffe is also an editor.
- Data papers depending on the content of the database
- Story maps per group (e.g. Remipedia, other groups?) - promote conservation etc.

8.7. Search for new editors (completing the geographic and taxonomic coverage), post-docs (preparing the future), and students (batch data encoding) with respect to the progress and projects (see section 4).

8.8. Review the funding opportunities for increasing and improving the data content, incl. proposals where data management can be integrated and funded as project tasks (e.g., to complete data for a taxon and or a geographic area) (see section 7).

8.9. Review outreach plans: webpages, social networks, representation in conferences, flyers, educative products and activities.

8.9.1. Webpages (first draft prepared before workshop by B. Vanhoorne)

##### Home page of WoRCS

- Send texts, photos, webpage design options to [info@marinespecies.org](mailto:info@marinespecies.org)
- V. Gerovasileiou and N. Bailly will select relevant paragraphs from proposal and report for the description of the group.
- Pictures: caves, activities, species: T. Iliffe posted a set of pictures on Google Drive for further selection/vote. He will mobilize a web designer for a proposal for the WoRCS home page layout and then contact the DMT.

- Adding logos & links of funders to the website / groups and societies as partners
- Logo: T. Iliffe and N. Bailly will ask artists to propose ideas. One to be selected further.
- Links to editors' website(s), if any.
- Add the stat of number of visitors.
- Add stats on taxa and cave data on top right about. V. Gerovasileiou and N. Bailly to select indicators.
- Add the search name box + relevant filters (to be able to select freshwater species in anchialine caves without those occurring only in freshwater caves and bodies).
- Link to relevant GSDs, e.g., Remipedia.
- Send an alert to taxonomic editors when WoRCS is up and running.
- When enough data, make ranked lists of caves according to number of recorded species; have two lists (marine, anchialine). And ranked species list by number of caves where they are recorded.
- For next year: Make a query listing the stygobionts at their highest taxon rank across all groups.
- 'Contact us' menu item.
- For the search box, add relevant tickboxes for filtering out truly freshwater species

#### Integration of T. Iliffe's webpages

- Test integration on a couple of species by B. Vanhoorne and N. Bailly
- T. Iliffe contacts info@marinespecies.org after he checks issues with the IT department of his university

**World Register of marine Cave Species (WoRCS) \*beta\***

Intro | Search taxa | Taxon tree | Sources | Statistics | Editors | Log in

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**The World Register of marine Cave Species (WoRCS)**

The World Register of marine Cave Species (WoRCS) aims to create a comprehensive taxonomic and ecological database of species known from marine and anchialine cave environments worldwide. The assembled data will form a Thematic Species Database (TSD) of WoRMS. The cave-related information will be managed by the WoRCS thematic editors in collaboration with the taxonomic editors of WoRMS, who manage the taxonomic content. The creation of this database will allow for an accurate assessment of the diversity and distribution of such faunas, and will provide information vital for evidence-based conservation.

**News**



**WoRCS editors got off to a flying start!**  
Added on: 2016-02-29 10:23:31 by Dekeyser, Stefanie  
 On February 22-25, eight experts on marine and anchialine cave faunas gathered at the Flanders Marine Institute (VLIZ), host institute of the World Register of Marine Species (WoRMS), for the first editor workshop of the World Register of marine Cave Species (WoRCS). ... [\[Read more\]](#)

[\[Add\]](#)

The thematic editors of this online database are

- **Álvarez Noguera, Fernando:** Arthropoda (Anchialine caves, Central America, South America)
- **Bailly, Nicolas:** Chaetognatha, Pisces (Data management, Arctic, Southern Ocean)
- **Boxshall, Geoff:** Crustacea (Anchialine caves)
- **Gerovasileiou, Vasilis:** Anthozoa, Ascidiacea, Brachiopoda, Echinodermata, Porifera (Coordinator/networking, Marine caves, Mediterranean Sea, Sessile Fauna)
- **Humphreys, William F.:** Animalia (Anchialine caves, Australasia)
- **Iliffe, Thomas M.:** Crustacea (Marine caves, Anchialine caves, North America, Caribbean Sea, Bahamas, Bermuda)
- **Jaume, Damià:** Crustacea, Thermosbaenacea (Anchialine caves, Mediterranean Sea)
- **Martínez García, Alejandro:** Annelida, Platyhelminthes, Npnapulida (Marine caves, Anchialine caves, Atlantic Oceanic Islands, Africa, Cuba, Meiobenthic groups)

**Citation**

Gerovasileiou, V.; Martínez, A.; Álvarez, F.; Boxshall, G.; Humphreys, W.F.; Jaume, D.; Bailly, N.; Iliffe, T. (2016) World Register of marine Cave Species. Accessed at <http://www.marinespecies.org/worcs> on 2016-03-11

Website and databases developed and hosted by VLIZ · Page generated 2016-03-11 · contact: Nicolas Bailly

Fig.6. The WoRCS home page as of 11 March 2016 (<http://www.marinespecies.org/worcs/aphia.php?p=stats>).

	<b>all taxa</b> [M, nF]	<b>all species</b> [M, nF]	<b>acc. species</b> [M, nF]	<b>acc. species</b> [nM, nF]	<b>checked taxa</b> [M, nF]
Biota	2,815	1,189	1,135	207	2,703 (96 %)
Kingdom <b>Animalia</b>	2,793	1,187	1,133	207	2,683 (96 %)
Phylum <b>Annelida</b>	178	64	57	1	172 (97 %)
Phylum <b>Arthropoda</b>	1,261	570	538	203	1,234 (98 %)
Phylum <b>Brachiopoda</b>	37	9	9	0	0 (0 %)
Phylum <b>Bryozoa</b>	54	16	16	0	53 (98 %)
Phylum <b>Cephalorhyncha</b>	6	3	3	0	6 (100 %)
Phylum <b>Chaetognatha</b>	9	4	4	0	9 (100 %)
Phylum <b>Chordata</b>	165	52	49	0	158 (96 %)
Phylum <b>Cnidaria</b>	130	42	39	1	122 (94 %)
Phylum <b>Echinodermata</b>	64	13	13	0	64 (100 %)
Phylum <b>Mollusca</b>	129	37	32	2	128 (99 %)
Phylum <b>Phoronida</b>	3	1	1	0	0 (0 %)
Phylum <b>Porifera</b>	644	334	331	0	644 (100 %)
Phylum <b>Rotifera</b>	16	3	3	0	16 (100 %)
Phylum <b>Sipuncula</b>	12	2	1	0	9 (75 %)
Phylum <b>Tardigrada</b>	70	37	37	0	63 (90 %)
Kingdom <b>Chromista</b>	20	2	2	0	19 (95 %)
Phylum <b>Ciliophora</b>	9	1	1	0	8 (89 %)
Phylum <b>Foraminifera</b>	6	1	1	0	6 (100 %)

Fig.7. The WoRCS statistics page as of 11 March 2016 (<http://www.marinespecies.org/worcs>).

### 8.9.2. Social networks:

#### Mailing list

- Already up and running, created before the workshop
- Address: [worcs@marinespecies.org](mailto:worcs@marinespecies.org)
- Do we need an email address for info requests? Or managed by Contact us on webpages.

#### FaceBook

- T. Iliffe opened WoRCS FB account (<https://www.facebook.com/groups/WoRCS/>). All will have password.
- Send remarks and notes to T. Iliffe.

#### Twitter

- CaveSpecies Twitter account for WoRCS has been created by T. Iliffe

### 8.9.3. Conferences

- Board of Scientific Diving (2nd conf. soon) in 2016
- 2nd Mediterranean Symposium on the conservation of dark habitats (RAC/SPA) in 2017-8.

#### 8.9.4. Others

##### IUCN Group

- W. Humphrey and T. Iliffe to contact the IUCN Cave Invertebrate Specialist Group to propose a subgroup on marine and anchialine cave species. See [http://www.iucn.org/about/work/programmes/species/who\\_we\\_are/ssc\\_specialist\\_groups\\_and\\_red\\_list\\_authorities\\_directory/invertebrates/caveinvertebrates/](http://www.iucn.org/about/work/programmes/species/who_we_are/ssc_specialist_groups_and_red_list_authorities_directory/invertebrates/caveinvertebrates/)
- Also possibly relevant: [https://www.iucn.org/about/work/programmes/gpap\\_home/gpap\\_biodiversity/gpap\\_wcpabiodiv/gpap\\_caves/](https://www.iucn.org/about/work/programmes/gpap_home/gpap_biodiversity/gpap_wcpabiodiv/gpap_caves/)

#### 8.10. Next Annual meetings

##### 8.10.1. Next annual meeting

##### Whereabouts

- Late May 28 – Early June 2017.
- 3 days after the next Freshwater Decapoda World Conference, UNAM, Mexico (<http://freshwaterdecapods.unam.mx/>).
- One half-day could be a symposium in the conference dedicated to Decapoda and caves.
- Meeting infrastructure available in UNAM.

##### Funding possibilities to be explored

- Counterpart in bilateral country agreement.
- Money for the meeting logistics (UNAM).
- CONABIO funds: a proposal in January 2017. A letter from each of us (attendance, scientific support, 2 page CV, agenda of the meeting).
- Giving short courses for some of us that would help to pay trip and stay.

##### 8.10.2. Years after

- Before or after the next Anchialine cave conference in Lanzarote, Canary Is., in 2018, A. Martínez.

## 9. References

Balian, E.V., Lévêque, C., Segers, H., Martens, K., (Eds.), (2008) Freshwater Animal Diversity Assessment. Developments in Hydrobiology, 198: xvi+640 p. Netherlands: Springer, ISBN 978-1-4020-8259-7, doi:10.1007/978-1-4020-8259-7. Reprinted from *Hydrobiologia*, 2008, 595. Website: <http://fada.biodiversity.be/>

Culver, D., White, W. (2012) Encyclopedia of Caves. 2nd Edition. Elsevier, Oxford. 654 pp.

Field, M.S., Kraemer, S. R., Palmer, A. N. (1999). *A lexicon of cave and karst terminology with special reference to environmental karst hydrology*. Office of Research and Development, US Environmental Protection Agency.

Himmelman, A.T., 2002. Collaboration for a change Web publication, [[https://depts.washington.edu/ccph/pdf\\_files/4achange.pdf](https://depts.washington.edu/ccph/pdf_files/4achange.pdf)], Accessed 05 March 2016. [Is a January 2002 update of previous version cited in the document]

Palmer, A. N. (1991) Origin and morphology of limestone caves. *Geological Society of America Bulletin* 103(1): 1-21.

Romero, A. (2009). *Cave biology: life in darkness*. Cambridge University Press.

Stock J. H., Iliffe T. M., Williams D. (1986) The concept “anchialine” reconsidered. *Stygologia*, 2: 90-92.

10. Non reported activities

Presentation of WoRMS (S. Dekeyzer).

Presentation of Aphia and hands on (S. Dekeyzer, W. decock, B. Vanhoorne and attendants).

Presentation of Marine regions (F. Souza Dias, N. De Hauwere).

During the presentation about data exchanges, N. Bailly presented some general principles about large database assembling drawn from the experience of many projects.

The main recommendation is that editors have to take care how to distribute their effort between the necessary databasing that they need for publishing scientific papers, and the voluntary effort they do to expose the data to all publics. Working together has to be carefully guided (Fig.7).

## “The working together conundrum”

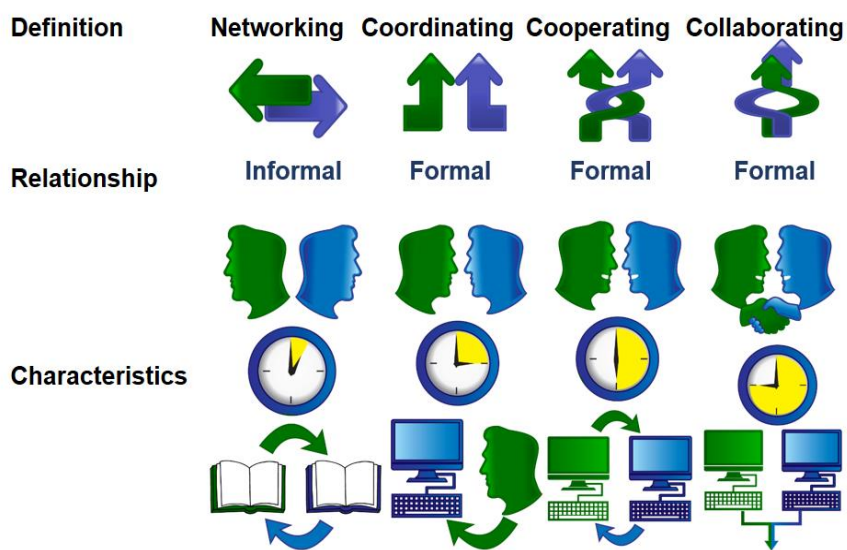


Fig.7. Modified matrix of Strategies for Working Together (Himmelman, 2002. *Collaboration for a change*). Slide by Lyra Pagulayan (FIN). Slide extracted from presentation 24Wed\_1100-1\_DataExchange\_NB.

## 11. Annexes

### 11.1. Agenda

When needed or more convenient, the agenda was modified on the fly from the original one (see below the actual one).

The number of outcomes have been reduced from 10 in the proposal to 8 during the workshop by merging the vocabulary with the list of targeted data, and the paper publication plan with the work plan.

The name of the file of the powerpoint presentation was added when exists.

#### **Workshop: World Register of Marine Cave Species (WoRCS)**

The goal of the WoRCS initiative is to create a comprehensive taxonomic and ecological database of known marine cave species worldwide (including those from anchialine caves) and to present this as a Thematic Species Database (TSD) of WoRMS, with all data dynamically linked to WoRMS and their team of taxonomic editors. Therefore, in WoRCS (as a subset of WoRMS), the taxonomy will be managed by the taxonomic editorial board of WoRMS, whereas the cave-related information will be managed by the WoRCS thematic editors in collaboration with the taxonomic editors of WoRMS. The geographical information used in WoRCS (e.g., locality, sea, ocean, and country's Exclusive Economic Zones) will be in accordance with international standards ([www.marineregions.org](http://www.marineregions.org)) used in WoRMS

#### **Outcomes:**

- Delimitation of the scope of the World Register of Marine Cave Species (WoRCS)
- List of targeted data and associated vocabulary (e.g. distribution, ecological traits, conservation status)
- List of current and potential new editors (if needed) and delimitation of their roles in (a) taxonomy, (b) geography, and (c) database management
- Plans for compiling a gazetteer of caves with geo-coordinates
- WoRCS governance and policies (including data exchange)
- Strategic plan (5 years)
- Work plan for the next year 2016-2017 with data encoding plan and publication plan

#### **Venue and date:**

Flanders Marine Institute (VLIZ) – Wandelaarkaai 7, 8400 Oostende; Beaufort Room (EuroMarine building)  
22-25 February 2016

#### **Confirmed participants:**

Vasilis Gerovasileiou (Hellenic Centre for Marine Research, Greece)

Nicolas Bailly (Hellenic Centre for Marine Research, Greece & FishBase Information and Research Group, Philippines)

Geoff Boxshall (Natural History Museum, Department of Zoology, UK)

Thomas M. Iliffe (Texas A&M University at Galveston, USA)

Alejandro Martínez (University of Copenhagen, Denmark)

Fernando Álvarez (Universidad Nacional Autónoma de México, Mexico)

William F. Humphreys (Western Australian Museum, Australia)

Damià Jaume (Instituto Mediterráneo de Estudios Avanzados, IMEDEA, Spain)

**Monday 22 February 2016 (day 1)**

**12:00 Arrival & sandwich lunch**

**13:00 Chair of the day Vasilis Gerovasileiou**

- Opening of the workshop [Vasilis Gerovasileiou & Nicolas Bailly]
- Practical information [Leen Vandepitte]
- Round-table [all]
- Adoption of the agenda

**13:30 Presentation of existing databases**

- World Register of Marine Species [WoRMS DMT]
- Database of Mediterranean marine cave biodiversity [Vasilis Gerovasileiou]
- Anchialine Caves and Cave Fauna of the World [Thomas M. Iliffe]
- Database from Stygofauna Mundi, SeaLifeBase and FishBase [Nicolas Bailly]
- Subterranean Marine Cave Fauna of the World [Alejandro Martínez]
- Anchialine fauna of Mexico [Fernando Álvarez]
- Anchialine fauna of the Balearic Islands [Damià Jaume]
- Other potential databases / checklists [all]

**15:30 Coffee / tea break**

**16:00** Defining the aims of WoRCS [Vasilis Gerovasileiou & all]

**16:30** List of targeted data [Vasilis Gerovasileiou & all]

**18:00 End of Day 1**

**Tuesday 23 February 2016 (day 2)**

**9:00 Chair of the day Nicolas Bailly**

Defining terminology (part 1) [Nicolas Bailly & all]

**10:30 Coffee / tea break**

**11:00** Presentation of the Aphia online editing interface [WoRMS DMT]

Hands-on training with the Aphia online editing interface

**12:30 Sandwich lunch**

**13:30** Hands-on training (continued)

**15:00** Defining the aims of WoRCS [Boxshall]

**15:30 Coffee / tea break**

**16:00** Setting up the WoRCS Editorial team [Vasilis Gerovasileiou & all]

**16:30** Data encoding plans for WoRCS [Nicolas Bailly]

**18:00 End of day 2**

**19:00 Dinner in Ostend, offered by LifeWatch**

**Wednesday 24 February 2016 (day 3)**

**9:00 Chair of the day Vasilis Gerovasileiou**

**9:00** Short presentation of Marine Regions [WoRMS DMT]

**9:45** Plans for compiling a gazetteer of caves with geo-coordinates [Thomas M. Iliffe]

**10:30 Coffee / tea break**

**11:00** Defining terminology (part 2) [Alejandro Martínez]

**12:00** Hands-on data input with the Aphia online editing interface

**12:30 Sandwich lunch**

**13:30** Data exchange between existing databases and WoRCS [Nicolas Bailly]

**14:00** WoRCS policies and governance [Nicolas Bailly & all] + finalizing setting up the WoRCS Editorial team

**14:30** Paper publication plan [Vasilis Gerovasileiou & all]



**15:30 Coffee / tea break**

**16:00** Outline for report writing [all]

**18:00 End of day 2**

**19:00 Dinner in Ostend, offered by LifeWatch**

**Thursday 25 February 2016 (day 4)**

**9:00 Chair of the day Nicolas Bailly**

Strategic plan for the next 5 years, including fundraising, conference participations, ... [Nicolas Bailly & all]

Detailed work plan for the next year, including possible meeting(s) & persons in charge [Nicolas Bailly & all]

**10:30 Coffee / tea break**

**11:00** Compiling workshop report [all]

Adoption of the workshop report & closure of the meeting [Vasilis Gerovasileiou & Nicolas Bailly]

**12:30 Sandwich lunch**

**13:30 End of workshop**

## 11.2. List of presentations

The files of presentations will be stored in GoogleDrive.

22Mon\_1330\_MeditCaves\_DB\_VG.ppt

22Mon\_1330\_UNAM\_FA.pptx

22Mon\_1600\_WoRCSaim\_VG.ppt

22Mon\_1630\_TargetedData\_List\_VG.ppt

23Tue\_0900\_Terminology\_NB.pptx

23Tue\_1630\_EncodingPlans\_NB.pptx

24Wed\_1100\_DataExchange\_NB.pptx

24Wed\_1330\_EditorialTeam\_VG.ppt

24Wed\_1400\_Policies\_NB.pptx

24Wed\_1430\_Papers\_PublicationPlan\_VG.ppt

24Wed\_1630\_WorkshopReport\_VG.ppt

25Thu\_0900\_StrategicPlan\_5years\_NB\_VG.ppt

25Thu\_0930\_WorkPlan\_1year\_NB\_VG.ppt

## 11.3. Datasets maintained by the founding editors

### 11.3.1. Database of Mediterranean marine cave biodiversity

[Presentation 22Mon\_1330-3-UNAM\_FA]

This database was created by V. Gerovasileiou and E. Voultsiadou. It contains >11,300 records of 2,500 taxa reported from >380 caves in 15 Mediterranean countries. Data were derived from 322 scientific studies, but also from primary research in eastern Mediterranean caves. All taxa in this database were cross-checked and taxonomically updated using the WoRMS.

Preliminary results and a short description of the database have been published in:  
Gerovasileiou V. and E. Voultsiadou, 2014. Mediterranean marine caves as biodiversity reservoirs: a preliminary overview, 45-50. [In Langar H., Bouafif C., and A. Ouerghi (editors). 2014. Proceedings of the first Mediterranean Symposium on the conservation of Dark Habitats. RAC/SPA, Tunis, 84 pp.].

Data regarding (a) Porifera, (b) eastern Mediterranean Sea (Aegean and Levantine ecoregions), and (c) non-indigenous species in Mediterranean marine caves have been published in the following papers:

Gerovasileiou, V. & E. Voultsiadou, (2012) Marine Caves of the Mediterranean Sea: A Sponge Biodiversity Reservoir within a Biodiversity Hotspot. PLoS ONE 7(7): e39873. doi:10.1371/journal.pone.0039873.

Gerovasileiou, V., Chintiroglou, C., Vafidis, D., Koutsoubas, D., Sini, M., Dailianis, T., Issaris, Y., Akritopoulou, E., Dimarchopoulou, D., Voultsiadou, E., (2015). Census of biodiversity in marine caves of the Eastern Mediterranean Sea. Mediterranean Marine Science, 16: 245-265.

Gerovasileiou, V., Voultsiadou, E., Issaris, Y., Zenetos, A., (2016). Alien biodiversity in Mediterranean marine caves. Marine Ecology. doi: 10.1111/maec.12268

Data for other groups of biota and Mediterranean regions are being processed in collaboration with taxonomic experts for different groups.

<b>MedCaves: Database of Mediterranean marine cave biodiversity</b>		
Number of references	<b>322</b>	The reference no 0 is Gerovasileiou, pers. comm. with the date to be put in the BIBLIO table.
Number of caves	<b>382</b>	Some of the "caves" are actually set of caves.
Number of taxa used for classification	<b>1573</b>	From phyla down to genera.
Number of taxa	<b>2583</b>	Taxa with strict nomenclatural code rules and ranks.
Number of synonyms	<b>2586</b>	Names that are standardized, e.g., Genus sp1 and Genus sp2 in the Biblio table are both linked under Genus sp. in the SYNONYMS table. It also includes common names, or ecologic names like Brown turf algae.
Number of citations of one name in one reference	<b>2789</b>	Contains the reference ID, the name given in the reference as plain text, the link to the synonym and the link to the taxon. Currently contains only one line per line of the BIOTA worksheet. So many are to be added.
Number of taxa in caves	<b>2397</b>	Number of taxa recorded from caves. it does not include yet the 174 species from Riedl, 1966 and 8 records where the zone has not been set up even as UK (unknown Zone). So add + 182
Number of names in cave zones	<b>11289</b>	Number of names recorded from cave zones. it does not include yet the 174 species from Riedl, 1966 and 8 records where the zone has not been set up even as UK (unknown Zone). So add + 182
Number of countries	<b>13</b>	Countries with information over the 28 with Med. or Black Sea coasts.
Number of one study in one country	<b>373</b>	Number of one study in one country.
Number of Mediterranean regions	<b>15</b>	Mediterranean regions with information over 15 defined by YYY (give the reference).
Number of one study in one region	<b>410</b>	Number of one study in one region.

Fig.8. MedCaves statistics.

### 11.3.2. Anchialine Caves and Cave Fauna of the World

[Presentation: online]

Thomas M. Iliffe

Website: <http://www.tamug.edu/cavebiology/>

It includes species lists from anchialine caves in Bahamas, Bermuda and Yucatan. The purpose of the database is to document the diversity, significance and distribution of anchialine caves and cave animals.

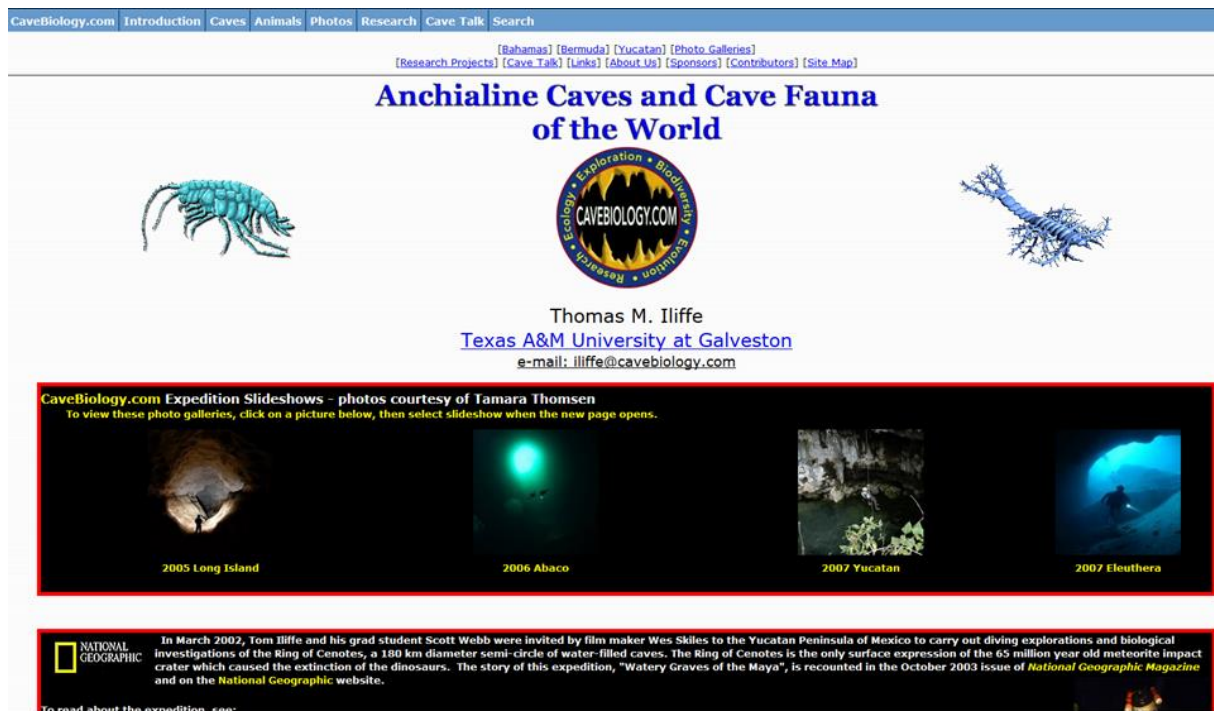


Fig.9. Website Anchialine caves and cave fauna of the World (<http://www.tamug.edu/cavebiology/>)

### 11.3.3. Database from Stygofauna Mundi

[Presentation: alive database]

Nicolas Bailly

During the BioFresh project, FIN (FishBase Information and Research Group, [www.fin.ph](http://www.fin.ph)) was charged with digitizing the crustacean part of the following book:

Botosaneanu, L. (ed.), 1986. Stygofauna Mundi. A faunistic, distributional, and ecological synthesis of the world fauna inhabiting subterranean waters (including the marine interstitial). Leiden, The Netherlands: Brill, E.J. and Dr. W. Backhuys, 740p.

Although primarily oriented to freshwaters (>2300 species for >3300 locality records), a number of data records from marine caves are included. This database was published under the BioFresh Portal.

Further data encoding should focus on other phyla.

Holthuis, L.B., 1986. Decapoda. In <i>Botosaneanu, L. (ed.), Stygofauna Mundi</i> , pp. 589-615.																
p	Arthropoda	sph	Crustacea	c	Malacostraca	sg	Eumalacostraca	spo	Eucarida	o	Decapoda	so	Natantia	io	Caridea	
spf	Oplophoroidea	f	Atyidae	sf		t		sg								
SGF Species No	Genus	Antecaridina					Species	lauensis								
3	Author	(Edmondson, 1935)					Year	1935								
GroupId	36	SpeciesId	2217	TaxonId	LineNo	24	Page	602	Corrected	<input checked="" type="checkbox"/>	Comments On	-1	Remarks On	-1	Taxon Rank	Species
Species locations and countries		LocationCodes		III 5, IV 7, VI 5												
III 5	N	Kuroshima, Yaeyama Group, Ryukyu Islands; Minami-daito, Daito Islands;					III 5	N	Ryukyu Is							
IV 7	N	Entedebir, Dahlak Is., Red Sea; Europa Island;					III 5	N	Japan							
VI 5	N	Uipi, New Georgia, Solomon Is.; Lan Is., Fiji Archipelago; Maui and Hawaii, Hawaiian Islands.					IV 7	N	Eritrea							
						VI 5	N	Hawaii								
						VI 5	N	Fiji								
						VI 5	N	Solomon Is								
SpeciesHabitats		HabCodes		C												
G		Anchihaline habitats.														

Fig.10. A species page in the StygoFauna Mundi database.

### 11.3.4. SealifeBase and FishBase

[Presentation: online]

Nicolas Bailly

Websites: [www.sealifebase.org](http://www.sealifebase.org), [www.fishbase.org](http://www.fishbase.org)

The ECOLOGY table in the SeaLifeBase already records about 60 species from caves, mainly from South America, which is complementary to the sources cited above. Some information are also recorded for fishes in FishBase.

**Grammonus ater** (Risso, 1810)

**IUCN Red List Status (Ref. 96402)**: Least Concern (LC) | **CITES (Ref. 94142)**: Not Evaluated | **Threat to humans**: Harmless

**Human uses**: Fisheries: of no interest | **FAO (Publication : search) | FisheriesWiki | Sea Around Us**

More information	Countries	Common names	Age/Size	References	Collaborators
FAO areas	Synonyms	Growth	Aquaculture	Pictures	
Ecosystems	Metabolism	Length-weight	Aquaculture profile	Stamps, Coins	
Occurrences	Predators	Length-length	Strains	Sounds	
Introductions	Ecotoxicology	Length-frequencies	Genetics	Ciguatera	
Stocks	Reproduction	Morphometrics	Allele frequencies	Speed	
Ecology	Maturity	Morphology	Heritability	Swim. type	
Diet	Spawning	Larvae	Diseases	Gill area	
Food items	Fecundity	Larval dynamics	Processing	Otoliths	
Food consumption	Eggs	Recruitment	Mass conversion	Brains	
Ration	Egg development	Abundance	Vision		

**Classification / Names**: Common names | Synonyms | Catalog of Fishes (gen., sp.) | ITIS | Col. | WoRMS | Cloffa  
 Actinopterygii (ray-finned fishes) > Ophidiiformes (Cusk eels) > Bythitidae (Viviparous brotulas) > Bythitinae  
 Etymology: *Grammonus*: Greek, gramma = signal, mark + Greek, onos = hake.

**Environment / Climate / Range**: Ecology  
 Marine, reef-associated. Subtropical; 47°N - 30°N, 1°E - 20°E

**Size / Weight / Age**:  
 Maturity: L<sub>m</sub> ? range ? - ? cm  
 Max length: 12.0 cm SL male/unsexed; (Ref. 4758)

**Distribution**: Countries | FAO areas | Ecosystems | Occurrences | Point map | Introductions | Faunafri  
 Eastern Atlantic: in the Mediterranean from the Balearic Islands to the Adriatic.

**Biology**: Glossary | Search (e.g. epibiont)  
 Inhabits shallow rocky areas (Ref. 4758). Probably a deep dweller that migrates to coastal areas in August (Ref. 12382). Uncommon species (Ref. 34024). Nocturnal, hides in caves during the day (Ref. 12382).

**Life cycle and mating behavior**: Maturity | Reproduction | Spawning | Eggs | Fecundity | Larvae

**Main reference**: Upload your references | References | Coordinator | Collaborators  
 Nielsen, J.G., D.M. Cohen, D.F. Markle and C.R. Robins, 1999. Ophidiiform fishes of the world (Order Ophidiiformes). An annotated and illustrated catalogue of pearlfishes, cusk-eels, brotulas and other ophidiiform fishes known to date. FAO Fish. Synop. 125(18):178p. Rome: FAO. (Ref. 34024)

Fig.11. A species summary page in FishBase ([www.fishbase.org](http://www.fishbase.org))

### Ecology of *Pennaria disticha*

<b>Main Ref.</b>	Migotto, A.E., A.C. Marques, A.C. Morandini and F.L. da Silveira, 2002			
<b>distribution</b>	Marine - Neritic supra-littoral zone <b>littoral zone</b> <b>sublittoral zone</b>	Marine - Oceanic epipelagic mesopelagic epipelagic abyssopelagic hadopelagic	Brackishwater <b>estuaries/lagoons/brackish seas</b> mangroves marshes/swamps	Freshwater rivers/streams lakes/ponds <b>caves</b> exclusively in caves
<b>Remarks</b>	Highlighted items on the list are where <i>Pennaria disticha</i> may be found. Distributed world-wide in warm seas (Ref. 3248). Known from tidal inlets, exposed areas of bays, including any ledges at their entrance, sounds, caves, shallow reefs and shallow coastal benthic habitats (< 25 m) (Ref. 86643). Also found in Carrie Bow Cay, Belize, in patch reefs, high and low spur and groove zones, sand trough, outer ridge and fore-reef slopes on substrates composed of dead corals and gorgonians at depths of 2 to 18 m. As with other hydroids, this species exhibits a pelagic medusoid stage (Ref. 87156).			
<b>Substrate</b>				
<b>Substrate</b>	<b>Benthic:</b> sessile; <b>Pelagic;</b> <b>Soft Bottom:</b> sand; <b>Hard Bottom:</b> rubble;			
<b>Substrate Ref.</b>	Spracklin, B.W., 1982			
<b>Special habitats</b>	<b>Coral Reefs:</b> reef slope/drop-offs; reef flats; lagoons;			
<b>Special habitats Ref.</b>				
<b>Associations</b>				
<b>Ref.</b>	Migotto, A.E., A.C. Marques, A.C. Morandini and F.L. da Silveira, 2002			
<b>associations</b>	colony-forming/symphorism;			
<b>Associated with</b>				
<b>Association remarks</b>				
<b>Parasitism</b>				
<b>Feeding</b>				
<b>feeding type</b>	mainly animals (troph. 2.8 and up)			
<b>feeding type ref</b>	DeFelice, R.C., L.G. Eldredge and J.T. Carlton, 2001			
<b>feeding habit</b>	selective plankton feeding			



Fig.12. A species ecology summary page in SeaLifeBase ([www.sealifebase.org](http://www.sealifebase.org))

#### 11.3.5. Subterranean Marine Cave Fauna of the World

[Presentation 22Mon\_1330-3-UNAM\_FA]

This database has been created by A. Martínez and collaborators, including Thomas M. Iliffe, Brett Gonzalez, Diego Fontaneto and Katrine Worsaae, by compiling published and unpublished records from the literature. The database includes information from marine subterranean environments such as marine marginal caves, anchialine caves and freshwater caves occurring as part of more extensive anchialine systems. These systems include Yucatán Peninsula, Caribbean islands (Cuba, Jamaica, Hispaniola, Bahamas, Turks and Caicos), Bermuda, Ascension, Macaronesia (mainly Canary Islands), Western Mediterranean, Balkans, Western Australia and several Indo-pacific oceanic islands (e.g. Okinawa, Christmas, and Palau). At the current stage, the database contains ca. 6,000 records for ca. 1,000 caves and ca. 1,500 species, along with ecological (depth, penetration, salinity, habitat, light) and geological (age, rock, substrate) data.

Other recent publications containing species lists of cave fauna:

Álvarez, F. and T.M. Iliffe (2008). Fauna anquihalina de la península de Yucatán. Pp. 370-418 in Fernando Alvarez and Gabino A. Rodríguez Almaraz (eds.), *Crustáceos de México: Estado Actual de su Conocimiento*, Universidad Autónoma de Nuevo León, Mexico.

Martínez, Alejandro, Ana María Palmero, María del Carmen Brito, Jorge Núñez, and Katrine Worsaae (2009). Anchialine fauna of the Corona lava tube (Lanzarote, Canary Islands): diversity, endemism and distribution. *Marine Biodiversity* 39, no. 3: 169-182.



Martínez, Alejandro, Brett González, Jorge Núñez, Horst Wilkens, Pedro Oromí, Thomas M. Iliffe, Katrine Worsaae (in press). Guide of the anchialine ecosystems of Jameos del Agua and Túnel de la Atlántida (Lanzarote, Canary Islands). Published by Cabildo de Lanzarote and Ministerio de Medio Ambiente (Spain).

Álvarez, F., T.M. Iliffe, S. Benitez, D. Brankovits and J.L. Villalobos (2015). New records of anchialine fauna from the Yucatan Peninsula, Mexico. Check List 11(1):1505 doi:http://dx.doi.org/10.15560/11.1.1505

### 11.3.6. Aquatic cave fauna of Mexico and Central America

[Presentation 22Mon\_1330-3-UNAM\_FA]

Fernando Álvarez

Started in the 1990s the context of projects about the Yucatan Peninsula incl. A more dedicated one about Decapoda, it records the occurrences 52 true anchialine species, up to 25 accidental species, in 226 localities of marine and anchialine caves, and contains taxonomy, references, specimen collection whereabouts, and conservation areas.

UNIBIO is the current location of the database, but this will change and be moved with all collections of UNAM under the new CCUD project.

Fig.13. The landing page of UNAM specimen collection.

### 11.3.7. Anchialine fauna of the Balearic Islands

[Presentation: oral]

Damià Jaume

The list of 89 species occurring in anchialine caves is stored in a spreadsheet with the taxonomy, AphiaID, habitat and remarks. The selection of species follows a strict definition of anchialine species.

### 11.4. Terms of Reference for WoRMS editors

WoRCS editors are invited to sign it.

#### **Terms of Reference for the Steering Committee, editors and data management team of the World Register of Marine Species and associated databases**

You are logged in as: <b>Name, LastName</b> [Logout] [My Aphia]
---

#### **AGREEMENT WITH: Name, LastName**

This document establishes the basis on which data and/or intellectual property (IPR) is provided to the World Register of Marine Species database and associated databases (WoRMS) and how these data and IPR are managed. The associated databases may be defined geographically, taxonomically, or by other themes.

By voluntarily providing data or other documented expertise or assistance to WoRMS you as WoRMS editor accept the terms laid out below.

The governance structure of WoRMS comprises three components:

- The **WoRMS editorial board** (WoRMS editors) includes all active editors and data providers.
- The **WoRMS steering committee** (WoRMS SC) leads the editorial board. The WoRMS SC members appoint a chair and vice-chair by majority vote. The SC will have 12 elected members and 1 ex officio DMT member. Elections will be organized yearly, with a rotation time of 3 years for each member to ensure continuity and renewal. All taxonomic and theme editors and data provider head managers are eligible for candidacy and can nominate candidates.
- The **WoRMS data management team** (WoRMS DMT) is appointed by VLIZ to run the database.
- Together WoRMS DMT and WoRMS SC further consult to decide WoRMS policy, plan future developments, raise funding, and promote public use of the database.

#### **Your rights as editor or data provider:**

1. You keep the right to use and publish any data which you have provided without needing to inform the WoRMS SC.
2. You can provide your data to WoRMS either via the online interface or by direct communication with WoRMS DMT.
3. Your contributions will be acknowledged in all publications of the database and derivatives of it, either personally or by your membership to the editorial board.
4. You will receive reports on the actions taken by the WoRMS SC and DMT.
5. You will be invited to vote and nominate candidates (including self-nominations) for the WoRMS SC, at least one month prior to the elections.

#### **You further agree that:**

1. The data provided to the database can only be removed for scientific reasons, with larger datasets only to be removed after approval by the WoRMS SC.
2. You have taken reasonable measures to ensure that the data provided is scientifically correct, and free of copyright infringements, and to inform the DMT in case of doubts.

3. You will inform the DMT of errors in the database, copyright infringements or plagiarism by third parties.
4. When you use the online editing interface, you will follow the suggested procedures in the online manual, and if needed request support and clarification from the DMT at [info@marinespecies.org](mailto:info@marinespecies.org) and the chief editor for your taxon group.
5. You agree to respond to requests from DMT or users to add or correct data as soon as feasible.
6. You delegate to the WoRMS SC and the DMT the authority to take the necessary actions to **store, copy** and **disseminate** the database, to **modify** the provided data to protect the integrity and scientific correctness of the database, to further develop the database and promote its use.

A non-exhaustive list of WoRMS SC and DMT activities is laid out below.

**Responsibilities and roles of the WoRMS SC:**

1. Responsibility to **represent the editors** in all matters relating to the databases, including liaison with other international programs, projects and initiatives concerning the databases, in close collaboration with the Data Management Team (DMT).
2. Responsibility for the **scientific correctness** of the database, and for identifying data gaps.
3. Act to appoint or replace editors who contribute to or validate content of the database.
4. Responsibility to evaluate database download requests, to **license the use** of downloads through a standard agreement application form, and to negotiate exceptional uses of the databases outside the standard license.
5. Act to inform the editors and DMT of infringements in use of the databases and undertake necessary corrective actions.

**Responsibilities and roles of the WoRMS DMT:**

1. Responsibility for **online publishing** of the database including: taking all necessary actions to insure the database is online at all times; protecting the integrity of the database and the persistence of the unique identifiers; archiving the databases at regular intervals in a secure facility; acting as a first line of support to users; informing editors of remaining unresolved questions.
2. Act to **provide copies** of the databases to third parties upon prior approval by WoRMS SC.
3. Responsibility for informing the WoRMS SC Chair of infringements in use of the databases, and for undertaking necessary corrective actions.
4. Act to **supervise editing activities**, control access and editing rights of editors, support the editors in the use of the online editing environment, upload species registers or other information, maintain the taxonomy in close consultation with, or upon request of, the editors.
5. Act to organize workshops for WoRMS editors and to organize the yearly elections for the WoRMS SC.

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