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Report of the Working Group on Marine Habitat Mapping (WGMHM)

30 May – 1 June 2017

ICES Headquarters, Copenhagen, Denmark

ICES International Council for the Exploration of the Sea

CIEM Conseil International pour l'Exploration de la Mer

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Executive summary

The Working Group on Marine Habitat Mapping (WGMHM) has held three annual meetings in 2015–2017.

The 2017 meeting was held at ICES HQ, Copenhagen, Denmark, 30 May to 1 June. Ten members attended the meeting from six countries. The first day of the meeting dealt with ToR A (International Mapping Programmes) and ToR B (National Mapping Programmes). Based on recommendations from the 2015 and 2016 meetings, the reporting of national mapping progress is now undertaken using a templated form. The objective for this approach is to (i) standardise the reporting of mapping progress; (ii) allow country representatives not attending the meeting to still contribute to the working group; and (iii) encourage the submission of information to the GeoNetwork.

Most of the meeting was dedicated to ToR C (Habitat mapping techniques and modelling), which generated much interest and discussion within the group. The group also specifically focused on Mapping and monitoring coral reef habitats using hyperspectral imagery, alternative modelling methods for hind-casting distribution and soft bottom mapping using sidescan sonar. ToR D examined the ecological (e.g. landscape ecology) and managerial uses (e.g. assessments of environmental status) of habitat maps – this mostly focused on detailed discussions about the value of different abiotic habitat maps for marine spatial planning and environmental management. ToR G (Sources of existing information to support habitat map production) is new for the WG in 2017. The objective of this ToR is to collate, within a database, online resources that can be used to support marine habitat mapping. The database will be updated annually and will be made publically accessible via the EMONDET portal. It was concluded that the addition of ToR G provided some much needed annual continuity for the group and as well as providing a useful resource for marine habitat mappers.

ToR H (Theoretical aspects of marine habitat mapping) is also new for 2017. This ToR included numerous presentations (e.g., 'Can we still use the concept of ecological communities?' and 'Effort required to create maps at the step of interpretation – how much detail is needed') and generated a lively debate within the WG. Finally, based on discussions within the 2017 working group, there was collective agreement on several intercessional work packages.

1 Administrative details

Working Group name

Working Group on Marine Habitat Mapping (WGMHM)

Year of Appointment within current cycle

2015

Reporting year within current cycle (1, 2 or 3)

3

Chair(s)

James Strong, UK

Meeting venues and dates

18–22 May 2015, Marine Research Institute, Reykjavik, Iceland (10 participants)

9–11 May 2016, Natural England Office, Winchester, UK (11 participants)

30 May – 1 June 2017, ICES HQ, Copenhagen, Denmark (10 participants)

2 Terms of Reference

ToR	Description
A	**International programmes (Updated)** Report on progress in international mapping programmes and discuss linkages between them (including OSPAR and HELCOM Conventions, EMODnet, EC and EEA initiatives and other projects). Offer technical assistance to international projects that benefit the international marine habitat mapping communityFurthermore, the Working Group
B	**National programmes (National Status Reports)** Present and review important results from national habitat mapping during the preceding year, as well as new on-going and planned projects focusing on particular issues of relevance to the rest of the meeting. Provide National Status Report updates in geographic format in the ICES webGIS
C	**Habitat mapping techniques and modelling** Evaluate recent advances in marine habitat mapping and modelling techniques, including field work methodology, and data analysis and interpretation
D	**Review practise about the use of habitat maps** Review practise about the use of habitat maps, for example mapping for the MSFD, marine spatial planning, and management of MPAs; and assess the ability to use habitat maps for monitoring of the environment
E	**Support for the development of common and candidate OSPAR biodiversity indicators for benthic habitats: Benthic habitats (completed 2015/4)** ICES is requested to support on-going OSPAR indicators work on benthic habitats, in

	support of the requirements under the MSFD. a) Using mobile bottom contacting gear data, produce fishing abrasion pressure maps (2009-2014) using the BH3 approach as a follow-up of the OSPAR request to ICES (Request 5/2014). Fishing abrasion pressure maps should be analysed by gear distribution, and type, in the OSPAR maritime area and be based on the methodology propose on the physical damage indicator (BH3); b) b) Evaluate the applicability of a reduced list of habitats in support the development of Typical Species indicator (BH1). This work should consider those habitats that have previously been identified by the COBAM Benthic experts group. Evaluation should consider data availability, and suggest possible prioritisation of habitats already included in the OSPAR list of threatened and declining habitats.
F	**Guidance on how pressure maps of fishing intensity contribute to an assessment of the state of seabed habitats (WKFBI) (completed 2016)** a) Using input from WGDEC and BEWG, incorporate and evaluate information on sensitivity of the benthic community of the various seafloor habitats, and provide habitat maps for sensitivity of at least one demonstration area of NW European waters (MSFD region/subregion). b) Provide input based on ToR 1) to WGSFD
G	**Sources of existing information to support habitat map production (New)** The identification of sources of information (e.g. bathymetry, oceanography, fisheries or socio-economic) that can be used for the production and enrichment of marine habitat maps.
H	**Theoretical aspects of marine habitat mapping (New)** Topics covering the theoretical aspects of habitat mapping (e.g. landscape ecology, supply-side ecology, implications of scale etc.).

3 Summary of Work plan

The WGMHM work plan is to annually address the Terms of Reference. The work plan specifically seeks to:

Collate the progress of seabed habitat mapping for ICES member states. This information is currently collected as a 'National Progress Report'. Members of the working group must also submit metadata information on this progress to the ICES Geoportal. This repository is also harvested for larger European collation exercise such as EMODnet.

The WG also discuss and contribute to international marine habitat mapping programmes. As such, much of the meetings are committed to discussing the progress and outputs of these programmes.

During 2015, the WG tackled specific ToR dealing with the development and implantation of indications of good environmental status for the Marine Strategy Framework Directive. Our advice was collated and reported in 2015.

The rest of the WG meetings, and intersessional time, is dedicated to discussing marine habitat mapping techniques and understanding theoretical aspects of this work. These discussions, and subsequent reports and published papers, help to distil these concepts and communicate them to an international audience.

4 Summary of Achievements of the WG during 3-year term

The WGMHM seek to make significant contributions to the following areas of the Science Plan:

- Metadata collation of national and international marine habitat maps;
- Assessment of the coverage and quality of marine habitat mapping;
- Provide technical assistance to the EMODnet project;
- Generate an opinion paper identifying the important current issues for marine habitat mapping;
- Complete a review of marine habitat classification schemes for habitat mapping;
- Database online resources that can assist in the production of marine habitat maps;
- Liaise with the deep-water ecology working group.

The main outputs generated by the WGMHM include:

- Manuscript reviewing the use of marine habitat classification schemes for mapping (in prep);
- Annual national mapping progress reports for ICES member states;
- 2015 advise drafting group (James Strong);
- Database on online marine habitat mapping resources;
- Main author/contributor on 'EU request for guidance on how pressures maps of fishing contribute to an assessment of the state of seabed habitats';
- Provision of advice on MSFD, namely:
    - Support for the development of common and candidate OSPAR biodiversity indicators for benthic habitats: Benthic habitats;
    - Support on-going OSPAR indicators work on benthic habitats, in support of the requirements under the MSFD.

The WGMHM contributed to the EU request (see above). Members of the working group contributed a significant amount of time to producing the pilot analysis that constituted the request work package.

5 Final report on ToRs, workplan and Science Implementation Plan

During the three-year period, the WGMHM have successfully dealt with the ToR allocated by ICES, e.g. ToR E in support for the development of common and candidate OSPAR biodiversity indicators for benthic habitats: Benthic habitats (completed 2015/4). The WG

also made a significant contribution to ToR F by providing maps and guidance on how pressure maps of fishing intensity contribute to an assessment of the state of seabed habitats (WKFBI); (completed 2016). ToR F required a substantial contribution of time and effort from members of the WGMHM but resulted in a productive workshop with other working groups and stakeholders. The collaboration between spatial fisheries data group and the benthic ecology group also generated a high-value output capturing the final recommendations for ToR F.

Through our work on ToRs A and B, the WGMHM contribute specifically to goals 3, 4 and 5 of the ICES strategic plan (2014–2018) and science policy priorities 28 and 31. Likewise, our interesting in sharing best practice for the collection and processing of habitat mapping data (both acoustic and ground truthing data), as well as optimum methods for modelling and using habitat maps aligns clearly with aspects of the ICES strategic plan and science plan priorities 28 and 31 for ToR C and 1, 2, 3, 4, 9, 12 and 16 for ToR D. Finally, the collaboration of the WGMHM on ToR F provided a very significant contribution to ICES goals 1, 2 and 3.

6 Cooperation

During the last three years, the working group has collaborated with Benthos Ecology Working Group (BEWG) and Working Group on Deep-water Ecology (WGDEC) on ToR F.

The WGMHM are also in contact with the deep-water ecology group (an attempt was made to run the two WG meetings in parallel for 2017 but could not happen due to a clash with a significant habitat mapping conference).

The chairperson of the WGMHM attended an advice-drafting meeting in 2015.

7 Summary of Working Group evaluation and conclusions

The WGMHM seek to make significant contributions to the following areas of the Science Plan:

- Metadata collation of national and international marine habitat maps;
- Assessment of the coverage and quality of marine habitat mapping;
- Provide technical assistance to the EMODnet project;
- Generate an opinion paper identifying the important current issues for marine habitat mapping;
- Complete a review of marine habitat classification schemes for habitat mapping;
- Database online resources that can assist in the production of marine habitat maps;
- Liaise with the deep sea ecology working group.

Annex 1: List of participants

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Participants at the 2017 WGMHM meeting at ICES HQ, Copenhagen, Denmark.

Annex 2: WGMHM resolution 2018–2020

The **Working Group on Marine Habitat Mapping** (WGMHM), chaired by James Strong, UK, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2018	DATE May	Hamburg, Germany	Interim report by 10 August	
Year 2019			Interim report by DATE	
Year 2020			Final report by DATE	

ToR descriptors

ToR	Description	Background	Science Plan topics	Duration	Expected Deliverables
A	Report on progress in international mapping programmes (including OSPAR and HELCOM Conventions, EMODnet, EC and EEA initiatives, CHARM, Mesh-Atlantic and other projects).	Capturing the presence and work of large international mapping projects is importance because (i) the WGMHM report becomes a useful 'state of the art' summary of marine habitat mapping activity, (ii) the presentations from these projects helps spread best-practice, standardisation and collaborative working within the group, and (iii) other presentations highlight relevant mapping work that may benefit the large international programmes.	16, 28 and 31	3 years	Annual updates and final report
B	Review and synthesise key results from national habitat mapping during the preceding year, as well as new on-going and planned projects focusing on particular issues of relevance to the rest of the meeting. Provide National Status Report updates in geographic format in the ICES webGIS.	The current extent of marine habitat mapping and modelling means that maps are meeting at international boundaries. It is important that maps are joined internationally and in a standardised manner. This requires an understanding of the extent and distribution of habitat mapping within nation states. Equally, WGMHM are often interested in specific habitats and wish to be kept informed of specific mapping exercises on these habitats, e.g. deepwater habitats or cold water corals. The reporting of national mapping is also the primary mechanism for encouraging WG members to submit survey metadata files to the various data archiving centres. The National Progress reports also states whether member countries have purchased significant survey items, such as ships, AUVs and sonars. This provides a good	16, 28 and 31	3 years	Annual updates and final report. Submission of of survey metatdata to ICES Data Center

		opportunity for others to identify useful resources for international colloboration.			
C	Summarise recent advances in marine habitat mapping and modelling techniques, including field work methodology, and data analysis and interpretation.	This ToR provides the main avenue for mappers to coomunicate new or improved techniques to the other scientists present (and captured in the report). As such, this ToR is essential for spreading best practice and developing new methods.	28 and 31	3 years	Annual updates and final report. The 2018 intersessional work will be directed towards producing our first marine habitat mapping best practice document (1–2 methodological topics only)
D	Review practise about the use of habitat maps, for example mapping for the MSFD, marine spatial planning, and management of MPAs; and assess the ability to use habitat maps for monitoring of the environment.	To encourage the diversification of the WGMHM, the group also consider how marine habitat maps are used for scientific and management purposes. Members of the group are often the creators of these maps and have important insights into how the maps can be used. Equally, it gives marine managers an opportunity to suggest how maps are best presented to support clarity and value for management purposes.	1, 2, 3, 4, 9, 12 and 16	3 years	Annual updates and final report. The WGMHM also made a substantial contribution to the ICES Special Request Advice 'EU request for guidance on how pressure maps of fishing intensity contribute to an assessment of the state of seabed habitats' Published 4 July 2016
E	The identification of sources of information (e.g. bathymetry, oceanography, fisheries or socio-economic) that can be used for the production and enrichment of marine habitat maps.	Many of the remotely sensed and modelled outputs that are of value to marine habitat mappers is available online. Although much of this information is centralised in large data archives, other information remains dispersed on the web. This ToR seeks to collate the important data soueces that are of value for marine habitat mapping into one database.	31	Year 1	An annually updated database listing important data sources suitable for marine habitat mapping
F	Identify and advance theoretical aspects of habitat mapping (e.g. landscape ecology, supply-side ecology, implications of scale etc.).	This ToR is to provide an opportunity for EG members to address the theoretical aspects of marine habitat mapping. As a science in its infancy, it is important that underpinning concepts are challenged and re-evaluated.	31	Years 1 and 2	Important presentations and discusses summarised in annual reports. Scientific publication assessing the influence of classification schemes on marine habitat mapping (to be submitted in md December 2017 to ICES Journal of Marine Science)

Summary of the Work Plan

Year 1	Completion of ToR E: OSPAR and MSFD related requests for information
Year 2	Completion of ToR F: Guidance on how pressure maps of fishing intensity contribute to an assessment of the state of seabed habitats (WKFBI)
Year 3	Annual reporting for remaining ToRs and comissioning of new intersessional papers and database.

Supporting information

Priority	These ToRs are essential for maintaining the WG as a focused and relavent group for marine habitat mapping. The ToRs also contribute to the disemination of innovative ideas and best practice. This in turn improves the quality and quantity of marine habitat maps.
Resource requirements	The only resouces required will be the occassional use of ICES HQ meeting rooms.
Participants	The Group is normally attended by some 10 - 15 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	There are no obvious direct linkages.
Linkages to other committees or groups	There is a very close working relationship with Working Groups on Benthic Ecology, Deep-Water Ecology, Marine Planning and Coastal Zone Management and Spatial Fisheries Data.
Linkages to other organizations	EMODnet bathymetry and EMODnet seabed habitats.

Annex 3: WGMHM self-evaluation

1) Name: Working Group Marine Habitat Mapping

2) Year of appointment: 2015

3) Chair: James Strong

4) Meetings:

18–22 May 2015, Marine Research Institute, Reykjavik, Iceland (10 participants)

9–11 May 2016, Natural England Office, Winchester, UK (11 participants)

30 May – 1 June 2017, ICES HQ, Copenhagen, Denmark (10 participants)

WG Evaluation

5) If applicable, please indicate the research priorities (and sub priorities) of the Science Plan to which the WG make a significant contribution.

The WGMHM seek to make significant contributions to the following areas:

- Metadata collation of national and international marine habitat maps;
- Assessment of the coverage and quality of marine habitat mapping;
- Provide technical assistance to the EMODnet project;
- Generate an opinion paper identifying the important current issues for marine habitat mapping;
- Complete a review of marine habitat classification schemes for habitat mapping;
- Database online resources that can assist in the production of marine habitat maps;
- Liaise with the deep sea ecology working group;
- In bullet form, list the main outcomes and achievements of the WG since their last evaluation. Outcomes including publications, advisory products, modelling outputs, methodological developments, etc.

Main outputs include:

- Manuscript reviewing the use of marine habitat classification schemes for mapping (in prep). The paper is being prepared for ICES journal of marine science. The WG will be submitting this paper in mid-December.
- Annual national mapping progress reports for ICES member states.
- 2015 advise drafting group (James Strong)
- Database on online marine habitat mapping resources
- Main author/contributor on 'EU request for guidance on how pressures maps of fishing contribute to an assessment of the state of seabed habitats'.
- Provision of advice on MSFD, namely:
- Support for the development of common and candidate OSPAR biodiversity indicators for benthic habitats: Benthic habitats

- Support on-going OSPAR indicators work on benthic habitats, in support of the requirements under the MSFD.

6) Has the WG contributed to Advisory needs? If so, please list when, to whom, and what was the essence of the advice.

The WGMHM contributed to the EU request (see above). Members of the working group contributed a significant amount of time to producing the pilot analysis that constituted the request work package.

7) Please list any specific outreach activities of the WG outside the ICES network (unless listed in question 6). For example, EC projects directly emanating from the WG discussions, representation of the WG in meetings of outside organizations, contributions to other agencies' activities.

None.

8) Please indicate what difficulties, if any, have been encountered in achieving the workplan.

The chair of the group changed halfway through the current evaluation period. This certainly generated some disruption for the group. It has also taken a sometime to increase the commitment of working group members to intersessional work and contributing to published products.

Future plans

9) Does the group think that a continuation of the WG beyond its current term is required?

Yes. Marine habitat mapping underpins various forms or marine science and environmental management. Furthermore, the science that supports these activities is generally in its infancy and requires international collaboration and standardisation to improve it.

10) If you are not requesting an extension, does the group consider that a new WG is required to further develop the science previously addressed by the existing WG.

No.

11) What additional expertise would improve the ability of the new (or in case of renewal, existing) WG to fulfil its ToR?

12) Which conclusions/or knowledge acquired of the WG do you think should be used in the Advisory process, if not already used?

Annex 4: Abstracts from WGMHM 2017 meeting

1. ToR (A): International programmes

Report on progress in international mapping programmes (e.g. including OSPAR and HELCOM Conventions, EMODNET, EC and EEA initiatives, CHARM, Mesh-Atlantic and other projects)

The next phase of the EMODnet Seabed Habitats programme

Helen Lillis and Eleonora Manca (JNCC)

The European Marine Observation and Data Network (EMODnet) consists of more than 160 organisations assembling marine data, products and metadata to make these fragmented resources more available to public and private users relying on quality-assured, standardised and harmonised marine data that are interoperable and free of restrictions on use. EMODnet is currently in its third development phase with the target to be fully deployed by 2020.

Seabed Habitats is one of seven themes under EMODnet; with its third phase beginning in May 2017, kicking-off with a meeting of the 12 partners (Figure 1) in Cambridge, UK.

Figure 1. Most of the EMODnet Seabed Habitats phase III partners at the kick-off meeting in April 2017.

New activities include:

- The collation of habitat point data from all over Europe;
- The review of habitats modelling in Europe; and
- The collation of habitat models from across Europe.

In the next two years the consortium will also be working on:

- Collating new habitat maps from survey;
- Producing new kinetic energy layers from waves and currents, in some areas;
- Extending the coverage and improving the broad scale habitat map (EUSeaMap); and

- Improving the interactive map for end users.

Discussion point:

Aligning EMODnet Seabed Habitats phase 3 project with the objectives of the ICES WGMHM

2. ToR (B): National programmes (National Status Reports)

Danish habitat mapping and working towards 2021 Marine Strategy implementation – in the North Sea and the Central Baltic Sea

Karen Edelvang

The Danish Ministry of environment and food has financed a minor review project on addressing the requirements of the Marine Strategy implementation towards 2021. The focus is *spatial protection measures in order to establish a coherent and representative networks of marine protected areas …adequately covering the diversity of the constituent ecosystems.* First part of the project provides the ministry with the knowledge to evaluate whether the Danish network of protected areas fulfil the requirements in the MSFD, the second part deals with identifying the ecologically and economically important areas in the Danish EEZ, whereas the third part will provide a list of recommendations on the methodology for designation of future protected areas. The project is planned to finish end of 2017.

Mapping vulnerable marine ecosystems in the Kolbeinsey Ridge, North Iceland

Julian M. Burgos, Steinunn H. Ólafsdóttir, Stefán Á. Ragnarsson

In this talk we describe the advances done in 2016 in regard to marine habitat mapping in Icelandic water, with particular focus on the vulnerable marine ecosystems in the Kolbeinsey Ridge (KR). Preliminary information suggested the presence of vulnerable marine ecosystems (VMEs) in the Kolbeinsey Ridge, in particular soft bottom sponge aggregations, hard bottom sponge gardens and hard bottom coral gardens. During the 2016 habitat mapping survey by the Marine and Freshwater Research Institute we carried out 30 underwater video transects on an area around 1800 km2 north and west of Grímsey Island, at depths between 68.8 and 439.8 m. Sampling locations were selected by dividing the area into 10 strata based on geomorphic and oceanographic parameters, as well as fishing intensity, and applying a Generalized Random Tesselation Stratified design. The resulting video material confirmed the presence of VME indicator species for hard bottom sponge aggregations (*Phakellia* sp., Mycale sp., *Plymastia* sp.), coral gardens in hard bottom (*Drifa* sp., Neptheidae), and seapen fields.

Discussion topics:

- Summarising the National Status Reports
- Discuss national and international trends of interest

3. ToR (C): Habitat mapping techniques and modelling

Assessing and Monitoring Coral Reefs Health Using Hyperspectral Imagery: Application to La Réunion Island

Bajjouk T.[1], Mouquet P.[2], Ropert M.[3], Hoarau L.[3] Le Dantec N.[2,4] & Delacourt Ch.[21]

Our study enabled us to illustrate the potential of hyperspectral imaging to (i) apprehend the spatial heterogeneity of shallow reef ecosystems and (ii) propose a spatial approach to estimate coral vitality index at the scale of coastal water bodies. This work was carried out on the reef platforms of La Réunion Island in the Indian Ocean.

The effects of the water column, light absorption with depth, were removed from hyperspectral images on the submerged areas. A novel processing method was thus developed, allowing for reflectance of the sea floor to be restored in shallow depths, as well as fine spatial resolution bathymetry generation.

Image processing techniques (LUT and spectral matching) were used to extract the proportions of the pure constituents (Coral, Algae, Sand and Seagrass) for each heterogeneous pixel of the image.

Information layers generated in this manner feed into the development of indicators on the biological status of the reefs by characterizing the heterogeneity of reef formations. A hyperspectral coral vitality index was thus produced, which is similar to the indices calculated from groundtruths and retained as part of the Water Framework Directive as a potential indicator of water body quality assessment.

Constraints, mainly related to geometric precision, necessitated alternative processing to perform change detection (aggregation, filter application to eliminate noise) to map and quantify the changes observed in coral cover, coral vitality and its geomorphological features between 2009 and 2015.

[1] [1]Ifremer/DYNECO, [2]UBO/LGO, [3]Ifremer/DOI, [4]CEREMA/EMF

Mapping *Modiolus modiolus*: suitable habitat, historic occupation and current distribution

Strong, J.A

Two studies, mapping the same species, but using dissimilar mapping and modelling methods.

- Study 1: estimate the regional loss of potential habitat for *M. modolus*
- Study 2: estimate the local loss of habitat occupied by *M. modiolus*

Study 1: an estimation of the regional loss of potential habitat for *M. modiolus*

Use an 'activity-led'[2] approach to assess the complete loss of habitat from anthropogenic sources. The assessment of these indicators is complicated by the fact that the extent of many marine habitats is not known. A pragmatic solution is the use of information on anthropogenic 'activities' data to assess damaging pressures (and corresponding loss of habitat) rather than measure the consequences of the activities directly (i.e. impacts from pressures and the change in overall habitat extent). Unlike impact and habitat extent information, activity data are sometimes spatially complete and routinely updated.

Study 2: an estimation of the local loss of occupied *M. modiolus* habitat in Strangford Lough

Until recently, Strangford Lough (Northern Ireland) contained an extensive area of biogenic reef created by *M. modiolus*. The condition and distribution of the *M. modiolus* in Strangford Lough has been the source of considerable interest recently following numerous reports that the biogenic reef has decreased substantially in extent and density. Speculation about the magnitude of the decline varies greatly due to the multiplicity of methods used to survey *M. modiolus* over the years.

Estimate the occupied distribution in (i) 1973–1985 (before decline), (ii) 2003 (before fishing ban), and (iii) 2007 (recovery period?).

The distribution of *M. modiolus* has been heavily influenced by 1) environmental variables, 2) biotic pressures, and most importantly, 3) anthropogenic pressures. No predictor variables are available for (ii) or (iii)!

An alternative approach is required:

- Interpolated presence/absence data within each of the three time periods (1973–1985, 2003, and 2007) to produce coarse presence/absence maps;
- Combine MBES, hydrodynamic modelling and observations to model habitat suitability (potential habitat) for *M. modiolus* in Strangford Lough; and
- Refining the boundary of the interpolated presence/absence map of *M. modiolus* (product of step 1) with the habitat suitability map (product of step 2) for each time period.

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[2] Loss of habitat: no prospect of the habitat recovering for a minimum of 12 years. Changes in habitat condition are not considered.

This study combined (i) new survey data (a dedicated multibeam echosounder survey of the Lough), (ii) a habitat suitability model for *M. modiolus* with (iii) historical diver surveys to estimate the extent and abundance in 1983 (before the suspected period of greatest decline), 2003 (introduction of a ban on mobile fishing gear in the Lough) and 2007 (the most recent diver survey available). Estimations indicate that the extent reduced from approximately 10.8 km^2 in 1983 to just 2.4 km^2 by 2007 and the abundance declined by 88 % in the same period. The decline has ominous implications both for the remaining population of *M. modiolus* and ecosystem functionality within the Lough.

Predictive Modelling of Soft Bottom Biotopes in the Sylter Outer Reef by High Resolution Backscatter Data

Pesch, R. Günther, C.P. Rückert, P. Schuchardt, B.

To investigate the predictability of benthic infauna communities by use of interpreted backscatter images an extensive pilot study was carried through in the southern part of the Natura 2000 site *Sylter Outer Reef*. The study was carried out within the scope of the 'German Biotope Mapping Project for the Exclusive Economic Zone of the North and the Baltic Sea', funded by the Federal Agency for Nature Conservation (Bundesamt für Naturschutz – BfN).

A sediment polygon data layer was made available by the Alfred Wegener Institute for Polar and Marine Research Sylt (AWI; Papenmeier & Hass unpublished). Taking the spatial configuration of the sediment polygons into account, 174 stations were sampled by van Veen grabs in the summer of 2015 according to a stratified random sampling design. The benthic infauna species were grouped to three known soft bottom communities and two outlier groups by average linkage clustering. The known communities comprised *Tellina–fabula* on fine to medium sediments, *Goniadella-Spisula* on medium to coarse sediments and *Goniadella-Spisula* on coarse sediments and are part of the new German red list biotope classification system level 5 (Führhäupter *et al.* 2015[3]).

To investigate the statistical relationship between the benthic infauna and the sediment composition the derived soft bottom communities were compared to grain size distribution patterns by contingency table analyses. Different kind of grain size classification systems thereby showed high and statistically significant relationships to the benthic infauna communities. The same held true for the relationship between soft bottom communities and sediment types derived from the side scan sonar images. The sediment polygon data was therefore converted to a 100 m x 100 m raster and used as a predictor for the high resolution mapping of the five communities in the area of interest by Random Forests. Next to the sediment polygon data, geostatictically derived grain size frac-

[3] Fürhaupter, K.; Meyer, T.; Bildstein, T.; Schuchardt, B.; Darr, A.; Zettler, M. (2015): Anpassung und Weiterentwicklung der Klassifizierung der Meeresbiotoptypen an internationale Entwicklungen sowie Fortschreibung der Roten Liste gefährdeter Meeresbiotope Deutschlands. Technische Dokumentation, FKZ: 3514 82 0800. Im Auftrag des Bundesamtes für Naturschutz (unveröffentlicht)

tion maps as well as topographical and hydrographical raster maps were included in the predictive mapping. The prediction results showed a high global prediction accuracy with a Kappa of 0.84 (independent validation on 20% of the entire data set) and 0.93 (intersection of station specific and predicted communities), respectively. For future mapping of biotopes in the EEZ of the North Sea insights from the pilot study will be used in terms of empirical strategies and designs to follow.

Seabed sediment mapping in the German Exclusive Economic Zone (EEZ): an approach for a standardized data interpretation

Propp, C.

The Federal Maritime and Hydrographic Agency (BSH) of Germany has started a sediment mapping program in cooperation with the Federal Agency for Nature Conservation (BfN) based on side scan sonar and ground truthing using grab sampler and underwater video. To establish a standardized mapping procedure, BSH and its project partners AWI, CAU, IOW and SaM have developed a specific technical guideline that includes requirements for the collection, processing and interpretation of backscatter data. Focus was put on the latter since the interpretation of backscatter data for the purpose of creating consistent sediment maps has not been defined or standardized by now. Concepts and rules for classification and discrimination were defined for different seafloor sediment types including the type of transition between them, the size of structures (minimum size = 100 m) and small-scaled combinations of different sediment types. Different levels of classification have been introduced for the sediment types, primarily based on the FOLK scheme (Folk, 1954). For the German North Sea, sand is classified according to the national classification scheme (Figge, 1981) to meet the requirements for biotope modelling on the sandy shelf of the German North Sea sector. According to the information available in the particulate area these data are combined in a standardized attribute table (GIS) together with additional information about the genesis of sediment types, ground truthing methods and other relevant information. In addition to these considerations, the technical guideline comprises a national catalogue of characteristic backscatter images of sediment types which occur in German territorial waters.

With the completion of the guideline, sediment maps are created according to the determined criteria. Quality tested sediment maps are currently available for the Natura 2000 protected areas “Borkum Reefground” (complete area) and “Sylter Outer Reef” (2/3 of the area).

The guideline has been discussed with experts from state agencies for nature conservation and environmental protection or commented by consultancies in civil and environmental engineering. At present, it is tailored to support German governmental marine mapping tasks in the EEZ but will soon be extended for mapping specifications applied in coastal zones. An alignment with similar efforts of the EU countries is planned in a further step in order to promote the effort of producing standardized maps that can easily be connected across the borders of the European coastal countries.

UK Habitat Classification Update

Lillis, H. and Parry, M.

The Marine Habitat Classification for Britain and Ireland was originally developed in 1996 using data collected for the Marine Nature Conservation Review (MNCR). These data were predominantly from coastal waters down to 50 m depth. The classification was updated in 2004 at which time a number of additional sublittoral sediment biotopes were added based on literature review rather than analysis of survey data. There is still poor coverage of circalittoral rock and sediment habitats occurring in waters deeper than 50 m. Since 2004 JNCC has undertaken numerous offshore surveys in circalittoral waters and it has often not been possible to match data to existing biotopes. The Country Agencies also have new data available from surveys undertaken since 2004. For this project, survey data is being analysed to identify new biotopes to fill in gaps in the classification and update existing biotope descriptions, where necessary (Figure 2). The classification is being reviewed in sections in the following order: sublittoral sediment, circalittoral and infralittoral rock, littoral sediment and littoral rock. Revisions to all sections will be published in 2017 or early 2018.

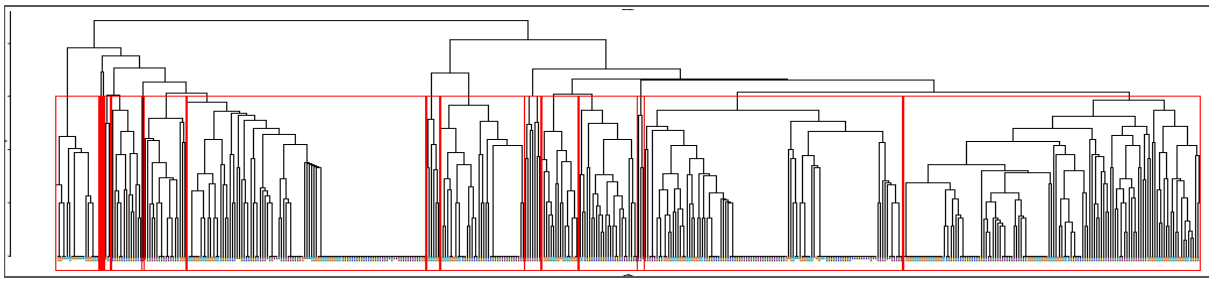

Figure 2. An example of a dendogram to illustrate how samples are clustered based on species composition.

Objectives:

- Run trials and develop an appropriate method for analysis.
- Identify new biotopes from a reanalysis of benthic survey data.
- Assess the validity of existing biotopes and consider revising them.
- Publish new and revised biotopes in the classification.
- Restructure the classification upper levels, dependent on user consultation.
- Arrange biotopes within the revised classification hierarchy, dependent on above.
- Revise the way biotope information / guidance is provided to the user to enable semi-automatic biotope matching, if feasible.

Key outcomes:

- New biotopes published to fill gaps in the classification.
- A more user-friendly classification structure to allow more accurate biotope assignment.

- R script published which shows the method used and allows similar analysis to be repeated easily.

Discussion

Effort required to create maps at the step of interpretation – how much detail is needed? Topics include:

- Maps for different purposes
- How are maps used
- Balancing confidence and resolution

Understanding the limitations of specific data types

4. ToR (H): Theoretical aspects of marine habitat mapping

Can we still use the concept of ecological communities?

An example from the German Bight

Fiorentino, D.[1], Gräwe, U., [2] Holstein, U., [3] Dannheim, J., [3] Wiltshire, K.H.[1] and Brey, T.[3, 4][4]

Classifications are used in all fields of scientific investigation. They are may be used to simplify the view on a system and to synthesize a large bulk of information. Although classifications have their part in our everyday investigation, we often miss to address two major questions: 1) how artificial are the classes we work with? and 2) what kind of boundaries do we expect to find between classes?

In the particular case of the concept of ecological communities, species are classified without considering or testing whether the targeted communities actually exist or are just artificial artifacts created by the classification process. Furthermore, crisp classifications are used to identify and define "communities" adding the limitation of correctly setting a border that possibly does not exist.

We address these questions in a classification exercise performed on a large data set of about 1000 grab samples of benthic macrofauna collected in the German Bight. We used an unsupervised fuzzy classifier to provide classification of any degree of species association. Furthermore we investigate relationship between the degree of species association and potential environmental drivers using Random Forest algorithm.

[4] 1) Alfred Wegener Institute Helmholtz Centrum for Polar and Marine Research, Coastal Ecology, Hafenstrasse 43, 25992 List, Germany
2) Leibniz Institut for Baltic Sea Research, Seestraße 15, 18119 Rostock, Germany
3) Alfred Wegener Institute Helmholtz Centrum for Polar and Marine Research, Am Handelshafen 12, 27570 Bremerhaven, Germany
4) Helmholtz Institute for Functional Marine Biodiversity at the University of Oldenburg, Germany

Results show that the German Bight benthos displays the full range of association's types driven by several environmental parameters highly related with fishery activities. We mapped areas with species associating at random and areas with species highly structured in communities. The first is characterized by a high species turnover, i.e. high dynamics, while the second is characterized by a low turnover, i.e. high stability. Less than 40% of the study area was occupied communities and this let's questioning the conservation strategies that are based on the community concept only. We display boundaries in a more natural way showing the weakening of communities' structure with increasing distance. Finally we shed light on the interaction and synergic effect of the environmental constrains in driving the distribution of high and low species turnover areas.

Marine Forests – hidden values and focused management

Today we experience a large demand for marine resources, but also high vulnerability of ecosystems. Marine forests are among the most productive with regard to biomass, but they are also the most endangered ecosystems on the globe. They contain a wide range of ecosystem functions and ecosystem values (N, C, fish, biodiversity, recreational values) as well as acting as a buffer to eutrophication and climate change. We need more knowledge to be able to target management to protect our marine forests, therefore we want to establish a project to describe and document the state of the marine forests in Danish waters.

This project has been applied to the Danish private research foundation VELUX and has just been granted 2 000 000 DKK. Project leader is professor Marianne Holmer from University of Southern Denmark with partners from DTU Aqua, GEUS and Aarhus University.

Discussion point:

Effort required to create maps at the step of interpretation – how much detail is needed? Topics include:

- Maps for different purposes
- How are maps used
- Balancing confidence and resolution
- Understanding the limitations of specific data types

5. ToR (D): Review the use of habitat maps

Discussion point:

The value of different abiotic habitat maps for marine spatial planning and environmental management

6. ToR (G): Sources of existing information to support habitat map production

Discussion point:

What do we want to work on intersessionally?

Discuss (i) classification paper, (ii) database of online information for supporting mapping and modelling, and (iii) opinion paper.

Annex 5: National Progress Reports 2017

United Kingdom – ICES Working Group Marine Habitat Mapping: National Progress Report (2016–2017)

Table 1. National progress report (NRP) source and uploads.

Country:	United Kingdom
Organisation completing NPR:	Joint Nature Conservation Committee with input from Agri-Food and Biosciences Institute (AFBI)
Map metadata uploaded into the ICES Geo-portal[5]:	YES
Cruise Summary Reports (CSR) uploaded[6]:	NO

Comments

The following map metadata records have been uploaded into the ICES Geo-portal, and the maps added to the EMODnet Seabed Habitats portal:

Broadscale habitat (EUNIS level3) for the Mid St Geroge's Channel recommended Marine Conservation Zone (rMCZ)	View map GB001503
Broadscale habitat (EUNIS level 3) for East of Haig Fras recommended Marine Conservation Zone (rMCZ)	View map GB001128
Broadscale habitat (EUNIS level 3) for North East of Farnes Deep recommended Marine Conservation Zone (rMCZ)	View map GB001126
Broadscale habitat (EUNIS level 3) for East of Celtic Deep recommended Marine Conservation Zone (rMCZ)	View map GB001118
Broadscale habitat (EUNIS level 3) for Farnes East recommended Marine Conservation Zone (rMCZ)	View map GB001122
Broadscale habitat (EUNIS level 3) for North West of Jones Bank recommended Marine Conservation Zone (rMCZ)	View map GB001316
Broadscale habitat (EUNIS level 3) for Markham's Triangle recommended Ma-	View map

[5] http://geo.ices.dk/geonetwork/srv/en/main.home
[6] Via either ICES or SeaDataNet

rine Conservation Zone (rMCZ)	GB001222
Seabed habitats west of the Isle of Lewis in Scotland	View map GB100111
Broadscale habitat (EUNIS level 3) for South East of Falmouth recommended Marine Conservation Zone (rMCZ)	View map GB001224
Broadscale habitat (EUNIS level 3) for Fulmar recommended Marine Conservation Zone (rMCZ)	View map GB001532
Broadscale habitat (EUNIS level3) for the Offshore Brighton recommended Marine Conservation Zone (rMCZ)	View map GB001509

Table 2. New mapping infrastructure (significant items such as ships, sonars, ROVs etc.).

Item	Organisation/Location
Currently procuring HD underwater video system to survey to depths of 1000m for RV Corystes	AFBI NI
Developed a new drop frame with HD camera and stripe lasers (as well as point lasers for sizing) that can be deployed off smaller vessels and used in ecologically sensitive areas (e.g. non disturbance zone of Strangford Lough) – we did our first survey with this two weeks ago and it worked well.	AFBI NI
Currently procuring underwater autonomous video system to run off small survey vessels for White Ribbon	British Geological Survey

Additional points of interest (optional):

Table 3. Marine habitat mapping or modelling programmes.

Mapping programme	Purpose[7]	Location(s)[8]	Progress[9]	Comments	Reference or link
Data and Evidence Coordination Programme for recommended Marine Protected Areas - MB0129	To produce broad-scale physical habitat maps (EUNIS level 3) to support designation of MCZs in UK Secretary of State waters.	UK Secretary of State waters, which comprises all English inshore waters (within 12nm), plus offshore waters (beyond 12nm) around England, Wales and NI.	Ongoing	~15 habitat maps completed or in progress in the last 12 months. Funded by Department of Environment, Food and Rural Affairs; coordinated by Cefas.	http://randd.defra.gov.uk/Default.aspx?&Module=More&ProjectID=18983
MAREMAP	To bring together Natural Environment Research Council (NERC) organisations with common geoscience objectives to integrate their research and inform practical applications such as marine planning, conservation and industry.	All UK	Funding has ended, but partnership continues		www.maremap.ac.uk
Updating UK priority habitat compilations	To compile the best available data for OSPAR threatened and/or declining habitats, Habitats Directive Annex I habitats and nationally listed priority habitats.	All UK	Ongoing	Work carried out by JNCC, Natural England, NRW, SNH, and DOENI. The following datasets were updated in 2016/17: UK Habitats Directive sandbanks UK Habitats Directive submarine structures Scottish Priority Marine Features UKSeaMap broad-scale physical habitat map	http://jncc.defra.gov.uk/seabedhabitatmapdata

[7] Habitats, physical seabed features, pressures etc.
[8] Sea area only.
[9] About to start, ongoing or complete.

Northern Ireland seabed habitat mapping programme	To underpin NI Dept. Of Agriculture, Environment and Rural Affairs (DAERA)'s policy requirements: support development of the network of MPAs in Northern Ireland and improve understanding of fisheries resources/essential fish habitat	Northern Ireland waters (<12nM) and NI fisheries interests in offshore waters	Ongoing	For FY17-18 there are plans to survey offshore potential Irish Sea MCZ site "Queenie Corner" and potential reef habitat in the North Channel	

Table 4. Additional projects and products of interest.

Project name	Purpose[10]	Comments	Reference or link
Mapping of *Modiolus modiolus* biogenic reefs in the Ards penninsular	EC Habitats Directive Annex I habitat extent and mapping for DOENI (now DAERA) to support SAC designation	Analysis of UKHO Civil Hydrography Programme and AFBI MBES with additional ground-truthing (complete)	https://www.afbini.gov.uk/publications/assessment-outer-ards-modiolus-modiolus-biogenic-reefs-against-special-area
UK National Seabed Mapping Programme Scoping Study	In 2015 and 2016 the UK Government commissioning a scoping study to investigate the costs and benefits of establishing a national seabed mapping programme.	No progress has been made since the scoping study was published in 2016.	https://www.maritimeuk.org/media-centre/publications/uk-national-seabed-mapping-programme-scoping-study/
Marine Habitat Classification for Britain and Ireland update	A national-scale reanalysis of thousands of seafloor samples to identify new biotopes to insert into the comprehensive classification system for the UK seabed.	Led by JNCC, in conjunction with NE, NRW, SNH, DAERI, AFBNI, Cefas and EA	http://jncc.defra.gov.uk/MarineHabitatClassification

[10] Technical development, mapping methods, data management, novel map products etc.

United States of America – ICES Working Group Marine Habitat Mapping: National Progress Report (2016–2017)

Table 1. National progress report (NRP) source and uploads.

Country:	USA
Organisation completing NPR:	National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Alaska Regional Office, Juneau, Alaska, USA
Map metadata uploaded into the ICES Geo-portal[11]:	No
Cruise Summary Reports (CSR) uploaded[12]:	No

Comments:

Activities are reported from July, 2016 – June, 2017.

National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) habitat mapping and modeling programs to support ecosystem-based fishery management and habitat conservation are reported for the North Pacific Region, including US waters of the Gulf of Alaska, Aleutian Islands, Bering Sea, Chukchi Sea, and Beaufort Sea.

Seafloor mapping programs with an emphasis on habitat mapping or biological community assessment are reported in brief, including activities of the NOAA Office of Ocean Exploration and Research, the NOAA Joint Hydrographic Center at the University of New Hampshire Center for Coastal and Ocean Mapping, and the NOAA National Centers for Coastal Ocean Science.

Table 2. New mapping infrastructure (significant items such as ships, sonars, ROVs etc.)

[11] http://geo.ices.dk/geonetwork/srv/en/main.home

[12] Via either ICES or SeaDataNet

Item	Organisation/Location

Additional points of interest (optional):

Table 3. Marine habitat mapping or modelling programmes.

Mapping programme	Purpose[13]	Location(s)[14]	Progress[15]	Comments	Reference or link
NOAA NMFS Alaska Region Essential Fish Habitat (EFH) Programmatic Update for the North Pacific	Update and review of EFH definitions for managed fish and crab species lifestages to support ecosystem-based fishery management and habitat conservation.	US waters of the Gulf of Alaska, Aleutian Islands, and Bering Sea	Complete	The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) mandates NOAA to identify habitats essential for managed species, termed Essential Fish Habitat, defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. EFH for managed fish species is required to be updated and reviewed by NOAA Fisheries and the North Pacific Fishery Management Council (NPFMC) every 5-years. The EFH update in 2017 was the first to use a habitat modeling approach to refine definitions of EFH, since those definitions were first adopted for North Pacific habitats in 2005. EFH updates were reviewed by NOAA stock assessment authors and the NPFMC. The next EFH review and update is scheduled for 2022, where the Chukchi Sea and the US Artic will be included.	Matt Eagleton, EFH Coordinator matt.eagleton@noaa.gov Chris Rooper, Habitat Models chris.rooper@noaa.gov Jodi Pirtle, Habitat Models jodi.pirtle@noaa.gov https://alaskafisheries.noaa.gov/habitat/efh
NOAA NMFS Alaska Region Fishing Effects Model and Impacts	Fishing effects model update to estimate fishing	US waters of the Gulf of Alaska, Aleutian Islands,	Complete	MSFCMA mandates NOAA to conserve EFH from adverse effects on those habitats,	Matt Eagleton, EFH Coordinator

[13] Habitats, physical seabed features, pressures etc.
[14] Sea area only.
[15] About to start, ongoing or complete.

Analysis to EFH for the North Pacific	impacts to EFH from all bottom-contacting gear types to support ecosystem-based fishery management and habitat conservation.	and Bering Sea		both fishing and non-fishing. Fishing impacts to EFH were reviewed by NOAA stock assessment authors to identify potential stock-level effects and their recommendations were reviewed by the NPFMC. This was the most comprehensive spatio-temporal fishing effects model developed and reviewed to date for the North Pacific that included time-varying fishing vessel activity by area and gear type.	matt.eagleton@noaa.gov John Olson, Fishing Effects Analysis john.olson@noaa.gov Brad Harris, Fishing Effects Model bharris@alaskapacific.edu
NOAA NMFS Alaska Region EFH Research Plan	EFH Research Plan revision following the programmatic update to EFH to support ecosystem-based fisheries management and habitat conservation.	US waters of the Gulf of Alaska, Aleutian Islands, Bering Sea, Chukchi Sea, and Beaufort Sea.	Complete	The EFH Research Plan for the Alaska Region of NOAA NMFS guides research to meet EFH mandates in Alaska.	Matt Eagleton, EFH Coordinator matt.eagleton@noaa.gov https://www.afsc.noaa.gov/Publications/ProcRpt/PR2017-05.pdf
NOAA Office of Ocean Exploration and Research (OER), NOAA ship *Okeanos Explorer*	Mapping for exploration of marine habitats and biological communities.			General program information reference and contact.	http://oceanexplorer.noaa.gov/okeanos/welcome.html Elizabeth (Meme) Lobecker, Physical Scientist, Integrated Ocean and Coastal Mapping (IOCM) center at University of New Hampshire (UNH) Joint Hydrographic Center (JHC) meme.lobecker@noaa.gov
NOAA OER, NOAA ship	Mapping for exploration of marine	Northern Marianas Islands, Marianas	Complete	Seafloor bathymetry and backscatter, water column backscatter, water column profiles,	2016 field season overview

Okeanos Explorer 2016 field season.	habitats and biological communities.	Trench Marine National Monument, and Wake Atoll section of the Pacific Remote Islands Marine National Monument.		and sub-bottom stratigraphic profiles. Underwater video, photographic images, and biological samples collected during ROV operations.	http://oceanexplorer.noaa.gov/okeanos/explorations/2016-overview/welcome.html
NOAA OER, NOAA ship *Okeanos Explorer* 2017 field season.	Mapping for exploration of marine habitats and biological communities.	Hawaiian Archipelago, Kingman Reef, Palmyra Atoll, Musician Seamounts, Pacific Remote Islands Marine National Monument, American Samoa, Republic of Kiribati, Tokelau, Samoa, and Cook Islands.	In Progress	Seafloor bathymetry and backscatter, water column backscatter, water column profiles, and sub-bottom stratigraphic profiles. Underwater video, photographic images, and biological samples collected during ROV operations.	2017 field season overview http://oceanexplorer.noaa.gov/okeanos/explorations/2017-overview/welcome.html
University of New Hampshire (UNH) Center for Coastal and Ocean Mapping (CCOM) NOAA Joint Hydrographic Center (JHC) Chase Ocean Engineering Lab, Durham, New Hampshire, USA				General program information reference and contact.	Paul Johnson, Data Manager pjohnson@ccom.unh.edu Larry Mayer, CCOM Director, JHC Co-Director larry@ccom.unh.edu Andy Armstrong, JHC Co-Director andy.armstrong@noaa.gov http://ccom.unh.edu http://ccom.unh.edu/reports
UNH CCOM NOAA JHC UNCLOS Kingman Reef-Palmyra Atoll Mapping	UNCLOS	Kingman Reef-Palmyra Atoll, Line Islands, Equatorial	Complete	Seafloor bathymetry, seafloor backscatter, and sub-bottom stratigraphic profiles.	Paul Johnson, Data Manager pjohnson@ccom.unh.edu http://ccom.unh.edu

R/V Ron Brown, RB16-01, 2016		Pacific Ocean.			http://ccom.unh.edu/reports
UNH CCOM NOAA JHC UNCLOS US Law of the Sea Cruise to Map and Sample the US Arctic Ocean Margin, Healy 1603, 2016	UNCLOS, Mapping of US Extended Continental Shelf	Chukchi Cap; Alpha Ridge *in partnership with Canada*	Complete	Seafloor bathymetry, seafloor backscatter, and sub-bottom stratigraphic profiles.	Paul Johnson, Data Manager pjohnson@ccom.unh.edu http://ccom.unh.edu/publications/us-law-sea-cruise-map-and-sample-us-arctic-ocean-margin-healy-1603
NOAA National Centers for Coastal Ocean Science (NCCOS)				General program information reference and contact.	https://coastalscience.noaa.gov/research/scem/seafloormapping

Table 4. Additional projects and products of interest.

Project name	Purpose[16]	Comments	Reference or link
Arrowtooth flounder (*Atheresthes stomias*) population connectivity in the Gulf of Alaska: Linking offshore spawning habitat with nearshore nurseries	Population connectivity study incorporating a habitat model to support ecosystem-based fishery management. NOAA NMFS Alaska Region. *In progress.*	A biophysical individual-based model for arrowtooth flounder (*Atheresthes stomias*) in the Gulf of Alaska was developed to examine connectivity between adult spawning habitat on the continental slope and nursery habitat nearshore. Larval fish trajectories and settlement in suitable nursery habitat were examined using a habitat model and seafloor terrain analysis, including the role of continental slope canyons as inshore transport pathways.	Esther Goldstein, Individual-Based Model esther.goldstein@noaa.gov Jodi Pirtle, Habitat Model jodi.pirtle@noaa.gov Gulf of Alaska Integrated Ecosystem Research Program (GOA IERP) https://www.nprb.org/gulf-of-alaska-project/about-the-project/
Sablefish (*Anoplopoma fimbria*) population connectivity and stock structure in the Gulf of Alaska and Aleutian Islands: Linking offshore spawning habitat with nearshore nurseries	Population connectivity study incorporating a habitat model to support ecosystem-based fishery management. NOAA NMFS Alaska Region. *In progress.*	A biophysical individual-based model for sablefish (*Anoplopoma fimbria*) in the Gulf of Alaska and Aleutian Islands will be developed to examine connectivity between adult spawning habitat on seamounts and along continental slope and nursery habitat nearshore. Larval fish trajectories and settlement in suitable nursery habitat will be examined to further understand population connectivity and stock structure to improve sablefish	Kalei Shotwell, Stock Assessment Author kalei.shotwell@noaa.gov Georgina Gibson, Individual-Based Model gagibson@alaska.edu Jodi Pirtle,

[16] Technical development, mapping methods, data management, novel map products etc.

		stock assessment models.	Habitat Model jodi.pirtle@noaa.gov GOA IERP https://www.nprb.org/gulf-of-alaska-project/about-the-project/
Smooth sheet bathymetry and seafloor substrate compilations for Alaska	Support ecosystem-based fishery management. NOAA NMFS Alaska Region. Locations include the Central Gulf of Alaska, Cook Inlet, Aleutian Islands, and Norton Sound, (*Complete*); Western Gulf of Alaska, and Southeast Alaska Inside Waters (*In Progress*).	Bathymetry and substrate compilations were used in habitat models and the fishing effects model for EFH and research programs (GOA IERP) that support ecosystem-based fishery management.	Mark Zimmermann, mark.zimmermann@noaa.gov https://www.afsc.noaa.gov/race/groundfish/bathymetry/default.htm
Seabed mapping to develop a habitat-based catchability function for the Bristol Bay red king crab (*Paralithodes camtschatica*) stock assessment	Support ecosystem-based fishery management. NOAA NMFS Alaska Region. *In progress.*		Robert McConnaughey bob.mcconnaughey@noaa.gov https://www.st.nmfs.noaa.gov/ecosystems/habitat/funding/projects/project16-031
Improving stock assessments for rockfishes using habitat-referenced acoustic surveys in the Gulf of Alaska	Support ecosystem-based fishery management. NOAA NMFS Alaska Region. *In progress.*		Chris Wilson, chris.wilson@noaa.gov Tom Weber, weber@ccom.unh.edu https://www.st.nmfs.noaa.gov/ecosystems/habitat/funding/projects/proj

			ect15-028
Alaska Deep Sea Coral Research and Technology Program, NOAA Office of Science and Technology, NOAA NMFS Alaska Fisheries Science Center	Support ecosystem-based fishery management and habitat conservation. NOAA NMFS Alaska Region. *Ongoing*.		Chris Rooper, chris.rooper@noaa.gov http://www.habitat.noaa.gov/pdf/NOAA_DSC_Report_2016.pdf

Germany – ICES Working Group Marine Habitat Mapping: National Progress Report (2016–2017)

Table 1. National progress report (NRP) source and uploads.

Country:	Germany
Organisation completing NPR:	Federal Agency for Nature Conservation Institute for Baltic Sea Research, Warnemünde, Bioconsult Schuchardt & Scholle Gbr, Federal Maritime and Hydrographic Agency
Map metadata uploaded into the ICES Geo-portal[17]:	NO
Cruise Summary Reports (CSR) uploaded[18]:	NO

Comments

In German marine waters, biotope mapping is done for the EEZ and the coastal areas separately. Whereas the states are responsible for the Territorial Sea, the Federal Agency for Nature Conservation (BfN) deals with the German EEZ of the Baltic- and the North Seas. The biotope mapping here is done within two different projects, both co-funded by BfN. The Federal Maritime and Hydrographic Agency (BSH) thereby coordinates activities regarding sedimentological mapping on different spatial resolutions.

The company Bioconsult Schuchardt & Scholle Gbr, the Alfred Wegener Institute (AWI) and the Leibniz-Institute for Baltic Research, Warnemünde aim to use sedimetological and other abiotic data layers as well as benthic abundance information maps for the delineation of hard and soft bottom biotopes with the areas of interest, that are mainly the protected areas protected within the Natura 2000 network

Table 2. New mapping infrastructure (significant items such as ships, sonars, ROVs etc.).

Item	Organisation/Location

Additional points of interest (optional):

[17] http://geo.ices.dk/geonetwork/srv/en/main.home
[18] Via either ICES or SeaDataNet

Table 3. Marine habitat mapping or modelling programmes.

Mapping programme	Purpose[19]	Location(s)[20]	Progress[21]	Comments	Reference or link
German EEZ Biotope Mapping	Biotope mapping in the German EEZ of the North and Baltic Sea on different spatial scales according the German biotope classification system	German EEZ of the Baltic sea and North sea	First pilot studies on high resolution mapping of benthic soft bottom communities in the Natura 2000 site Sylter Outer Reef (North Sea) and Fehmarn Belt (Baltic Sea)		
SedAWZ – sediment mapping in the German EEZ	Full coverage mapping sediment mapping in the German EEZ of the North and Baltic Sea. Product: standardized sediment distribution maps	German EEZ of the Baltic sea and North sea	Area-covering sediment distribution maps are created primarily for the mapping and modelling of marine biotope (see other project). Sediment maps (quality tested) available for the Natura 2000 protected areas "Borkum Reefground" (complete area) and "Sylter Outer Reef" (2/3 of the area)	Area-covering sediment distribution maps are created primarily for the mapping and modelling of marine biotope (see other project). Sediment maps (quality tested) available for the Natura 2000 protected areas "Borkum Reefground" (complete area) and "Sylter Outer Reef" (2/3 of the area)	web-link to the standardized sediment mapping guideline: http://www.bsh.de/en/Products/Books/Guideline_for_Seafloor_Mapping2016/index.jsp

[19] Habitats, physical seabed features, pressures etc.
[20] Sea area only.
[21] About to start, ongoing or complete.

Table 4. Additional projects and products of interest.

Project name	Purpose[22]	Comments	Reference or link

[22] Technical development, mapping methods, data management, novel map products etc.