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Working Group on Biodiversity Science (WGBIODIV)

2018/MA2/EPDSG01 The **Working Group on Biodiversity Science** (WGBIODIV), chaired by Christopher Lynam*, United Kingdom, and Andrea Belgrano*, Sweden, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2019	4–8 February	Copenhagen, Denmark	Interim report by 1 April	
Year 2020			Interim report by	
Year 2021			Final report by	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Test the benthic response indicator: Capacity to support formal assessment and management advice Use the indicator to explore its effectiveness in different disturbance/environmental change scenarios Explore the utility of the indicator in a broader geographical context	In the previous three-year term WGBIODIV concluded that indicators to assess biodiversity are not workingdue to the lack a theoretical foundation. WGBIODIV addressed this problem by designing a trait-based sensitivity indicator of benthic communities. For example, establishment of pressure-state relationships, validation of indicator calculations and evaluation against the WGBIODIV indicator quality criteria is still pending. Indicator testing is the logical next step following the successful completion of the previous ToR.	2.1; 2.2; 6.1	3 years	A tested and operational indicator of community response to ecosystem change will be delivered through WG report. Potential production of a peer review paper.
b	Investigate mechanisms linking trophic guilds under contrasting levels of pressure and/or primary production in case study areas: Using diet/trait information, and both predator and prey abundance to estimate potential impact on prey due to consumption by predators. Contrast risk due to natural	Understanding of pressure-state relationships are fundamental to indicator assessments. However, as pressure is removed through management and ecosystems begin to recover, the nature and/or strength of previously defined pressure-state relationships may change. Climate change effects may further modify or mask the effects of anthropogenic pressures. This ToR will investigate responsiveness of indicators to	2.2; 2.3; 2.5	3 years	Identify whether recovery of ecosystem components (e.g. predatory fish) can lead to depletion of prey groups such that natural processes dominate change. Delivered through WG report. Potential production of a peer review paper.

	mortality (consumption) with risk due to fishing pressure Project change in risk for prey groups due to increase in predator abundance or shifts in community composition as predator communities recover Clearly define roles of top down control and bottom up limitation at different trophic levels	pressure in regional seas where demersal fishing pressure has been reduced and temperature has increased.			
c	Examine the efficacy of spatial management measures as means of conserving, protecting and promoting marine biodiversity	The implementation of the management plans for the Natura 2000-sites is under way and will have substantial impacts on human activities, namely by spatial measures such as (partial) fisheries closures and marine reserves. However, the Habitat Directive addresses only a limited range of taxa i.e. excluding the majority of epibenthic species and marine fish. WGBIODIV considers that is important to know, how much the current MPA networks will contribute to the protection of these taxa.	6.1; 6.3; 6.4	3 years	Production of maps of biodiversity in selected marine regions to inform on occurrence of biodiversity and to guide spatial management for its conservation.

Summary of the Work Plan

Year 1	Develop assessment targets for benthic response indicator; provide first analysis on trophic guilds and linkages to pressures; develop method to create and overlay single-species distributions.
Year 2	Final evaluation of benthic response indicator; progress analysis of trophic guilds vs. anthropogenic pressures; create maps of biodiversity hotspots.
Year 3	Finalise and evaluate work on trophic guild and hotspots.

Supporting information

Priority	The current activities of this group will lead ICES into issues related to the integrated ecosystem assessments and the implementation of the ecosystem approach to marine management. Consequently, these activities are considered to have a very high priority.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource lies in the commitment of scientist from different member states to participate in the group.
Participants	Participation in WGBIODIV has slightly increased due to the outreach strategy of hosting meeting in Spain and Italy, thereby attracting scientist from host countries and Mediterranean area.
Secretariat facilities	None.

Financial	No financial implications.
Linkages to ACOM and groups under ACOM	There is a linkage to ACOM/SCICOM steering group Integrated Ecosystem assessments (IEA). The results of WGBIODIV are important to WGECO and may be of relevance for WGINOSE and WGIAB.
Linkages to other committees or groups	The outcomes of WGBIODV will be important to the ICES high priority work area 'Marine Strategy Framework Directive (MSFD)'.
Linkages to other organizations	OSPAR, HELCOM, European Commission

Working Group on Fisheries-Induced Evolution (WGEVO)

2018/MA2/EPDSG02 The **Working Group on Fisheries-Induced Evolution** (WGEVO), chaired by Bruno Ernande, France, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2019	TBD	TBD	Interim report by end of July	
Year 2020			Interim report by end of July	**Change of Chair**: Outgoing: Bruno Ernande Incoming: TBC
Year 2021			Final report by end of July	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Provide a forum for international collaboration and exchange of emerging scientific insights on fisheries-induced adaptive changes. The activities of WGEVO will provide ICES with a basis for advice on whether and how the effects of fisheries-induced adaptive change need to be taken into account in ecosystem approach to management.	a) Science Requirements b) Advisory Requirements	2.2	Years 1, 2, 3	Proposal of a dedicated Theme session at ICES ASC. Provision of summary recommendations about which stocks assessed by ICES are at most risk in terms of fisheries-induced evolution in Year 2
b	Assemble and review empirical evidence of fisheries-induced adaptive change and its consequences for the conservation of biodiversity and sustainable exploitation of marine species within an ecosys-	a) Science Requirements	2.2; 6.1	Years 2, 3	Potential participation in joint projects and publications (e.g. papers) among participants and others A Cooperative Research Report in Year 2 (and/or paper)

	tem context.				
c	Develop scientific and methodological tools to monitor and respond appropriately to risks to biodiversity and sustainable exploitation posed by fisheries-induced adaptive change, with a particular emphasis on making these tools readily available for a broader range of scientists and managers.	a) Science Requirements b) Advisory Requirements	2.2; 6.1	Years 1, 2, 3	Methodological tools for fisheries-induced selection pressure estimation (R-scripts) with a R notebook as a User, the results will be summarised in one peer-reviewed publication on fisheries-induced selection pressures
d	Link methodological tools to estimate fisheries-induced selection to stock assessment procedure to generalize fisheries-induced selection monitoring to any analytically assessed stock	a) Science Requirements b) Advisory Requirements	5.1; 5.3	Years 2, 3	Automation of fisheries-induced selection pressure estimation by using stock assessment outputs Collaboration with stock assessment WGs

Summary of the Work Plan

Year 1	Review and discuss ongoing and recently completed research in the field Statistical analysis of exogeneous (fishing characteristics) and endogeneous (stocks life-history characteristics) determinants of fisheries-induced selective pressures Complete and submit a manuscript on fisheries-induced selection pressures and their determinants in exploited fish stocks together with R scripts and User guide for fisheries-induced selection pressures estimation
Year 2	Review and discuss ongoing and recently completed research in the field Write and submit a Cooperative Research Report on the evidence for the incidence and consequence of fisheries-induced evolution across a wide range of fish stocks Start automating fisheries-induced selection pressure estimation based on stock assessment outputs
Year 3	Review and discuss ongoing and recently completed research in the field Finalize automation of fisheries-induced selection pressure estimation based on stock assessment outputs Discuss future research needs Write the final 3-year term report

Supporting information

Priority	The activities of the Working Group on Fisheries-induced Evolution will provide ICES with a basis for advice on whether and how the effects of fisheries-induced adaptive change need to be taken into account in present and future management. Due to the potentially long lasting effects of fisheries-induced evolutionary changes, such advice is needed in relation with the precautionary approach, the ecosystem approach, biodiversity conservation, and the evaluation of risk and uncertainty.
Resource requirements	The research activities providing input to WGEVO are ongoing, and corresponding resources have been committed by the engaged institutions. The administrative resources

	for convening the annual WGEVO meeting are negligible.
Participants	The Group is normally attended by 8–10 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	Linkage to Assessment WGs under ACOM
Linkages to other committees or groups	Linkage to SCICOM
Linkages to other organizations	None

Working Group on Phytoplankton and Microbial Ecology (WGPME)

2018/MA2/EPDSG03 The **Working Group on phytoplankton and microbial ecology** (WGPME), chaired by Marie Johansen, Sweden and Rowena Stern*, 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 2019	11-14 March	Las Palmas de Gran Canaria, Spain	Interim report by 1 May	Meeting in association with WGZE and WGIMT
Year 2020			Interim report by Date	
Year 2021			Final report by Date	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Generate improved knowledge of small food web components that are poorly monitored/assessed	There is a lack of consideration of microbial biomass in monitoring and assessment studies.	1.3	3 Years	Review paper (in year 3) Feed into relevant national and international working groups as appropriate
b	Explore the use of indicators and provide recommendations for methods development over a joint one-day workshop with WGZE.	a) Potentially harmonize methodological approaches (e.g. molecular tools) b) Provide more precise phytoplankton descriptors (MSFD) c) Advice e.g. to	1.3; 4.1; 4.4	Year 1	Recommendations for methods standardization and indicator sets.

		OSPAR-COBAM			
c	Conduct an integrated analysis of phytoplankton and microbial plankton re-sponses to global warming.	Understand consequences of long-term changes e.g. in phenology and body size for foodweb func-tioning and associated eco-system services.	1.3; 2.5	3 years	Papers producrion depending on the key outcomes.
d	Produce a guide of live vs Lugol-fixed key species from exisitng samples.	Facilitate better comparability between time series, producing representative images for to facilitate better comparability between time series, producing representative images for all of the species included in each time series relevant to WGPME, provide realistic images pointing out limits of species IDs.	4.4	3 years	Recommendation document to ICES to set up a database and ICES identification leaflets.
e	Produce a Cooperative Research Report on Phytoplankton/ Zooplankton (in collaboration with WGZE)	Develop an integrated plankton report presenting trends in occurrence of both phyto and zooplankton	1.3; 1.9	Year 2	CRR: Phytoplankton and Zooplankton Status Report
f	Investigate factors affecting the closeness of correlations between chlorophyll a and phytoplankton biomass.	There is a need to further develop phytoplankton related indicators. The phytoplankton biomass indicators developed so far for the MSFD only consider Chl a as a rough estimate of plankton biomass.	3.3; 4.1	Year 3	Position paper with recommendations for the scope of using chlorophyll:biomass (biovolume) correlations in different contexts

Summary of the Work Plan

Year 1	A joint workshop with WGIMT, WGZE with the goal of further methods standardization. This is of high priority, to finalize the plankton status report. Most of the ToR will run for the whole 3 years period.
Year 2	Assemble data for (online), to continue work on manuscripts already in preparation. Finilize the integrated plankton report.
Year 3	Discuss assesment efforts historically made of the small food web components. The generation of recommendations to improve how they best can be concidered and applied in food web assessments.

Supporting information

Priority	The current activities of this Group will lead ICES into issues related to the ecosystem effects of fisheries, especially with regard to the application of the Precautionary Approach. Consequently, these activities are considered to have a very high priority.

Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible. However the resource of a database with identification leaflets of phytoplankton would be recommended.
Participants	The Group is normally attended by some 20–25 members and guests.
Secretariat facilities	Standard secretarial support
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	There are no obvious direct linkages.
Linkages to other commities or groups	There is a close working relationship with WGZE, WGIMT and also some linkage to WGHABD.
Linkages to other organizations	None specific

Working Group entitled "Towards a EURopean OBservatory of the non-indigenous calanoid copepod *Pseudodiaptomus marinUS*" (WGEUROBUS)

2018/MA2/EPDSG04 A **Working Group entitled "Towards a EURopean OBservatory of the non-indigenous calanoid copepod *Pseudodiaptomus marinUS*" (WGEUROBUS)**, chaired by Marco Uttieri*, Italy, and Arantza Iriarte*, Spain, will be established and will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2019	14–15 October	Peniche, Portugal	Interim report by 20 November	
Year 2020	DATE Sept/ Oct (tbc)	Plymouth, UK (tbc)	Interim report by DATE	
Year 2021	DATE Sept/ Oct (tbc)	Bilbao, Spain (tbc)	Final report by DATE to SCICOM	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Compile and analyse data on the geographical distribution, seasonal patterns and interannual variations of *Pseudodiaptomus marinus* in European waters.	*Pseudodiaptomus marinus* was first observed in European waters in 2007, and it has since been expanding relatively rapidly in European waters, reaching transitional, coastal, as well as oceanic environments. Much of the information on its occurrence, though, is still unpublished and a clear view of the spatial and temporal distribution of this species in Europe is lacking. Thus a need to compile data and update the geographical distribution, seasonality and	1.3; 1.9	Years 1-2	Peer-reviewed publication

		interannual variations of this species in European waters has been identified. Furthermore, the analysis of the spatial and temporal variations will be very useful to understand which are the environmental conditions that favor the establishment of this alien species.			
b	Identification of key ecological, biological and behavioural traits of *Pseudodiaptomus marinus*.	The identification of the ecological, biological and behavioural traits of this species will help to understand its successful colonization of different types of environments and will provide vital information to establish its potential uses.	1.7	Years 1-3	A database compiling known traits for *P. marinus* in different environments in European waters. Manuscript/Conference presentation
c	Molecular identification of *Pseudodiaptomus marinus* strains occurring in different environments in European waters.	Molecular characterization is a useful tool to identify the geographic origin of *Pseudodiaptomus marinus* genotypes present in European waters. Genomics and transcriptomics analyses may help to understand the apparent versatility regarding the environmental conditions in which it can live.	4.4	Years 1-3	Establishment of a repository of European voucher specimens preserved according to a commonly agreed protocol, to be used for comparative studies. Manuscript/Conference presentation
d	Investigate the possible dormancy strategies of *Pseudodiaptomus marinus*.	*Pseudodiaptomus marinus* has no documented resting stages, however recent data point at the potential adoption of dormancy strategies to overcome unfavourable conditions. The exploration of this topic will shed light on possible biological adaptations used to increase the invasiveness of this species.	1.7	Years 1-3	Manuscript

Summary of the Work Plan

Year 1	The group will deal with all of the ToRs during the Year 1 (with various degrees of intensity).
Year 2	The group will continue with all of the ToRs and we expect that two of those will be completed during Year 2 (a, b)
Year 3	The group will focus on completion of the remaining ToRs (c, d)

Supporting information

Priority	Biological invasions represent a serious threat to aquatic ecosystems, and are presently a major issue in the scientific community. Among non-indigenous copepods, the calanoid copepod *Pseudodiaptomus marinus*, native to the Indo-Pacific, has been increasingly reported in European waters since 2007. This species is particularly well-suited to serve as a model organism for ecotoxicological studies, and is amenable to experimental rearing. The participants will constitute a network to explore joint initiatives to study the different aspects of the biology and ecology of *P. marinus*.

Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	Approximately 30 participants expected
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and group under ACOM	There are no obvious direct linkages.
Linkages to other committees or groups	This workshop is directly related to research and advisory goals of several EPDSG EGs, including the Working Group on Integrative Morphological and Molecular Taxonomy (WGIMT) and Working Group on Zooplankton Ecology (WGZE). There are also direct linkages with HAPISG EGs, including the Working Group on Introductions and Transfers of Marine Organisms (WGITMO) and Working Group on Ballast and Other Ship Vectors (WGBOSV).
Linkages to other organizations	The work of this group is potentially aligned with similar work by the Intergovernmental Oceanographic Commission of UNESCO (IOC) and the International Maritime Organization (IMO).

Scallop Assessment Working Group (WGScallop)

2018/MA2/EPDSG04 The **Scallop Assessment Working Group** (WGScallop), chaired by Lynda Blackadder*, Scotland, 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 2019	7–11 October	Isle of Man	Interim report by 1 December	
Year 2020			Interim report by Date	
Year 2021			Final report by Date to SCICOM	

ToR descriptors

ToR	Description	Background	Science plan codes	Duration	Expected Deliverables
a	Compile and present data on scallop fisheries in ICES areas IV, VI and VII by collating available fishery statistics.	The fisheries are socio-economically important and there is a need to collate these data at a national level to ensure assessments can proceed.	5.1	Years 1,2,3	Landings, effort and commercial sampling data on listed species, from each country.
b	Review recent/current stock assessment methods of the main scallop species and explore other methodologies; including comparisons with fishery dependant indicators.	The aim is to assess the status of scallop stocks and contribute to Integrated Ecosystem Assessment and Management and descriptor 3 of the MSFD.	5.1, 6.3	Years 1,2,3	Report on alternative assessment methods. Link with WKLIFE.

c	Collate all available data and attempt to conduct a stock assessment for the north east Irish Sea.	The Isle of Man currently conducts stock assessments on their territorial seas. The aim is to assess the wider area.	5.1, 6.2	Years 1,2,3	Stock assessment for north east Irish Sea.
d	Review and report on current scallop surveys and share expertise, knowledge and technical advances.	Focus will be on reporting recent updates with regards to surveys and sampling, use of cameras, gear efficiency and selectivity, impact of scallop dredging, discard mortality, MPA's and closed areas, bycatch.	1.4, 1.5, 4.4, 5.2, 5.4	Years 1,2,3	WG report chapters. Exchange of scientific staff on surveys. Database to collate bycatch data.
e	Continue to refine stock structure using best available information on genetics and larval dispersal and look to improve current mapping of scallop stocks.	Knowledge on the genetic stock structure and extent of larval dispersal is still weak but a number of projects are underway.	1.4, 1.8	Years 1,2,3	WG report chapters and relevant maps. Link with WGSFD.
f	Keep current biological parameters under review and update when more information becomes available and report on all relevant aspects of: biology, ecology, physiology and behaviour, in field and laboratory studies.	Several biological parameters are important for analytical assessments and parameters may vary depending on the stock area.	5.1, 5.2	Years 1,2,3	Update knowledge on crucial stock parameters.
g	Compare age reading methodologies and attempt to develop common practices and determine precision and bias of scallop age reading data derived from different readers and methods.	Many institutes rely heavily on aging methods but there are no common methodologies or protocols.	4.4, 5.1	Years 1,2,3	Produce guidelines on agreed methodologies.

Summary of the Work Plan

Year 1	Annual standard outputs for ToR a,d,e, f. Collate lists of available data for Irish Sea (c). Age reading workshop (g), arrange scientific staff exchange on surveys (d) and knowledge exchange on current scallop stock assessment methods (b).
Year 2	Annual standard outputs for ToR a,d, f. Collate available data for Irish Sea (c). Age reading guidelines further discussed (g). Update and report on genetic and larval dispersal models and attempt to colloborate on further work (e). Review scallop stock assessments caried out by national institutess (b).
Year 3	Annual standard outputs for ToR a,d, f. Stock assessmnet for Irish Sea (c). Age reading guidelines produced (g). Produce maps on genetic stock structure and larval dispersal (e) Further develop scallop stock assessment methods (b).

Supporting information

Priority	The fisheries for scallops are socio-economically important and trans-national in Europe and North America. Management of stocks in Europe is primarily by technical measures and in most countries there are generally little or no management instruments to control fishing effort. This is currently the only scientific assessment forum for discussion and development of common assessment methods for scallops. Consequently, these activities are considered to have a very high priority.
Resource requirements	The research programmes, which provide the main input to this group, are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	The Group is normally attended by 16 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	There are no obvious direct linkages as the WG does not currently provide advice.
Linkages to other committees or groups	There are currently no direct linkages but the WG has made recommendations for WGSFD and WKLIFE.
Linkages to other organizations	None.

OSPAR/HELCOM/ ICES/Working group on Seabirds (JWGBIRD)

2018/2/

The 3 year JWGBIRD ToR, approved by ACOM in 2017, can be found here:

http://community.ices.dk/Committees/Resolutions/Attachments/Draft%203year%20work%20programme%20of%20the%20Joint%20OSPAR_HELCOM_ICES%20Working%20Group%20....docx

Only experts appointed by national Delegates or appointed in consultation with the national Delegates of the expert's country can attend this Expert Group

The Working Group on Marine Mammal Ecology (WGMME)

2018/2/ The **Working Group on Marine Mammal Ecology** (WGMME), chaired by Anders Galatius (Denmark) and Anita Gilles (Germany), will meet in Büsum, Germany, 11–14 February 2019 to:

a) Review and report on any new information on seal and cetacean population abundance, population/stock structure, management frameworks (including indicators and targets for MSFD assessments), and anthropogenic threats to individual health and population status;
b) Review and update information on the ecological role of marine mammals, e.g. influence on structure, function and transfer of energy (and of parasites) in marine foodwebs;
c) Review additional aspects of marine mammal fishery interactions not covered by WGBYC. Details of this ToR to be agreed with WGBYC;
d) Review the population-level effect of cumulative human impacts on marine mammals and further develop and/or update the threats matrix;
e) Update the database for seals.

WGMME will report by 15 March 2019 for the attention of the Advisory Committee. Regional database.

Only experts appointed by national Delegates or appointed in consultation with the national Delegates of the expert's country can attend this Expert Group

Supporting information

Priority	The activities of this Group contribute to the underatanding of the ecological role of marine mammals
Scientific justification	ToR a is a standing term of reference. However, the group proposes to expand its scope since it would be useful to include information on threats to population status. ToR b aims to address the ecological role of marine mammals, in response to emerging issues e.g. in seal-fisheries interactions. The group also proposes to include a review on the occurrence of trematode gastric parasites and the role of fish in the life cycles of respiratory parasites of marine mammals to follow up other areas not covered by this year´s review of digestive tract parasites. ToR c is proposed in the recognition of common interests between WGMME and WGBYC, recognising that some issues related to marine mammal-fishery interactions may finally be covered by neither group. ToR d aims to address the interactive effects of multiple stressors (e.g., noise, fisheries, marine constructions, pollution, habitat degradation). ToR e is a standing term of reference to keep the reworked seal database up to date.
Resource requirements	None
Participants	The Group is expected to be attended by 15-20 members.
Secretariat facilities	Web conference
Financial	None
Linkages to advisory committees	ACOM
Linkages to other committees or groups	WGBYC
Linkages to other organizations	OSPAR

EGs dissolved in 2018

2017/2/EPDSG07	A workshop entitled "Towards an European observatory of the invasive

	calanoid copepod Pseudodiaptomus marinus" (WKEUROBUS)	
2017/2/EPDSG06	ICES-PICES Workshop on Political, Economic, Social, Technological, Legal and Environmental scenarios used in climate projection modelling (WKPESTLE)	**Report pending**.
2014/MA2/SSGEPD06	Working Group on data poor diadromous fish (WGDAM)	ToRs complteted. Will not pursue a new 3-year term.
2015/MA2/SSGEPD02	Working Group on Small Pelagic Fishes, their Ecosystems and Climate Impact (WGSPEC)	Will not pursue a new 3-year term.

Resolutions approved in 2017

Benthos Ecology Working Group (BEWG)

2017/MA2/EPDSG01 The **Benthos Ecology Working Group** (BEWG), chaired by Silvana Birchenough, 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	14–18 May 2018	Banyuls-sur-Mer, France	Interim report by 30 June	
Year 2019	6–10 May	Ulster, Northern Ireland, UK	Interim report by 30 June	
Year 2020	4–8 May	Bergen, Norway	Final report by 30 June	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
A	**Long-term benthic series and climate change** 1. To identify methodological issues in long-term series comparability	The need for the BEWG to work on current tools and techniques associated with the understanding of natural variability and climate change on the benthos is of importance. There is a need to review and compile methodological issues associated with long-term series comparability in marine assessments.	2.1	1–3 years	Review paper on current methodological applications
B	**Species distribution modelling and mapping** 1. To report on ongoing case study: "Towards a benthic ecosystem functioning map: interregional comparison of two approaches	Distributional modelling (SDM) helps the understanding of the distributionof species and communities. These are considered to be robust tools in support of a scientifically-sound management of the marine ecosystem. While qualitative SDM (i.e. modelling the likelihood of occurrence of benthic feature) has been regularly applied, there is a need to focus on quantitative modelling techniques (e.g. modelling densities or biomass) over environmental drivers (e.g. sediment type, organic matter content and other relvatn parameters) and processes. BEWG will report on the performance of different qualitative and quantitative species distribution modelling methods, e.g. methods validity and with hypothesis driven case studies to showcase the use, benefits and further gaps associated with these tools.	1.3; 1.5; 1.7	Year 1-3	Position paper (with a case study example).
C	**Benthos and legislative**	A wide suite of benthic quality indicators were	1.5; 2.4		

	drivers 1. To report on the use of benthic indicators and ongoing initiatives 2. Variability and expert judgement of benthic species tolerances/ sensitivities 3. To review the development of effective monitoring programmes, e.g. design, harmonisation and quality assessments (e.g. MPAs). Case study developed under the –Joint Monitoring Programme -JMP	developed, intercalibrated and applied within the framework of several international regulations. At present, the most relevant directives within the North Atlantic realm are the Water Framework Directive, the Habitats Directive and the Marine Strategy Framework Directive. BEWG will investigate the Compatibility and complementarity within the use of benthic indicators and targets for management applications. Further work will concentrate on investigating the importance of species autecology in indicator development and application and review the development of effective monitoring programmes, e.g. design, harmonisation and quality assessments.		Years 1-2 Years 1-3 Years 1-2	Position paper Research paper(s) Review paper
D	**Benthic biodiversity and ecosystem functioning** 1. To report on the ongoing case studies to assess ecological responses across sediment gradients. 2. To consider new functional indicator needs to support MSFD requirements. 3. To identify links between benthic functions and ecosystem services.	Disentangling the link between biodiversity and ecosystem functioning is currently considered to be key to fully understand the health of marine ecosystems. This topic hence became a cross-cutting theme since the BEWG 2012 meeting. BEWG will therefore review and identify benthic indicators to reflect the link between biodiversity and ecosystem functioning and review how ecological function and diversity relates to different parts of the benthic communities at different spatial scales, taking account of e.g. ecological processes and biological traits. BEWG will also scope for research on the functional diversity of macrobenthos in relation to ecosystem functioning. This work has been an important topic and an overview of current and recent research gaps and priorities wil be discussed. The ongoing discussion will be based on a conceptual perspective, BEWG will continue investigating the link between ecosystem functioning and ecosystem services.	1.3; 1.7; 1.9	Years 1-3 Year 1-3 Year 1-2	Research paper to report on a selected case study. Viewpoint paper Viewpoint paper
E	**Benthic biodiversity and conservation: to**	Understanding ecological issues associated to the development/proposal of MPAs and how effec-	6.1; 6.2; 6.4	Years 1-3	Review paper

	review the role of benthic ecology in MPAs **1.** To review and report on the implications of the designation and management of Marine Protected Areas (MPAs) in relation to role of benthic ecology.	tive MPAs are going to be for the conservation of priority benthic species is key to support conservation and management strategies. This work has been developed to understand the different levels of protection (i.e. management measures) being applied within MPAs. The exercise will help to assess whether the designation processesin place are adequate to protect the species in need of protection, creating further repercussions to the ecosystem function and processes in specific habitats and species. This ToR will consider issues associated with conservation/restoration, Autecological/environmental as well as human issues.			
F	**To explore the feasibility to undertake studies (e.g. laboratory or field experiments) to test ecologically relevant hypothesis in relation to benthic responses.** 1. To explore funding opportunities and collaborative proposals for setting up and conducting experimental studies; 2. To compile a list of scientific ideas to develop research Master's thesis projects and promote co-supervision activities within BEWG members.	Conducting applied science to test direct hypothesis driven questions, which can help to support and validate dedicated case studies Similarly BEWG recognises the need to widen its scientific scope and a way to support this activitiy is by jointly supervising specific research projects. This type of further research will help for extending its remit, build dedicated set of skills and widen its influence accross differet networks. The BEWG also recognises the need toinvite and include early career scientists in to our annual meetings, helping to shape the new round of ecologists.	tbc	Years 1-3 Year 1-3	Review paper Thesis preparation and invitation to meetings.

Summary of the Work Plan

Year 1	ToRs a., b.1, c.1-3, d.1-3, e.1, f. 1-3
Year 2	ToRs a., **B.1, C.1-3, D.1-3**, e.1, **F. 1**-3
Year 3	ToRs **A.**, **B.1, C.1-3, D.1-3**, e.1, **F. 1**-3

Supporting information

Priority	The current activities of BEWG will continue along the main priority within BEWG ToRs, based on: long-term series and climate change, benthic indicators and EU directives, and species distribution modelling, and one cross-cutting (horizontal) axis on benthic biodiversity and ecosystem functioning (including issues directly in connection to MPAs). All issues mentioned fit the ICES Science Programme and are considered to be of high priority. The BEWG are active contributors and aim to report their outcomes directly to ICES in their annual report and in paralell as peer reviewed literature. Some of the outputs will be submitted to ICES JMS, Ecological Indicators, Marine Pollution Bulletin, etc.)
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	The Group is normally attended by some 20-30 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and group under ACOM	There are no obvious direct linkages.
Linkages to other committees (groups	There is a possibility for interaction of several ICES expert groups, among which WGDEC, WGSFD, WGECO, WGMHM and WGEXT.
Linkages to other organization	The group has had also interaction with OSPAR IGC-COBAM.

Working Group on Zooplankton Ecology (WGZE)

2017/MA2/EPDSG02 The **Working Group on Zooplankton Ecology** (WGZE), chaired by Sophie Pitois, UK, and Lidia Yebra, Spain, 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	19–23 March	Helsinki, Finland	Interim report by 1 May	
Year 2019	11–14 March	Las Palmas de Gran Canaria, Spain	Interim report by 1 May	Meeting in association with WGIMT and WGPME.
Year 2020			Final report by 1 May	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
A	Review the use of zooplankton production methodologies in collaboration with PICES BIO WG37	a, c) Over the past two decades, quantitative evaluation of zooplankton production and its driving forces has been emphasized as a component of improving our understanding of how marine ecosystems respond to global change. While many methodologies to estimate zooplankton production have been proposed, we have limited knowledge identifying which methods are the most practical and relevant for measuring the production rates of natural zooplankton populations and/or communities across a wide range of phyla and trophic levels. The Working Group has identified and pursued	1.3; 1.9	Year 1-3	Plan of collaborative activities (y1), List of scientists and laboratories measuring zooplankton production among PICES and ICES nations (y1-3),

		the need for an evaluation of existing, new and emerging methodologies (see Reports of the Working Group ICES CM 2004/C:07, ICES CM 2011/SSGEF:01, ICES CM 2014/SSGEF:09 and ICES CM 2015/SSGEPD:05). At the workshop 'ICES/PICES cooperative research initiative: towards a global measurement of zooplankton production' (held during the 6th ICES/PICES Zooplankton Production Symposium in 2016), the community decided to propose to the PICES-BIO committee the Working Group entitled 'Zooplankton Production Methodologies, Applications and Measurements in PICES regions' (WG37) to foster targeted activities for promoting scientific collaboration and better coordination in support of knowledge transfer.. WGZE and WG37do share common interests and their collaboration is of utmost importance for the success of the ICES/PICES cooperative initiative.			Coordinated compilation of zooplankton production data (online database, y1-3), Comparison between models in use to estimate zooplankton production (peer-reviewed publication, y2)
B	Compile data and provide expert knowledge and guidance in the definition of key traits of zooplankton species in the ICES area	a) Zooplankton traits are increasingly needed to determine the relative fitness of plankton along environmental gradients and to predict and assess community shifts and their consequences. Although a wide range of traits has been classified in recent years, data are scattered in the literature and uncertainties remain from paucity of observations.	1.8 ; 1.9	Years 1-3	A compiled database of known species-level zooplankton traits for the North Atlantic and adjacent seas. A peer-reviewed publication on the methods and data of this compiled database. A "wish list" of key zooplankton species within the ICES area that are still missing some or all trait data.
C	Recovery of "Dark Data" (datasets that are not available publicly) collected on or before WGZE time-series were started around 1990.	a, b, c) Many scientific data sets over the past 50+ years were collected at a time when the technology for curation, storage, and dissemination were primitive or non-existent, and consequently many of these datasets are not available publicly. These so-called ‘‘dark data’’ sets are essential to the understanding of how the ocean has changed chemically and biologically in response to the documented shifts in temperature and salinity (aka climate change). This ToR will seek to identify, acquire, and help make public (i.e., “bring into the light”) dark zooplankton data sets collected in the North Atlantic over the past decades. Each data set rescued by this process will be submitted for archiving and a DOI, and then made publicly available through data centers such as the ICES Data Centre, BCO-DMO, and COPEPOD. Needed are: 1) To prescribe a protocol for dark data recovery i.e. a best practice list of steps to document and submit data to a public repository.	1.4; 1.9	Years 1-3	Metadata, database input, Possible peer-review publication (may produce a “data paper” such as Earth System Science Data if our efforts appear to be successful)

		2) To determine where dark data are located. 3) To identify and make contact with the holders of such data. 4) To engage with data holders to provide the data and metadata to a public data repository in order to make them discoverable and re-useable for future research. 5) To provide adequate citation / publication of the data (DOI) so the originator is given full credit. One example is the collection of data sets associated with the TASC program in the early 1990's. The physical data were available (they were assembled on a CD), but many of the biological data sets remains hidden in file cabinets, on originator's floppy disks, or the like. A number of WGZE members have expressed interest in "rescuing" data sets they have participated in collecting over the years, but are not currently available.			
D	Macrozooplankton in mesopelagic zone	a, b) The mesopelagic zone, stretching from 200 to 1000 m depth, comprises about 60% of planet's surface and 20% of the ocean´s volume, constituting a large part of the total biosphere. The bulk part of the fish of the world live there, by number as well as by biomass: a 2008 study put the world marine fish biomass at 0.899 billion tonnes, a number that is only slightly lower than the 1980 estimate of mesopelagic fish biomass alone (~ 1 billion tonnes). It is, however, a zone of wide diversity; the dominating taxonomic groups are crustaceans, various jellyfishes and cephalopods in addition to the fishes. Recent studies indicate that the total amount of mesopelagic fish biomass globally has been grossly underestimated, possibly by a factor of 10. The new assessment suggests a biomass in the order of 10,000 million tonnes, roughly equivalent to 100 times the annual catch of traditional fisheries of about 100 million metric tons. Even though much is known about the mesopelagic community and its functioning in the marine ecosystems, still much remains unknown, especially the role of the many macroplanktonic taxa.	1.3; 1.9	Years 1-3	This three-year ToR will review our knowledge about the mesopelagic macrozooplankton taxonomy, abundance and biomass, trophic ecology, reproductive biology, and their impact on the flux of carbon into the deep-sea, and the role of the mesopelagic zone as a site for carbon sequestration. The aim is to produce a summary publication.
E	Analyze changes in the geographic distributions, seasonal patterns, and interannual trends of Arctic and North Atlantic macro- and meso- zooplankton species	a) Climate-related changes in the physical and chemical oceanic environment have been considered as major drivers of significant fluctuations in zooplankton. Meso- and macro-zooplankton are key components in the marine food web, hence studies on their distribution, diversity, and population dynamics are significant for understanding ecosystem dynamics. This ToR will explore long-term data on the distribution (spatial and temporal), abundance, composition, and species diversity of zooplankton in the ICES regions. Within the rapidly changing subarctic and Arctic regions, a special focus will also be given to macroplankton data series (e.g., euphausiids and amphipods). To pursue this ToR, WGZE's existing time-series compilation and analysis tools (used for the ICES Plankton Status Report) will be expanded to include and handle full species data.	1.3; 1.4; 1.9	Years 1-3	Zooplankton Status Report contribution, Link to 'dark data', Possible peer-review publication

F	Gelatinous plankton – time-series collection, and recommendations regarding monitoring	a) Gelatinous plankton plays an important role in the oceanic and coastal ecosystems, forming spectacular population blooms. Compelling evidence is showing that jellyfish bloom size, frequency, period, and magnitude is increasing, although a global increase in abundance has been widely debated. Gelatinous organisms are opportunistic species quickly adapting to environmental changes, enhancing their feeding, growth, and reproduction. Despite their increasing significance, gelatinous plankton is not conventionally monitored together with other zooplankton. Jellyfish sightings are common in the warm waters of the Mediterranean and monitoring has also become widespread in the ICES area including colder waters. However, often datasets are not available ("dark data") and a variety of methods are being used. This new ToR will providethe basis for future studies on distribution and temporal patterns of gelatinous zooplankton. Therefore, it will: i) provide an inventory of existing time-series on gelatinous plankton in the ICES area together with a compilation of metadata on the available datasets. ii) establish a summary of quantitative methods used in studies of gelatinous plankton and provide recommendations for the best practice for the implementation of gelatinous plankton monitoring in current time-series in the ICES area	3.1; 3.2; 3.6	Years 1-3	Zooplankton Status Report contribution, Link to 'dark data' to provide a metadata compilation. Recommendations for the monitoring of gelatinous plankton
G	Determine the status of microzooplankton time-series data collection within the ICES area.	a, c) In 2007, a WGZE ToR reviewed the role of microzooplankton in the marine food web and concluded i) that the group should include both micro-and mesozooplankton experts and ii) that microzoplankton time-series and monitoring within the ICES area should be encouraged. This new ToR will assess progress made in this area over the last ten years and will identify any collaboration, gaps or overlap with other WGs (e.g. WGIMT; WGPME).	1.3; 1.9; 3.2; 3.4	Years 1-3	List of scientists and laboratories measuring microzooplankton groups within time-series datasets. Data table to compare sampling & analysis methods and to indicate which groups are regularly counted and which groups are routinely being missed; Database input; Webpage content update.
H	Review the applicability of continuous and real-time zooplankton techniques in long-term monitoring	a) Sampling of zooplankton today is often conducted using a combination of acoustics and imaging systems in addition to sampling with nets. Both the acoustics and imaging data provide streams of information that can, with developing classification algorithms, be analyzed and distributed in realtime. In addition, acoustic scattering techniques have the potential to provide zooplankton data at a high temporal resolution over large spatial ranges. This ToR will endeavor to provide a synthesis of current realtime systems and make	4.1; 4.4	Years 1-3	Synthesis of current continuous and realtime systems. A recommendation document on how time-series sites can enhance and modernize their data and analysis data

		recommendations for how time-series sites can enhance and modernize their data and analysis data acquisition systems.			acquisition systems.
I	Expand and update the WGZE zooplankton monitoring and time-series compilation	a, b, c) It gives a rare opportunity to examine regional and transatlantic distribution and temporal patterns within the zooplankton time-series, including new methods identified by WKSERIES, to discern significant changes over time and to identify potential environmental or climate drivers.	1.3; 1.4; 1.9	Years 1-3	To update the next edition of the Plankton Status Report (PSR) Webpage content update Additional peer-reviewed publication
J	Design and carry out coordinated and collaborative activities with WGIMT and WGPME (including the molecular/taxonomic tasks)	c) Synergy is expected based on development of the common activities strategy	1.6; 1.8	Years 1-3	Plan of activities
K	Develop, revise and update of zooplankton species identification keys initially focusing on the most abundant taxa at the ICES time-series sites and ensuring their availability via the web, including especially ICES Zooplankton Identification Leaflets.	a) Extremely important tool in terms of capacity building of the scientific community	1.6	Years 1-3	Updated Taxonomic Leaflets uploaded to the web page
L	Planning of the 7th Zooplankton Production Symposium.	This symposium is a common initiative of ICES and PICES and if both organizations would like to keep 5-years intervals the next one should be organized in 2021. Discussion on the planning of the 7th ZPS started between WGZE and PICES Deputy Executive Secretary (Hal Batchelder). WGZE members from USA and Canada will explore possibilities to organise the next ZPS in North America.		Year 2, 3	To engage in preparations and organisation of Theme sessions.

Summary of the Work Plan

Year 1	At the moment, all the suggested ToRs are planned as three-years activities covering the entire extension period. Certainly, a various workload intensity in specific ToRs in each year is expected.
Year 2	At the moment, all the suggested ToRs are planned as three-years activities covering the entire extension period. Certainly, a various workload intensity in specific ToRs in each year is expected.
Year 3	At the moment, all the suggested ToRs are planned as three-years activities covering the entire extension period. Certainly, a various workload intensity in specific ToRs in each year is expected.

Supporting information

Priority	The activities of this group are a basic element of the EPDSG, fundamental to understanding the relation between the physical, chemical environment and living marine resources in an ecosystem context. Reflecting the central role of zooplankton in marine ecology, the group members bring a wide range of experienced expertise and enthusiasm to bear on questions central to ICES concerns. Thus the work of this group must be considered of very high priority and central to ecosystem approaches.
Resource requirements	Resource required to undertake the "normal" activities of this group is negligible.
Participants	The Group is normally attended by some 25–30 members and chair-invited members.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and group under ACOM	The Group reports to the SCICOM EPDSG. Mainly WGZE provides scientific information on plankton and ecosystems but irregularly contributing to the advisory part of ICES activities as well.
Linkages to other committees groups	Any and all expert groups interested in marine ecosystem monitoring and assessments, modelling and/or plankton studies, including fish and shellfish life histories and recruitment studies. Close cooperation with the WGPME and WGIMT is planned and expected.
Linkages to other organization	The Plankton Status Report is of interest and practical use to a range of interested groups within ICES, PICES, CIESM, and GOOS with other national and international research groups and agencies. Exchange of information and cooperation is expected with other organisations as IOC, SCOR, COML/CMarZ, and others which have research activities meetings etc., of interest and relevant to the activities of the WGZE. Contacts are maintained through networking and collaborative activities.

Working Group on Harmful Algal Bloom Dynamics (WGHABD)

2017/MA2/EPDSG03 The **Working Group on Harmful Algal Bloom Dynamics** (WGHABD), chaired by Eileen Bresnan, 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	23–26 April	Tarragona, Spain	Interim report by 15 June	
Year 2019	2–4 April	Oslo, Norway	Interim report by 15 May	
Year 2020			Final report by DATE	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
A	Deliver National Reports on harmful algal events and bloom dynamics for the years 2017, 2018 and 2019.	HAB events may affect human activities and marine ecosystems at different levels. Understanding can best be achieved by integrating multiyear data sets.	5.5; 5.6; 5.7	Year 1,2,	Summary of national reports in Annex in WGHABD report. Contribute with reports to HAE-DAT.
B	There are a number of fish killing	The WG identified a need for a	2.7; 5.5	Year 1	Work with chair of IP-

	algae activities underway during the reporting period from 2017–2020 e.g. IP-HAB task team on fish killing algae, fish killing algae colloquium in 2018. Participants involved with these activities will update the WG with progress and a summary will be provided to ICES and the IOC and other relevant WGs	detailed assessment of the scale of the problem and the identification of key knowledge gaps.			HAB task team on fish killing algae to produce peer review paper.
C	ICES-PICES-IOC Harmful Algal Event Database (HAE-DAT) – the harmful algal event database will be updated by participants on an annual basis. This database will be used to produce 'products' such as spatial descriptions of harmful algal events in the ICES area . Examples include maps of incidence of toxicity and/or mortalities, updates to ICES Ecosystem reviews that can be updated annually or as required.	Data from the ICES area in HAE-DAT has been updated and quality controlled for the 2014–2016 period and historic data entry and QC is almost complete. Outputs from this database will allow the regional and spatial distribution of harmful algal events to be examined.	3.4; 4.2; 6.3	Year 1,2,3	Outputs on request and as described in ToR D
D	ICES WGHABD will produce a HAB Status Report. This will represent the ICES contribution to the Global HAB Status Report for the North Atlantic area. This will use data and products generated from HAE-DAT and supplementary time series data as appropriate.	Data from the ICES area in HAE-DAT has been updated and quality controlled for the 2014–2016 period and historic data entry and QC is almost complete. Outputs from this database will allow an examination of the harmful algal events in the ICES area over the last 25 years.	1.3; 5.6; 6.1	Year 1, 2 ,3	Year 1: Data QC complete and plots produced. HAB Status report finalised at 2018 meeting. Year 2: Global HAB Status Report launched. Presentation at ISSHA HAB conference, other associated activities as they arise. Year 3. Special issues of Harmful Algae on Global HAB Status report containing papers from the ICES area.
E	Report on new findings in the area of harmful algal bloom dynamics	WG members report new findings on the topic of algal bloom dynamics in the ICES area. This is a particularly valuable ToR for providing the most up-to-date status of HAB dynamics in the ICES area.	1.3; 1.6; 5.6	Year 1,2,3	A report on new findings in the area of harmful algal bloom dynamics.
F	HABs and the EU Marine Strategy Framework Directive (MSFD). Currently there is no consistent approach in Europe to including HABs in the	WGHABD will review the pending EU commission decision and how HABs are included in the MSFD.	1.5; 6.3	Years 1,2,3	Year 1: A section in the WGHABD 2018 report reviewing the the EU commission decision in relation to

	assessment of GES for the MSFD. A commission decision on the MSFD is pending. .				HABs Year 2-3: Further work driven by outputs from year 1.
G	Review how physical, chemical and biological interactions control the dynamics of selected harmful micro-algae	Harmful algal genera respond to environmental forcing in different ways. During each meeting a different genus will be evaluated to provide a comparative evaluation of known and potential responses to physical / environmental forcing.	1.3; 1.7; 2.2	Years 1,2,3	Produce summary for ICES report. During Yr 1 – genera will be Gambierdiscus and Fukuyoa. Species for review during years 2 and 3 will be selected at the preceding meeting.
H	Ciguatera Fish Poisoning (CFP) is an emerging issue in the ICES area. This ToR will provide an update of CFP incidence in the ICES area, new developments in methodology to research the issue, modelling efforts, risk assessments to protect human health, initiatives in other bodies such as IP-HAB, PICES etc.	There are currently a number of initiatives underway examining different aspects of CFP in the ICES area.	5.6; 6.1; 6.3	Years 1,2,3	Year 1: update to WGHABD on work underway to address this issue in affected areas in Europe. Year 2 and 3; deliverables pending developments in this area of work.
I	Species specific HAB detection methods and other cutting edge technologies are now moving from research towards operational use. WGHABD will aim towards developing collaborations with other WGs working in this area to optimise practical applications in operational situations.	Optical and molecular methods have been used routinely in HAB context for the 15 years. New state of the art methods have been trialled in the ICES area. Potential for collaboration with other WGs.	1.6; 3.3; 4.1	Year 2, 3	Year 3: Output to be decided based on collaboration with other WGs and discussions during Year 2.

Summary of the Work Plan

Year 1	Finalise QC of HAE-DAT data, production of outputs and ICES Status report. Review EU commission decision and role of HABs in the MSFD. Update on activities in relation to CFP and implications for the ICES area. Present national reports, new findings, complete HAE-DAT entries for 2017 data. Work with IP-HAB to finalise production of manuscript on fish killing algae, review HAB genera Gambierdiscus and Fukuyoa.
Year 2	Contribution of ICES input to the Global HAB Status Report and input into activities around its launch. Agree associated peer review publications to be produced for year 3. Activities on HABs and MSFD, and CFP as decided in Year 1. Present national reports, new findings, complete HAE-DAT entries for 2018 data. Review of Hab genera to be decided. Communicate with other WGs with regard to ToR I. Respond to advisory requests as appropriate.
Year 3	Production of peer review publications for Global HAB Status Report special issue. Input to associated activities as appropriate. Activities on Habs and MSFD and CFP as decided in Year 2. Present national reports, new findings, complete HAE-DAT entries for 2019 data. Review of Hab genera to be decided. Pariticipate in activity associated with ToR I.

Supporting information

Priority	The current activities of this WG address the strategic goals 1,2 and 3 in the ICES strategic plan. Output from this WG also represents the contribution from ICES at a number of forums (e.g. UNESCO-IOC) which consider problems associated with HABs at a global scale. The WG is also producing the contribution from the ICES area to the Global HAB Status report currently being produced by the IOC.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	The Group is normally attended by some 20–25 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	Output from HAE-DAT and ICES HAB status report will provide material for ACOM should requests for advice require consideration of impacts from HABs. .
Linkages to other committees or groups	There is a working relationship with WGPME, WGZE, WGITMO. The cooperation with Aquaculture EGs could be further developed.
Linkages to other organizations	UNESCO-IOC Intergovernmental Panel on Harmful Algal Blooms, IOC/SCOR Global HAB (previously GEOHAB - Global Ecology and Oceanography of Harmful Algal Blooms)

Working Group on Oceanic Hydrography (WGOH)

2017/MA2/EPDSG04 The **Working Group on Oceanic Hydrography** (WGOH), chaired by Paula Fratantoni, USA, and César González-Pola, Spain, will meet work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2018	20–22 March	Norwich, UK	Interim report by 1 May	
Year 2019	19–21 March	Bergern, Norway	Interim report by 1 May	
Year 2020			Final report by DATE	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Examine the hydrographic variability of the North Atlantic and its subpolar seas. Identify events, trends and drivers in the region .	The contributors to the WGOH bring together a wide range of observations taken by various national programmes. Here we annually monitor developments in the environmental conditions that they sample.	1.1; 1.2; 1.9	3 years	Annual interim reports will include details of national programmes and most up to date findings.
b	Standard Sections and Stations summarized into	The Working Group recognises the need for disseminating	1.1; 1.2; 1.9	3years	Annual. IROC report for

	the production of the IROC report and submitted to IROC data portal.	climate information in a timely and appropriate manner. This agenda item will allow WGOH members to prepare the document during the meeting. We will review proposed new developments in IROC content.			CRR submission. Text and figures to ICES by June 30th each year. Data to portal by 1st September each year.
c	Report on developments within international climate monitoring, multi decadal reanalyses & prediction programmes relevant to ICES	Benefit both to ICES and the international monitoring programmes to enhance internal information exchange. Additionally developments in the capacity to make climate forecasts of hydrographic parameters are being made by the international community, that may have the potential to aid future ICES work.	1.2; 1.9; 4.2	2 years	Identify the products of potential use to ICES. Report as part of 2nd year progress.
d, e, f	Support for ICES processes on hydrographic data and ocean scale marine climate variability. Including Data Centre, other EGs, and advice programmes where and when requested	As required support for ICES Data centre on hydrographic data. Oceanic hydrography remains a fundamental component of assessing the state of marine ecosystems. WGOH documents interannual to multidecadal variability and trends in the oceanic hydrography for most ecoregions and will review the available 'Ecosystem Overviews' as they become available for each regional sea.	1.2; 1.9; 6.3	ongoing	Response to requests and reviewing input from Datacentre at WG meetings. Submit review to the annual interations of Ecosystem Overviews.
g	Contribute to objectives, activities of parent science steering group SSGEDP	A flexible ToR to allow WGOH to contribute to EPDSG requirements as they develop over the term of the current science plan.	1.1; 1.2	3 years	As and when defined by our steering group EDPSG
h	Prepare a new decadal symposium in 2021	The WGOH has been responsible for previous decadal symposia (e.g. the 2011 symposia in Santander). Such a large event requires thorough preparation and starting the preparation early acts to assure a successful event.	NA	3 years	Progress to be reported annually
i	Ongoing self evaluation of the EGs work.	WGOH is a long established EG within ICES and has ToRs that are closer to an annual workplan. The main product is the annual IROC which has been produced for 15 years, and must be continually developed - through ongoing self evaluation and review	NA	3 years	WGOH Final Report under multiannual ToRs 2020

Summary of the Work Plan

Year 1	a) IROC 2018 production & recommendations for modifications to IROC format and content, including discussion on potential for reanalyses, forecast products to be included and addition of ICES Regional Ecosystem area focussed component, also potential move to purely web based product. b) WG Activities progress report including highlights of North Atlantic hydrographic conditions and any significant events synthesized from the national reports and IROC findings. c) Initial identification of climate monitoring, reanalysis and forecasting programmes. d) develop plans for Decadal Symposium
Year 2	a) IROC 2019 production including first implementation of recommended changes. b) WG Activities progress report including highlights of North Atlantic hydrographic conditions and any significant events synthesized from the national reports and IROC findings. c) Map marine climate reanalysis and forecast parameters to ICES interests. e) Prepare for for Decadal Symposium
Year 3	a) IROC 2020 production and review of content and requirement to continue IROC process. b) WG Final report c) Participation and delivery of Decadal Symposium

Supporting information

Priority	Oceanic hydrography remains a fundamental component of assessing the state of marine ecosystems. WGOH documents interannual to multidecadal variability and trends in the oceanic hydrography setting the vital context for prevailing conditions & ecosystem change. The IROC has been cited more than 110 times (http://tinyurl.com/ICES-IROC) demonstrating that it is an important resource for the marine science community within and beyond ICES.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	The Group is normally attended by about 15–20 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 all the groups of EPDSG. The most direct link is to WGOOFE where the activities of the 2 groups are complementary. WGOH focusses on the larger Atlantic space and long term climate scales. Link to PUBCOM for the annual production of the IROC.
Linkages to other organizations	IOC, JCOMM, CLIVAR

Working Group on Resilience and marine ecosystem services (WGRMES)

2017/MA2/EPDSG05 The **Working Group on Resilience and Marine Ecosystem Services** (WGRMES), chaired by Sebastian Villasante, Spain, and Andrea Belgrano*, Sweden, 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	19–20 November	Vigo, Spain	Interim report by 15 December	
Year 2019	5–6 September	Gothenburg, Sweden	Interim report by 1 November	**Change in Chair:** **Outgoing**: Gonzalo Macho Rivero, Spain **Incoming**: Andrea Belgrano, Sweden
Year 2020		Vigo, Spain	Final report by DATE	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
A	To undertake a literature search to assess the current data available to document the resilience of marine ecosystem services	Information and data on marine ES is scarce and not organized. Links to ICES Science Plan 1st, 2nd and 3rd thematic areas, and WGs described above	1.3; 2.4; 5.8	1 year	-Interim report -Global review paper: Key drivers for resilient small-scale fisheries. - Exploration of potential opportunities for collaboration with EU institutions and fishery organizations -Online repository with results from year (2015-2017)
B	To document the current approaches available in connection to multidimensional valuation of marine ecosystem services	Valuing marine ES is key for policy makers. Regional and local data is lacking in Europe. Links to ICES Science Plan 1st and 2nd Thematic Areas; and WGs described above	4.3; 6.5; 7.1	2 years	-Interim report -Paper review on intrinsic, instrumental and relational values of marine ES -Special Session at ASC 2018 -Special Session at PICES 2018 -Extended version of the online repository
C	To review the available information and to produce a document with the co-production of marine ES	Marine ES are co-produced by a mixture of natural capital andvarious forms of social, human, financial and technological capital. Human intervention in the co-creation of marine ES is a key driver in ES delivery,	4.1; 5.4; 7.7	2 years	-Interim report -Special Session at ASC 2019 -Special Session at AAA Conference 2019 -Global paper about co-production of marine ES -Special Issue "*Blue Growth under the*

					Antrophocene"
D	To work on the Special Issue entitled: "Tipping points and social transformations of marine ES"	Document critical changes which facilitate transformations of social groups. Links to ICES Science Plan 1st, 2nd and 3rd thematic areas, and WGs described above and below. Links to the Strategic Initiative on the Human Dimension	2.4; 5.1; 7.3	2 years	-Interim report -Global paper documenting social transformations of marine ES. -Special Session at ASC 2020 -Special Issue "*Tipping points and social transformations of marine ES*"
E	Governance and scenarios for sustainable marine ES	The role of institutions is key to develop assessments of best practices of integrated assessments of marine ES	6.3; 6.6; 7.6	3 years	-Interim report -Global paper on governance of

Summary of the Work Plan

Year 1	Review of existing frameworks, methodologies and tools to study socio-economic dimensions of marine ecosystem services
Year 2	Undestanding of ecological, economic, cultural, social drives of changes of marine ecosystem services
Year 3	Scenarios and policy recommendations for resilient trajectories of marine ecosystem services

Supporting information

Priority	High. The current activities of this Group will lead ICES into issues related to marine ecosystem services, integrating fisheries management and ecosystem services frameworks. Consequently, these activities are considered to have a very high priority.
Resource requirements	None required other than those provided by the host institute.
Participants	The Group is normally attended by some 15 members and guests.
Secretariat facilities	None.
Financial	No financial implications. The WGREMS will explore to get funds from H2020 calls and others to support and expand the activities inside and outside Europe
Linkages to ACOM and groups under ACOM	AFWG, WGECO, WGRFS
Linkages to other committees or groups	There is a close working relationship with WGBIODIV, and also EPISG EGs (WGMHM, WGMPCZM, WGSFD), SICCME, WGIMM, WGLMEBP, WGISUR, WGMARS, and BONUS.

Linkages to other organizations	The work of this group is aligned with other global nodes of ES research such as the Ecosystem Services Partnership in which the one of the chair (Dr. Villasante) is also co-leader of the Thematic Working Group "Economic and monetary valuation" and (www.es-partnership.org). The work is also in line with the current Future Earth Program, the Natural Capital Project (http://www.naturalcapitalproject.org/) , ++ and numerous scientific and regulatory governmental and university's departments in ICES countries.

Resolutions approved in 2016

Working Group on Seasonal-to-Decadal Prediction of Marine Ecosystems (WGS2D)

2016/MA2/SSGEPD01 The **Working Group on Seasonal-to-Decadal Prediction of Marine Ecosystems** (WGS2D), chaired by Mark R. Payne, Denmark, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2017	12–16 June	ICES HQ, Copenhagen, Denmark	Interim report by 1 August	
Year 2018	27–31 August	ICES HQ, Copenhagen, Denmark	Interim report by 15 October	
Year 2019	26–30 August	ICES HQ, Copenhagen, Denmark	Final report by 15 October to SCICOM	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Identify case studies	Predictable biological variables that are potentially useful to end-users will be identified by i) Surveying the current needs within the ICES community for ecological forecast products for direct use in planning and advice; and ii) Reviewing the state of knowledge about links between the physical environment and biological response variables	1.5; 4.1; 1.3	Year 1-2	Set of identified case studies. To produce a review paper
b	Review methods for assessing predictability	Methods to evaluate the confidence level associated with ecological forecast products using both qualitative and quantitative metrics will be reviewed and where necessary, developed	1.5; 4.1; 1.3	Year 1-2	Review paper
c	Assess predictability of selected case studies	The predictability of the selected case studies identified in ToR a) will be assessed using the tools identified in ToR b)	1.5; 4.1; 1.3	Year 2-3	Report describing the results of the analyses.
d	Develop protocols for operational delivery of ecological forecast products	Protocols for the operational delivery of ecological forecast products to end-users in the wider ICES community will include open-source code for processing data and generating predictions, and	1.5; 4.1; 1.3	Year 1-3	Template for "Forecast sheet", similar to ICES Advice sheet; Report describing protocols for

		standardized formats for communicating the scientific basis, skill and uncertainties associated with the prediction			operationalisation
e	Delivery of forecast products	Case studies that demonstrate an acceptable degree of predictive skill in ToR c) will be converted to operational products following ToR d)	1.5; 4.1; 1.3	Year 3	Operational forecasts of biological variables delivered to endusers
f	Joint activities with PICES SG-CEP	Outline a future research programme and coordinate joint workshop with the PICES Study Group on Climate and Ecosystem Predictability (SG-CEP)	1.5; 4.1; 1.3	Year 1-3	Report from joint workshop held with SG-CEP in year 3

Summary of the Work Plan

Year 1	Identify case studies. Review methods for assesing predictability. Develop protocols for delivering products operationally.
Year 2	Assess the predictability of identified case studies .
Year 3	Joint activities with PICES SG-CEP. Development and delivery of operational forecasts.

Supporting information

Priority	Due to the new opportunities to improve the advisory process that this working group will examine, the work should be considered as a high priority.
Justification	Tremendous advances in oceanographic observing and modelling systems over the last decade have led to dramatic improvements in our ability to predict the ocean; skillful annual and multi-annual forecasts are now a reality in e.g. the North Atlantic. However, the logical next step of translating these predictions of the physical environment into predictions about biological outcomes and incorporating them into advice remains just a dream: just 1-2% percent of stocks today incorporate any form of environmental information into their tactical management procedures. Nevertheless, exploiting this predictive skill to aid in the management of marine resources is emerging as one of the new challenges in marine science and can be seen as a key prerequisite for developing ecosystem-based management of marine systems. WGS2D aims to take up this challenge. While research has historically focused on recruitment, many other biological responses with management relevance, such as spatial distributions, growth and the timing of key events, are also tightly linked to the physical environment and therefore potentially predictable. The group will identify these "low-hanging" and predictable management-relevant biological variables and use them to produce ecological forecast products delivered in an operational manner for applications in advice-generation within the ICES area. WGS2D will also harness the momentum developing in this research area. Theme Session I to be held at the 2016 ICES ASC, entitled "Seasonal-to-decadal prediction of marine ecosystems: opportunities, approaches, and applications" has been well received within the ICES community, with over 30 abstracts submitted. CLIVAR and PICES (with co-sponsorship from ICES) will hold a workshop this August on the closely related theme of ENSO-driven biological forecasts and intend to develop a "sister" PICES working group to the group proposed here. The proposed WGS2D working group is therefore the logical

	move for ICES to continue to push developments in this area and to reap the benefits.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	Participants would include scientists with expertise in fisheries management, marine biology, oceanography and climate. It is envisaged that the working group will be attended by 10-15 members from within the ICES community, together with guests from PICES.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and group under ACOM	ToR e) will generate operational forecasts of biological variables that have direct relevance for advice generation and the monitoring of these stocks. The relevant end-user ACOM working-groups will be closely involved in this process.
Linkages to other committees (groups	Given the interdisciplinary nature of the working group, there are natural linkages of many other ICES groups, including •SICCME - The ICES-PICES Strategic Initiative on Climate Change Impacts on Marine Ecosystems •WGSPEC - Working Group on Small Pelagic Fishes, their Ecosystems and Climate Impact •WGOH - Working Group on Oceanic Hydrography •WGOOFE – Working Group on Operational Oceanographic Products for Fisheries and Environment •WGRFE - Working Group on Recruitment Forecasting in a Variable Environment Depending on the case studies chosen in ToR a) linkages to relevant end-user working-groups, including ACOM, the relevant advice-generating working groups (e.g. HAWG, WGWIDE) and survey planning groups (e.g. WGMEGS) will also be formed and used to help shape the operational forecast products.
Linkages to other organization	The working group will have close linkages to a sister group within the PICES community, the Study Group on Climate and Ecosystem Predictability (SG-CEP) that is currently being established. ICES is also co-sponsoring a workshop together with CLIVAR and PICES in August 2016 that will be instrumental in the establishment of this group. The proposed chair of WGS2D has already had close conversations with this group, and linkages have been written into the Terms of Reference here (ToR f). Activities to link the two groups even closer, including at least one joint meeting and manuscript production, are envisaged.

Working Group on Integrated Morphological and Molecular Taxonomy (WGIMT)

2016/MA2/SSGEPD04 The **Working Group on Integrated Morphological and Molecular Taxonomy** (WGIMT), chaired by Naiara Rodriguez-Ezpeleta, Spain, and Elaine Fileman, 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 2017	31 March	Boulogne-sur-Mer, France	Interim report by 1 June	
Year 2018	24 March	Helsinki, Finland	Interim report by 1 June	**Change of Chair:** Outgoing: Ann Bucklin Incoming: Elaine Fileman and Naiara Rodriguez-Ezpeleta

Year 2019	15 March	Las Palmas de Gran Canaria, Spain	Final report by 1 June	Meeting in association with WGZE and WGPME

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
A	Ensure balanced morphological – molecular expertise among membership of WGIMT	a) Integrative taxonomy requires experts in both morphological and molecular taxonomic approaches. b,c) Members in common will facilitate coordination between WGIMT and SCICOM EGs and help ensure goals are met.	1.6; 1.8	Year 1,2,3	WGIMT will continue to add new members, who are experts in morphological and molecular taxonomy for major zooplankton groups; 2 members in common with other SCICOM EGs.
B	Fully populate the WGIMT web platform with information, protocols and resources to support progress in research and development	a) Locating and accessing morphological and molecular taxonomic information can be difficult: some classical taxonomic references are out-of-print; molecular data are not released prior to publication. b,c) Open access to data and information will expand use of state-of-the-art molecular technologies (e.g., High-Throughput Sequencing) for integrative taxonomy of zooplankton.	1.4; 1.6; 1.7	Years 1,2,3	Complete and fully populate all areas of WGIMT.net web portal (Year 1). Complete specially-designed elements and deep links to support and promote use of technologies (Years 1, 2).
C	Initiate and support provision of standards, training materials, and taxonomy workshops	a,b) Workshops, including ICES Taxonomy Workshops, are very effective in engaging target audiences and ensuring trained technicians and researchers for applications in fisheries and ecosystem management. c) Co-sponsored workshops and meetings with other SCICOM EGs will increase impact and likelihood of application for advisory applications.	1.6; 1.7	Year 2	Design, organize and offer integrative taxonomy workshops; request support via ICES Taxonomy Workshop funds (Year 2)
D	Demonstrate leadership in promoting and encouraging use of integrative taxonomic approaches for assessment of pelagic biodiversity	a,b,c) Integrative taxonomy is an emergent field; uses and applications for fisheries and ecosystem management should be explained in high-visibility settings in ICES and other organisations through special sessions	1.6; 1.8	Years 1,2,3	Organize special sessions at national and international conferences: ASLO/TOS Ocean Sciences Meetings; ICES ASC (Years 1, 2, 3).
E	Advise on the implications of	b,c) Integrative taxonomy (e.g., 'library' of DNA sequences for	1.4;1.7; 1.8	Years 2,3	Report via SSGEPD and SCICOM EGs on promise,

	developments for marine science and management	accurately-identified species) can provide a foundation for genetic methods for assessing species, diversity and abundance in integrated ecosystem assessments. c) Standardized metagenetic data can fulfill requirements of biodiversity assessments (WGPME) and indicators defined in the Marine Strategy Framework Directive (WGAGFM).			progress and pitfalls , of metagenetics (metabarcoding) for integrated ecosystem assessments (Years 1, 2, 3).
F	Publish high-profile peer-reviewed articles that provide documented evidence of advances in metagenetic analysis of zooplankton diversity, distribution, and abundance.	a) Stronger foundation and visibility in primary research literature is needed to establish the validity of metagenetic approaches for analysis of zooplankton diversity. b) Publication in peer-reviewed scientific journals will demonstrate validity of data, protocols, and results, and allow dissemination and new applications in ecosystem management.	1.6; 1.7; 1.8	Years 1, 2, 3	Publish two papers focused on integrative taxonomy of zooplankton using state-ofpthe-art molecular approaches, including overview, review, and perspective articles (Years 1, 2, 3).
G	Determine the status of microzooplankton time-series data collection within the ICES area.	a, c) Determine the status of microzooplankton time-series data collection within the ICES area, assess progress made in this area over the last ten years, and identify collaboration, gaps or overlap with other WGs (WGZE, WGPME).	1.4	Years 2, 3	List of scientists and laboratories measuring microzooplankton groups within time-series datasets; data table to compare sampling and analysis methods, indicate which groups are regularly counted or routinely missed; database input; webpage update.
H	Review and evaluate methodologies used for metagenetic analysis of plankton.	a, c) Recommend development of standardized protocols for applications in fisheries management and ecosystem assessment.	1.6; 1.8	Years 2, 3	Present findings at scientific conferences (Year 2); Report to EG members and ICES community (Year 2, 3); prepare manuscript for publication in peer-reviewed journal (Year 3).

Summary of the Work Plan

Year 1	Recruit new members for WGIMT, ensuring balanced membership (ToR a); fully populate all areas of web portal (ToR b). Cooperate with other SCICOM EGs to promote and accelerate use of state-of-the-art molecular approaches for biodiversity assessment and applications for management and assessment goals (ToR e).
Year 2	Carry out collaborative activities with other SCICOM EGs to promote integrative taxonomy (ToR c). Publish peer reviewed scientific articles on topics central to the WGIMT mission (ToR f). Compile and disseminate information on microzooplankton (ToR g).

Year 3	Recommend, encourage, and enable use of integrated morphological and molecular taxonomic analysis of zooplankton in integrated ecosystem assessments in ICES area seas (ToRs d,e,f,h).

Supporting information

Priority:	This Working Group will assist ICES and its Expert Groups with issues related to the development, dissemination and application of taxonomic knowledge and skills in support of Integrated Ecosystem Understanding. Accurate identification of species and characterization of species-level diversity are and will remain foundations of integrated ecosystem assessments of function and state. Integrated taxonomic approaches – including morphological, molecular, optical, and other – may enhance and accelerate progress toward rapid, automatable, and near-real-time identification of species for fisheries and integrated ecosystem assessments; detecting of the impacts of climate change on species diversity, distribution, abundance; and understanding alterations in food web structure and function, and associated biogeochemical cycles. The availability of and need for new technology and techniques in taxonomic analysis make WGIMT's goals and activities important and high priority.
Resource requirements:	No additional resources are requested or required for planned activities.
Participants:	The Expert Group now includes 42 members from 15 countries, with strong representation among experts in morphological and molecular taxonomic approaches. We continue to seek additional members, including especially members from partner ICES Working Groups and other scientists with needed expertise and knowledge. The goal is to maintain balance and coverage of varied taxonomic approaches (including morphological taxonomists for the full range of taxonomic groups) and ICES geographic regions.
Secretariat facilities:	None.
Financial:	No financial implications.
Linkages to ACOM and groups under ACOM:	None.
Linkages to other committees or groups:	WGIMT arose as a Study Group from the WGZE in response to perceived need, meeting in association with WGZE during 2012 and 2013. WGIMT will remain in close partnership with WGZE and is pursuing additional partnerships (e.g., WGPME, WGAGFM), while promoting and supporting integrated morphological and molecular taxonomy science for the benefit of the ICES science and advisory communities as a whole.
Linkages to other organizations:	The work of this group relates to and is connected to a diversity of other projects and organisations, e.g., EU DEVOTES (DEVelopment Of innovative Tools for understanding marine biodiversity and assessing Good Environmental Status), BONUS BIO-C3 project, NOAA COPEPOD and COPEPODITE, GOBI, and others.

Working Group on Cephalopod Biology and Life History (WGCEPH)

2016/MA2/SSGEPD05 The **Working Group on Cephalopod Biology and Life History** (WGCEPH), chaired by Graham Pierce, Spain, and Jean-Paul Robin, France, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2017	6–9 June	Madeira, Portugal	Interim report by 1 September to SSGEPD	
Year 2018	5–8 June	San Sebastian, Spain	Interim report by 1 August to SSGEPD	
Year 2019	4–7 June	Athens, Greece	Final report by 1 August to SCICOM	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
A	Report on cephalopod stock status and trends: Update, quality check and analyse relevant data on European fishery statistics (landings, directed effort, discards and survey catches) across the ICES area.	This task is fundamental to support the assessment task and will involve a Data Call.	5.2	Years 1, 2 and 3	Annual report
B	Conduct preliminary assessments of the main cephalopod species in the ICES area by means of trends and_or analytical methods. Assess the relevance of including environmental predictors.	The purpose is to assess the status of cephalopods stocks and contribute to Integrated Ecosystem Assessment and Management.	1.3; 5.1; 6.1	Years 1, 2 and 3	Peer-reviewed manuscript on assessment methodologies and results (year 3)
C	Update information on life history parameters including variability in these parameters. Define cephalopod habitat requirements.	There is a need to undesrtand variability in life history parameters in the wild and to provide knowledge to support captive rearing.	1.7; 5.2	Years 1 and 2	Publication on rearing conditions and habitat preferences (Year 2)
D	Evaluate the social and economic profile of the cephalopod fisheries, with emphasis on small scale fisheries and mechanisms that add value to cephalopod products (e.g. certification).	There is a need to better quantify the social and economic of cephalopod fisheries across Europe.	5.8; 7.2	Year 1, 2 and 3	Report on social and economic importance of cephalopod fisheries (Year 3)
E	Recommend tools for identification cephalopod species and update best practices for data collection.	Currently cephalopods are not consistently identified to species in commercial and survey catches.	1.6; 3.2	Year 1, 2 and 3	Manual for cephalopod field identification and data collection (Year 3)

Summary of the Work Plan

Year 1 (2017)	Report on updated trends in Cepahlopod landings and abundance indices .(a) Report on updated cephalopod stock assessments (b) Report on scientific articles in relation to life-history and habitat requirements (c) Report on social and economic profile of cephalopod fisheries (d) Report on available information for species identification (e)
Year 2 (2018)	Report on status and trends in cephalopod stocks (a and b)) First draft of paper in relation to population modeling and assesment tools (b) Peer review paper on rearing conditions and/or habitat preferences (c) Report on mechanisms that add value to cephalopod products (e.g. certifications) (d) Draft of Manual for cephalopod field identification and data collection (e)
Year 3 (2019)	Report on updated trends in Cephalopod landings and abundance indices .(a) Peer-review paper on cephalopod population modeling and assesment tools (b) Report on socio-economic issues related to cephalopod management options Manual for cephalopod field identification and data collection guidelines (e)

Supporting information

Priority	The current activities of this Group will inform ICES about the role of Cephalopods in the ecosystem and evaluate their importance as part of directed and indirected fisheries. Cephalopods are important components of marine ecosystems, as predators and as prey, more important than their biomass might suggest due to their high productivity and large year-to-year variation in abundance. Cephalopod catches are replacing depleted finfish catches in some fisheries and ecological replacement is also hypothesised. Thus, for promoting the sustainable use of the seas and conserving marine ecosystems, cephalopod biology and life history has to be understood. As an example, directed cephalopod fisheries, especially small-scale fisheries, are increasingly important and it is necessary to have in place a useful system of data collection and stock evaluation that would be adequate to support managementthese activities are considered. These activities are believed to have a very high priority.
Resource requirements	As noted in several previous reports, participation in WGCEPH is limited by availability of funding, especially as many members and potential members are university staff with no access to “national funds” for attendance at ICES meetings. Although there are no specific resource requirements, funding to assist wider particupation would be beneficial.
Participants	In recent years the group has fluctuated from around 15 attendees and as few as 6 to 8 regular members, with a strong bias towards participants from the Iberian peninsula. There is a need to broaden participation to ensure good attendance every year
Secretariat facilities	None.
Financial	No specific financial implications (but see resource requirements).
Linkages to ACOM and groups under ACOM	The results of WGCEPH are potentially relevant for advice in the case that formal assessment and management are introduced for any of these species.
Linkages to other committees or groups	Possible links with groups working on predators of cephalopod (e.g. WGBIE, WGCS, WGMME). WGCEPH would like to encourage improved data collection on cephalopods during trawl surveys. It will make available (e.g. to IBTSWG) detailed diagrams and protocols for identifying cephalopods and collecting biological parameters during the scientific surveys. WGCEPH will provide information to SCICOM and its satellite committees as required to respond to requests for advice/information from NEAFC and EC DG Fish.

Linkages to other organizations	Cost Action (FA 1301) CephsinAction, Cephalopod International Advisory Council (CIAC).

Working Group with the Aim to Develop Assessment Models and Establish Biological Reference Points for Sea Trout (Anadromous *Salmo trutta*) Populations (WGTRUTTA)

2016/MA2/SSGEPD06 The **Working Group with the Aim to Develop Assessment Models and Establish Biological Reference Points for Sea Trout (Anadromous *Salmo trutta*) Populations (WGTRUTTA)**, chaired by Johan Höjesjö, Sweden, and Alan Walker, 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 2017	24–26 April	Gothenburg, Sweden	Interim report by 1 November to SSGEPD	The interim reports in 2017 and 2018 will be delivered late in the year in relation to the meeting dates since they will also report on intersessional work by several sub-groups, compiling databases and developing and fine-tuning population models.
Year 2018	6–8 February 15–19 October	Copenhagen, Denmark Lisbon, Portugal	Interim report by 1 November to SSGEPD	
Year 2019	25 February – 1 March	Dorchester, UK	Final report by 1 December to SCICOM	

ToR descriptors

	Description ToR	Background	Science Plan codes	Duration	Expected Deliverables
a	Compile information from a selection of suitable rivers across Europe with long-term data on parameters such as juvenile densities, habitat characteristics and, if available, abundances of ascending spawners and out-migrating smolts.	To facilitate the development of population dynamic models, an important first step is to compile available information/data. The outcomes from WKTRUTTA2 in combination with data from research collaborations on sea trout will be an important starting point for this work. The compiled data will provide basic information on population dynamics and life history variation of sea trout in different areas and stream types and will be used as a basis for the development of population models under ToR b. This exercise will also facilitate identification of geographical areas with data deficiencies (e.g. absence of stock-recruitment data) that hampers the development of assessment methods and which should	6.1; 6.2	Year 1	A database on juvenile densities, habitat characteristics and other important information along a south/north and coastal/inland gradient across Europe.

		therefore be prioritized in future monitoring and research programmes.			
b	Develop new, and validate and fine tune existing population models for sea trout.	There are different approaches available for modelling fish populations. By using abundance data from different life stages, information on habitat quality and fisheries data etc, the group will develop and evaluate different ways to model sea trout populations. This work will, to a large extent, be based on already existing data, such as stock-recruitment relationships derived from monitoring data on abundance and/or fisheries data (catch and CPUE-data) from a number of rivers across Europe. Models with different levels of complexity (taking into account e.g. habitat variation within rivers and between catchments, occurrence of lakes, migration obstacles and resident trout etc), as well as the representativeness of index rivers for larger areas with sparse information will be evaluated.	6.1; 6.2	Year 1-3	Evaluation of approaches / methods for modelling sea trout populations, with respect to assessment needs, availability of data, geographical coverage, complexity etc. Presentation of new models and a summary at the ASC meeting in 2019. In addition a peer-reviewed article on population modelling in Sea Trout will be produced.
c	Establish and evaluate different approaches for estimating Biological Reference Points (BRPs) across regions with different characteristics and conditions for sea trout.	There is a growing need to develop assessment methods for sea trout populations. Establishment of BRPs is a prerequisite to be able to assess status of populations. Different ways of estimating BRPs from population models developed under ToR b, based on e.g. stock-recruitment relationships or estimated pristine abundance levels, will be evaluated. This in turn enables assessment of status in relation to BRPs across Europe (on area or individual stock level).	6.1; 6.2	Year 2-3	Establishment of Biological Reference Points by using different approaches depending on e.g. data availability and type of population model used.

Summary of the Work Plan

The working group will address key questions relating to the assessment of sea trout stocks in the North Atlantic and Baltic. The overall plan is to establish the working group in 2017 with subgroups across Europe. Over the 3-year period, there will be 4 meetings in total; Sweden (Gothenburg), Denmark (Copenhagen), Portugal (Lisbon) and UK (place to be decided). Subgroups will work on the ToRs between these meetings with regular contact through email and/or webinars. Most of the work regarding deliverables for the different ToRs will be planned and performed in parallel. The main goal of WGTRUTTA is to take on the work initiated during WKTRUTTA2, i.e. develop and evaluate different methods for modelling sea trout populations, and define BRPs and a protocol that can be used to assess status of sea trout populations in different regions.

Year 1	In year 1, the working group will be established and divide tasks among group members and prioritize among available data sources. The group will start to create a database in a gradient across European rivers to be able to develop new and existing population models. The database will be finalized in November 2017 and one of the outcomes of this work will be a recommendation on suitable index rivers in different areas, and identification of gaps and weaknesses in current monitoring programs. In parallel, the group will start to develop population models based on the available data. The starting point for the work during year 1 will be the output from WKTRUTTA2.
Year 2	In year 2, the group will continue to work on the database and potentially add new data and stream systems. Development of population models will continue. The group will also start to evaluate different approaches for estimating Biological Reference Points (BRPs), based on the population modelling work.
Year 3	During year 3, the focus will be to continue the development and validation of different population models, and the work to establish BRPs in different regions across Europe. At the completion of the year, WGTRUTTA should be able to recommend suitable population models and approaches to estimate BRPs, which could be used to assess status of sea trout populations across Europe.

Supporting information

Priority	The inclusion of sea trout and other diadromous fish in EU policy areas including the CFP and Marine Strategy Framework Directive means that it is important to improve the methods currently available to manars to assess the status of stocks and investigate the effects of management actions. The final report and recommendations will guide both individual countries in making progress on sea trout assessment and management and will steer ICES on the best next steps for sea trout science, assessment and advice.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resources required to undertake additional activities in the framework of this group are negligible.
Participants	The Group will be attended by some 15-20 members and invited guests.
Secretariat facilities	Requires coordinating activities from ICES secretariat for the 4 meetings.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	Links to ACOM and WGBAST who provide advice on Baltic sea trout and WGDIAD regarding diadromous fish stocks, life histories, threats and sustainable use of the resource.
Linkages to other committees or groups	Relevant to HAPISG and EOSG. The activities of this group will take forward the scene-setting work of WKTRUTTA which met in 2012 and WKTRUTTA2 that met in 2016.
Linkages to other organizations	FAO

Working Group on the Biology and Life History of Crabs (WGCRAB)

2016/MA2/SSGEPD08 The **Working Group on the Biology and Life History of Crabs** (WGCRAB), chaired by Martial Laurans, France, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2017	7–9 November	Brest, France	Interim report by 15 December 2017	
Year 2018	6–8 November	Jersey	Interim report by 10 December	
Year 2019	4–8 November	Tromsø, Norway	Final report by 10 December to SCICOM	

ToR descriptors

ToR	Description	Background	Science Plan codes	Duration	Expected Deliverables
a	Compile data on landings, discards, effort and catch rates (CPUE) and provide standardised CPUE, size frequency and research survey data for the important crab and lobster (Homarus) fisheries in the ICES area, and Atlantic Canada and Greenland. Maps will be produced to synthesise the data. One part of these data will be provide to the ICES Data Centre.	The fisheries for crabs and lobster are socio-economically important and trans-national in Europe and Canada with the demise of fin fisheries in some regions.		3 years	Landing, discard, effort and catch data on listed species, from each country. WG report chapter
b	Evaluate assessment of the status of crab and lobster (Homarus) stocks including use of indicators, empirical assessment, analytical assessment in relation to data sources and data quality, development and suitability of reference points for management.	Management of stocks in Europe is primarily by technical measures only and in most countries there are generally no management instruments to control fishing effort. Knowledge of the population dynamics of these species is still weak. These stocks may be at risk from over-fishing due to the lack of control of fishing effort, and hence an evaluation of the sustainability of these fisheries is necessary.		3 years	Report on evaluation of alternative assessment methods.
c	Review the impact of climate divers (temperature, ocean acidification, changes associated climate change and disease) on important crab and lobster species within the ICES, Atlantic Canada and West Greenland. Studying the effects resulting from changes in decreasing pH which can be considered under ocean acidification. Specific parts will be achieve to work on the different subjects.	WGCRAB will investigate the relative importance of fishing and environment on crab and lobster recruitment. Furthermore there is a growing concern in the WG about the consequences of future climate change for important crab species in our region. Observed increases in sea water temperatures have already entailed expanded distribution areas of some species in the northeast Atlantic. However, a rise in the seawater pH would probably be the most serious consequences of the		3 years	Highlight important issues to be basis for research on effect of climate changes on important crab stocks. Each year a specific point will be delivered on the main knowledges and results for the production of WG report chapter (2019). In reflection, a paper on the review of the main results could be expected.

		climate change on crustaceans such as crabs. These issues will be dealt with by the WGCRAB in future.	
d	Review research and new knowledge on vital crab and lobster population biology parameters;	Several stock parameters are important for analytical assessments. Biological information is therefore required to provide standardised indices and for use in analytical assessments. Crab stock parameters may change due to size selective and single sex fisheries, through by-catch in other fisheries or through the impact of other seabed uses, such as gravel extraction. Since important crab stocks in Europe are managed without fishery independent data it may be an option to investigate any useful stock parameter indicators for assessment purposes.	Updated knowledge on crucial stock parameters for important crab stocks.

Summary of the Work Plan

Year 1	Annual standard outputs for a, b. Continue analysis for ToR d, e. Tentative plan for ToR c.
Year 2	Annual standard outputs for a, b. Continue analysis for ToR d, e. Complete evaluation of useful assessment methods to assess crab and lobster species in ICES areas. Complete request to ACOM and SCICOM (being both an assessment, advice and working group).
Year 3	Annual standard outputs for a, b. Combine analysis, research and report ToR d and e.

Supporting information

Priority	High. The fisheries for crabs and lobster are socio-economically important and trans-national in Europe and Canada with the demise of fin fisheries in some regions. Management of stocks in Europe is primarily by technical measures only and in most countries there are generally no management instruments to control fishing effort. Knowledge of the population dynamics of these species is still weak. These stocks may be at risk from over-fishing due to the lack of control on fishing effort, and hence an evaluation of the sustainability of these fisheries is necessary. The activity of the Group is therefore considered to be of high priority in particular if it's activity can move towards resource assessment without losing biological inputs.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible..
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 today, but if the EG will produce stock assessments in future WGCRAB will have linkages to several EGs under ACOM.
Linkages to other committees or groups	The EG aims to be able to give advises on how to exploit important crab stocks in the ICES area and is therefore related to EGs such as WGCRAN and the ICES/NAFO NIPAG.
Linkages to other organizations	

Resolutions approved in 2015

Working Group on *Crangon* fisheries and life history (WGCRAN)

2015/MA2/SSGEPD04 The **Working Group on *Crangon* fisheries and life history** (WGCRAN), chaired by Josien Steenbergen, Netherlands, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2016	23-25 May	Oostende, Belgium	Interim report by 1 August to SSGEPD	
Year 2017	7-9 November	Hamburg, Germany	Interim report by 15 December to SSGEPD	
Year 2018	9-11 October	ICES HQ, Copenhagen, Denmark	Final report by 1 December to SCICOM	

ToR descriptors

ToR	Description	Background	Science Plan topics addressed	Duration	Expected Deliverables
a	Data collection of the status of the stock.	Report and evaluate population status indicators like recent landings and effort trends in the brown shrimp fisheries or length based mortality estimates from Dutch and German scientific surveys. Generate a standardized lpue time-series of higher accuracy for the Netherlands with horse power days calculated based on hours at sea. Investigate methods to gain a better understanding of the recruitment processes and density dependence.	141, 143, 131, 134, 161, 162, 212, 311, 321	year 1,2,3	A time-series of standardized stock indicators shall be delivered by all WGCRAN members within each annual report.
b	VMS analysis	Combine VMS, landings and effort data to gain a population distribution indicator and to monitor regional distribution and regional shifts in fishing effort. Evaluate the variability of the results by comparing different VMS data interpolation methods.	133,141,143, 144, 146, 212, 311	year 1,2,3	Results shall be summarized in peer-reviewed paper.
c	Decision-support tools	Develop brown shrimp-specific management decision-support tools to evaluate strategies on how to sustainably and efficiently	141, 145, 134, 311, 312, 334	year 1,2,3	Results shall be summarized in a peer-reviewed paper.

		harvest the brown shrimp stock			
d	Investigate the effects of new gears on the catch efficiency of shrimp	Analyze and enumerate the effects of new gears (e.g. pulsetrawl, combined pulse-trawl and standard gears, large or new mesh types, pumpsystem, letterbox etc.) and their implications on the Crangon stock, the bycatch, the catch efficiency and the possible lpue based management strategies	141, 134, 213, 214	year 1,2,3	Results shall be summarized in a peer-reviewed paper.
e	Possible methods to assess and manage the brown shrimp fisheries	Review and evaluate possible methods to assess and manage the brown shrimp fisheries in the ICES region. Gather, compile and evaluate information on the onboard and ashore sieving fractions and processes and new national bycatch/discards data from e.g. DCF	161, 162, 141, 143, 212, 214, 215, 311	year 1,2,3	Results shall be summarized in a peer-reviewed paper.
f	Inform WGCRAN on the progress in the research field infections and diseases	Analyzing infection levels with bacilliform viruses and/or the occurrence of other diseases and determining the potential effects they might have on the population.	141,145,146, 134, 131,212, 311	year 1,2,3	Results shall be summarized in a peer-reviewed paper.
g	Aquaculture aspects	Determining the potential on using brown shrimp as a species for use in aquaculture system. Improvement on how to rear and grow shrimps in the lab and to obtain “in-situ”, real field growth rates for comparison		year 1,2,3	Results shall be summarized in a peer-reviewed paper.
h	Harmonize German and Dutch surveys	Optimize and harmonize German and Dutch surveys to improve comparability, to analyze spatio-temproal trends of stock indicators (biomass, distribution, mortality, etc.) and to ground-truth VMS derived lpue estimates.		year 1,2,3	Results shall be summarized in a peer-reviewed paper.
i	Information exchange	Exchange of information on national legislation, laws (e.g concerning Natura 2000) and developments (MSC process) concerning the brown shrimp fisheries in the whole North Sea for an improved cooperation and coordination of research and advice efforts. Presentations on developments and ongoing brown shrimp research in the	312, 311, 313	year 1,2,3	Results shall be summarized in a peer-reviewed paper.

	ICES area.

Summary of the Work Plan

Year 1	Stock status indicators (ToR a) shall be udated and harmonized between countries. Data for Manuscripts related to ToR b-d and f-g shall be available New hauls to be included in the analysis under ToR h shall be available New information from ToR I shall be reported
Year 2	Stock status indicators (ToR a) shall be udated and harmonized between countries. Data for Manuscripts related to ToR b-d and f-g shall be analyzed New hauls to be included in the analysis under ToR h shall be available New information from ToR I shall be reported
Year 3	Stock status indicators (ToR a) shall be udated and harmonized between countries. Manuscripts related to ToR b-d and f-g shall be submitted New hauls to be included in the analysis under ToR h shall be available New information from ToR I shall be reported

Supporting information

Priority	Crangon fisheries are economically important with landings value ranking this species among the top three species caught from the North Sea. The priority of WGCRAN is to understand the interactions between the brown shrimp population (structure and abundance) and human behaviour (mainly fishing effort) the environment and the ecosystem. One important aspect is and will be the monitoring, investigation and development of population status indices.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	The Group is normally attended by some 10 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and group under ACOM	WGCRAN aims at a permanent linkage with ACOM after year 2 when sound and proven stock indicators have been developed and a good management plan has been developed under ToR h.
Linkages to other committees groups	There is a linkage to WGBEAM as similar surveys are used. WGELECTRA as the use of the pulse gear by a larger fraction of the fisherman might have implications on the stock, WGINOSE by providing data for the integrated assessment. WGSAM as the SMS key runs will be used to estimate natural mortality of brown shrimp. Members of WGCRAN are also members in the these groups.
Linkages to other organization	CWSS = Common Wadden Sea Secretariat; TMAP = Trilateral Monitoring and Assessment Programme; RCM –NSEA

ICES/PICES Working Group on Climate Change and Biologically-driven Ocean Carbon Sequestration (WGCCBOCS)

2015/MA2/SSGEPD05 The **ICES/PICES Working Group on Climate Change and Biologically-driven Ocean Carbon Sequestration** (WGCCBOCS), chaired by Nianzhi Jiao, China, Louis Legendre, France, and Richard Rivkin, Canada, will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2016	17 June (kick-off meeting)	Hong Kong, China	Interim report by 31 December	
Year 2017	23–27 September	Vladivostok, Russia (PICES Annual Conference)	Interim report by 1 December	
Year 2018	4–8 June	Washington D.C., USA	Final report by 1 December	

Overview

Carbon sequestration is among the important earth-ecosystem services provided by the oceans. Atmospheric CO_2 that is taken up by phytoplankton can be transformed by the pelagic food webs into various organic materials, some of which are exported from the surface and sequestered in coastal shelf sediments and the deep ocean, or partly transformed into long-lived dissolved organic compounds. This ICES/PICES Working Group will promote interdisciplinary exchanges among the research communities by bringing together experts who have experience using observational, experimental and modelling approaches to characterize and assess one or more of the biologically-driven ocean carbon pumps and their environmental and climate consequences. The working group has long-term objectives of improving prediction and advice for climate policy and adaptation in the environment of changing climate.

1 Link the studies on different biologically-driven ocean carbon pumps
   1.1 Review current understanding of the three types of these pumps: the biological carbon pump (i.e. soft tissue pump), the carbonate pump, and the microbial carbon pump, and the controlling mechanisms for these pumps;
   1.2 Review current estimates of the magnitude of these pumps;
   1.3 Review and propose potential interaction pathways among these pumps;
   1.4 Foster collaborations among scientists in studying the interaction of these pumps.
2 Integrate different approaches to study biologically-driven ocean carbon pumps
   2.1 Review current available experimental and modelling approaches to characterize and assess these pumps;
   2.2 Identify the ability of the existing approaches to study and quantify the interactions among pumps;
   2.3 Propose new approaches to studying the interactions among pumps.
3 Improve prediction and advice for climate policies that are related to biologically-driven ocean carbon pumps
   3.1 Foster collaborations in developing numerical models to predict the impact of climate change on these pumps;

3.2 Explore and where possible quantify the potential effects of climate change on the ecosystem services supported by the carbon pumps

3.3 Provide an operational framework within which scientists could formulate advices on climate policy to international organizations.

ToR descriptors

ToR	Description	Background	Science Plan topics addressed	Duration	Expected Deliverables
a	Document and identify current knowledge about the biologically-driven carbon pumps	To review and study the interactions among the carbon pumps and to predict how they may change in an evolving climate; To advance the understanding of the relationship among the carbon pumps; To review key processes and assess biological factors and environmental variables that control carbon sequestration in the ocean.	EPD 1, 3, 4	1.5 years	Review paper during year 2
b	Develop standard monitoring protocols	It is essential to review and compare current approaches and develop standardized protocols for measuring and reporting key parameters and variables during field studies and laboratory experiments on biologically-driven ocean carbon sequestration.	IEOM 25, 27, 28	3 years	Review papers and technical report in year 3
c	Promote international collaboration for developing new experimental approaches and facilities	Current approaches are not adequate to comprehensively study the interactions of these ceabon pumps. New experimental approaches and facilities are needed to better quantitatively address important processes that control ocean carbon pumps and carbon sequestration.	EPD 1, 4, EPI 11, 13	3 years	Plans for new experimental approaches and facilities
d	Explore techniques for prediction of biologically mediated carbon sequestration in oceans	Integrate results from laboratory and field studies into numerical modeling for forecasting biologically-driven ocean carbon sequestration in the contemporary and future ocean.	EPD 3, 4, EPI 11, IEA 22	3 years	Recommend improvements to models integrating biologically-mediated carbon pump processes.
e	A science symposium	Organize a science symposium in year 3 to present, discuss and publish forecasts of the effects of climate change on biologically-driven ocean carbon sequestration; provide scientific advice to international organizations such as IPCC to aid in establishing climate policies.	2EPD 3, 4, EPI 11, IEA 22	1 year	Specal issue of a scientific journal

Summary of the Work Plan

Year 1	**(1)** Hold an initial organizational meeting. **(2)** Review and document current understanding of the mechamisums the pumps, the estimate of the magnitude of the pumps, and the extisting approachs. **(3)** Propose and plan the future directions of research and new approaches and facilities. **(4)** Develop concenptual models.
Year 2	(5) Hold an annual meeting to review the progress. (6) Continue to develop new approaches. (7) Recommend improvements to numerical models for integrating biologically-driven carbon pump processes.
Year 3	(1) Continue to develop and review the new approaches. (2) Continue to recommend improvements to numberical models and review their results concerning the biologically mediated sequestration of carbon in oceans. (3) Hold a scientific symposium to review the outcome of the WG, and draft the final report of the WG and the advice of climate policy to international organizations.

Supporting information

Priority	The current activities of this Group will support science advice to the relevant organizations (ICES, PICES, etc) on issues related to the impacts of climate change on the capability of the ocean to sequestrate anthropogenic carbon, and its consequences on the marine ecosystem functionality.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group will be supplied from institutional resources and will have no impact on ICES or PICES.
Participants	The Group is normally attended by some 20–25 members plus possibly invited experts. The attached list of proposed working group members is provisional, and subject to approval and recommendations for change by ICES and PICES.
Secretariat facilities	No resources are requested from ICES or PICES.
Financial	All costs for support personnel will be supplied through institutional resources. See below for details and financial responsiblities or support personnel. The symposium organizers (year 3) may approach ICES and PICES for support for the symposium in due time.
Linkages to ACOM and group under ACOM	Provision of the best available advice on the implications of climate change for the sequestration of carbon (ecosystem service) by the ocean.
Linkages to other committees groups	The proposed WG is relevant to the WG on Interactive, Physical-biological and Ecosystem Modelling (WGIPEM), and the WG on Phytoplankton and Microbial Ecology (WGPME), but distinct in its missions.
Linkages to other organizatior	This WG will be a joint WG between ICES and PICES.

Recommended Members

The recommended members listed below are provisional and have not yet committed to serve on the Working Group

(1) ICES members

Robin Anderson (Canada), **Female**, Scientist at Fisheries and Oceans Canada, expertise in quantitative aquatic ecology, the microbial loop and carbon cycling in the oceans, effects of human activity on marine habitat, aquaculture, marine tailings disposal and drilling wastes at offshore oil sites. Email: M.Robin.Anderson@dfo-mpo.gc.ca

Bo Barker Jørgensen (Denmark), Male, Professor at Aarhus University, expertise in marine biogeochemistry and microbial ecology on the deep sub-seafloor biosphere, sulfur and methane cycling and microorganisms in marine sediments, "cryptic sulfur cycle" in the methane zone, the controls on methane fluxes and their sensitivity to climate change. Email: bo.barker@bios.au.dk

Louis Legendre (France, co-chair), Male, Professor at Laboratoire d'océanographie de Villefranche, expertise in biological oceanography and marine biogeochemistry, numerical ecology, and philosophy of science, blending theoretical studies, laboratory research, and fieldwork in the Atlantic, Pacific and Arctic Oceans, and in the Mediterranean Sea. Email: legendre@obs-vlfr.fr

Marion Gehlen (France), **Female**, Scientist at Laboratoire des Sciences du Climat et de l'Environnement, expertise in biogeochemical ocean modeling, marine ecosystems and biogeochemical cycles under anthropogenic pressure, linking impacts of climate change across the foodweb up to higher trophic levels, predictability of changes in marine biogeochemistry and ecosystems. Email: gehlen@lsce.saclay.cea.fr

Rudolf Amann (Germany), Male, Scientist at Max Planck Institute for Marine Microbiology, expertise in analysis of the diversity, quantitative composition and function of marine microbial communities based on nucleic acid techniques including genomics. Email: ramann@mpi-bremen.de

Ulf Riebesell (Germany), Male, Professor at GEOMAR Helmholtz Centre for Ocean Research Kiel, expertise in Marine biogeochemistry, pelagic ecosystems, plankton physiology and ecology, ocean acidification, warming, and deoxygenation. Email: uriebesell@geomar.de

Corina Brussaard (Netherlands), **Female**, Scientist at Royal Netherlands Institute for Sea Research, expertise in the interaction between viruses and their hosts in relation to climate change, and more specifically on how this interaction is affected by environmental factors, such as CO_2 concentration and temperature, the availability of nutrients and light. Email: Corina.Brussaard@nioz.nl

Yngvar Olsen (Norway), Male, Professor at Norwegian University of Science and Technology, expertise in physiology and ecology of marine phytoplankton, the zooplankton food web and environmental aspects of marine aquaculture and the farming of seaweed. Email: yngvar.olsen@ntnu.no

Carol Robinson (United Kingdom), **Female**, Professor at University of East Anglia, expertise in the role of marine bacteria, phytoplankton and zooplankton in the global cycling of carbon and oxygen, measurement of seawater dissolved inorganic carbon and CO_2 sink, carbon flux in the ice-ocean-plankton systems, cycling of carbon through the marine microbial foodweb. Email: carol.robinson@uea.ac.uk

Adrian Burd (United States of America), Male, Professor at University of Georgia, expertise in marine biogeochemical modeling, studying how different marine systems function and how they might change under changing environmental and climate conditions, focusing particle flux and coastal systems. Email: adrianb@uga.edu

Ronald Benner (United States of America), Male, Professor at University of South Carolina, expertise in the carbon, nitrogen, and phosphorous cycles in aquatic environments, using experimental and geochemical approaches to characterize biogeochemical processes and the roles of microorganisms as key players in the transformations of C, N and P. Email: benner@mailbox.sc.edu

(2) PICES members

Angelica Peña (Canada), **Female**, Scientist at Fisheries and Oceans Canada, expertise in numerical modeling of marine ecosystem and biogeochemistry, marine new production and carbon export in form of particle flux, marine ecosystem response to climate change. Email: Angelica.Pena@dfo-mpo.gc.ca

Curtis Suttle (Canada), Male, Professor at University of British Columbia, expertise in marine virology (one of the World's leading marine virologists), studying the role of marine viruses in nutrient and energy flow in the oceans. Email: csuttle@eos.ubc.ca

Richard Rivkin (Canada, co-chair), Male, Professor at Memorial University of Newfoundland, expertise in biological oceanographic processes, studying nutrient metabolism, photoadaptations of photosynthesis, carbon metabolism and cell division of phytoplankton, procaryotic and eukaryotic microheterotrophs, and the regulation of bacterial growth and loss. Email: rrivkin@mun.ca

Nianzhi Jiao (China, co-chair), Male, Professor at Xiamen University, expertise in marine microbial ecology and biogeochemistry, carbon cycles and sequestration by microbes, one of the key members proposing the microbial carbon pump, co-chairman of a SCOR working group. Email: jiao@xmu.edu.cn

Fengping Wang (China), **Female**, Professor at Shanghai Jiao Tong University, expertise in Microbial ecology and microbial participated biogeochemical cycles in the deep subsurface biosphere; environmental adaption mechanisms of extremophiles. Email: fengpingw@sjtu.edu.cn

Chuanlun Zhang (China), Male, Professor at Tongji University, expertise in geomicrobiology and biogeochemistry, integrating molecular DNA-, lipid biomarker- and stable isotope- approaches to study the mechanisms and pathways of carbon and energy metabolisms in the deep sea gas hydrates and mid-ocean ridge hydrothermal vents. Email: archaeazhang_1@tongji.edu.cn

Toshi Nagata (Japan), Male, Professor at University of Tokyo, world's leading researcher in dissolved organic matter in deep oceans, also expertise in marine microbiology and biogeochemistry. Email: nagata@aori.u-tokyo.ac.jp

Koji Suzuki (Japan), Male, Professor at Hokkaido University, expertise in microbial oceanography, marine plankton, biogeochemical and material circulation, biological diversity, metagenomic analysis, physiological ecology and remote sensing. Email: kojis@ees.hokudai.ac.jp

Sang-Jin Kim (Korea), Male, Scientist at Korea Ocean Research & Development Institute, expertise in management for genome resources of marine and extreme organisms. Email: s-jkim@kordi.re.kr

Eun Young Kwon (Korea), **Female**, Professor at Seoul National University, expertise in marine biogeochemical modeling, comparing effects of different marine carbon pumps in sequestrating carbon. Email: ekwon76@snu.ac.kr

Vladimir Shulkin (Russia), Male, Scientist at Pacific Geographical Institute, Russian Academy of Sciences, expertise in geochemical aspects of environmental problems in the coastal areas from the watersheds through the rivers and estuaries to the sea, including contamination by trace metals, excessive load of nutrients and related eutrophication issues, assessment of the water ecosystems quality. Email: shulkin@tig.dvo.ru

Phoebe Lam (United States of America), **Female**, Professor at University of California Santa Cruz, expertise in marine geochemistry focusing on the role that marine particles play in the biogeochemical cycling of major and minor elements in the ocean such as carbon, iron, and other trace elements. Email: pjlam@ucsc.edu

Uta Passow (United States of America), **Female**, Researcher at University of California Santa Barbara, expertise in biological oceanography, studying mechanisms of the functioning of different marine biological carbon pumps under climate change. Email: uta.passow@lifesci.ucsb.edu

Working Group Support Personnel

Secretaries and Logistics

Rui Zhang, Marine ecology. Xiamen University, China. Email: ruizhang@xmu.edu.cn

Ya-Wei Luo, Biological oceanography and ecological modeling. Xiamen University, China. Email: ywluo@xmu.edu.cn

Technical and Data

Two PhD trained researchers housed at Xiamen University, China will provide technical and data analytical support for the Working Group.

Resolutions approved in 2014

Working Group on Operational Oceanographic Products for Fisheries and Environment (WGOOFE)

2014/MA2/SSGEPD10 A **Working Group on Operational Oceanographic products for Fisheries and Environment** (WGOOFE), chaired by Dominique Obaton, France, and Rodney Forster, 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 2015	11–12 January **2016**	Brussels, Belgium	Interim report by 20 February 2016 to SSGEPD	
Year 2016	24–25 January **2017**	Brussels, Belgium	Interim report by 15 March 2017 to SSGEPD	
Year 2017	20-21 November **2018**	Brussels, Belgium	Final report by 15 December to SCICOM	

ToR descriptors

ToR	Description	Background	Science Plan topics addressed	Duration	Expected Deliverables
a	Develop, through an iterative process with users, further index based products of environment and oceanographic change and variability for application to and take up by the ICES integrated assessments and advice;	The supply of ocean data from Copernicus and other services is increasing exponentially. The challenge is to extract useful products for the ICES community.	1,4,9,13,22	3 years	Fact-sheets and access to selected index-based products of environment and oceanographic change (in addition to ICES own operational ocean products)
b	Demonstrate, through specific case studies, applications of oceanographic products in integrated assessments and advice;	Clearly described case studies are required in order to demonstrate best practice and to increase user confidence in using the products of operational oceanographic services.	1,4,9,13,22,25	3 years	Documented case studies of the application of OOPS in integrated ecosystem assessment and advice (case study 1: use / non-use of operational data by HAWG)
c	Communicate through various	The field of operational	25,28	3 years	At each year-end –

	mechanisms, to the ICES community the availability of oceanographic datasets, products and time-series. This should include publicizing and maintaining the WGOOFE website, developing Fact sheets for ICES expert groups and further targeted meetings with groups and workshops;	oceanography is changing rapidly as new technologies and new modelling approahces are integrated into observing systems. Critical evaluation is required to guide users to the most useful products.			refresh of WGOOFE content, addition/deletion of links and updated scoring of products, adding fact-sheets where possible. Peer-review paper (mid-2016): "How to obtain and use OOPs: assessment from a user perspective"
d	Act as an interface for ICES for multinational projects, networks and organizations on operational oceanographic products, such as MyOcean2 + Follow-on, Copernicus Marine Service, Emodnet, Seabasin Checkpoint studies, Euro-GOOS and work with producers of the expectations and abilities of users;	User requirements are also constantly evolving in response to changing national and international pressures, hence the interface function of WGOOFE to match user needs to data suppliers is important.	22,25,28	3 years	Overview of work provided in a summary document
e	Respond to ad hoc requests for advice on oceanographic products for the ICES ecosystem modelling, advisory and ocean observing communities;		22,25	3 years	As requested

Summary of the Work Plan

Year 1	Define scientific research questions to be explored, such as: what is the impact of ingesting different data sources in to assessment models (integrated/fisheries/…) [free to WGOOFE, but effort/cost at the other EGs] Case Study Development: Approach the regional assessment expert groups (e.g. WGINOSE, WGEAWESS, WGNARS) to start process. Evaluate data provision to HAWG (has the data been used; if not, why? Are there improvements needed?). WGOOFE has struggled to obtain user involvement at its own meetings, and will achieve this by asking for WGOOFE members to attend relevant expert group meetings (to ask for their data needs and how they will make a commitment to use the products provided). [by March 2015] Approach WGOH about using spatial ocean data in IROC e.g. MyOcean SST. By Spring, – all WGOOFE members to send idea for ONE index product to chairs. With reasoning why. Divide into – fish/fisheries, MSFD (OSPAR common indicators), climate change. Plus references. [by March 2015] Hands-on data meeting autumn 2015. Identify most important ecosystem indices (scoring system – science value, but also useful to reporting, other ICES groups), synthesis, presentation (ensembles, comparisons) and data visualisation. Data not already included in OOPS. E.g. mixed layer depth, duration of stratification integrated over sea areas. Work with ICES data centre during the week. Provide feedback to ICES on use of the first suite of OOPS products. Develop work plan for Year 2 based on new developments. Proposed meetings: virtual meeting in spring 2015 (after EGU or Liege Colloquium), in-person meeting in autumn 2015.

Year 2	Develop further indices following first OOPS results by means of joint meeting with WGINOSE – spring 2016. Examine new services arising from Copernicus Marine, Land, Climate Services. Provision of advice on new, large-scale data services (EMODNET?). Develop work plan for Year 3 based on new developments.
Year 3	Expand provision of advice on data to a wider range of ICES groups Fully documented case study with e.g. WGINOSE.

Supporting information

Priority	The current activities of this Group will lead ICES into issues related to the provision of integrated ecosystem management and advice.
Resource requirements	The research programmes which provide the main input to this group are already underway, and resources are already committed. The additional resource required to undertake additional activities in the framework of this group is negligible.
Participants	The Group is normally attended by some 10-20 members and guests.
Secretariat facilities	None.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	The integrated ecosystem assesment working groups, as well as any other advisory groups which would benefit from environmental and oceanographic information being incorporated in their advisory work.
Linkages to other committees or groups	There is a very close working relationship with WGOH, as well as the working groups under SSGEIA.
Linkages to other organizations	MyOcean Follow-On and the GMES Copernicus Service.