Ecosystem Processes and Dynamics Steering Group EGs Resolutions

Resolutions approved in 2019

Working Group on Integrated Morphological and Molecular Taxonomy (WGIMT)

2019/FT/EPDSG01 The **Working Group on Integrated Morphological and Molecular Taxonomy** (WGIMT), chaired by Elaine Fileman, UK, and Jasmin Renz*, Germany, will work on ToRs and generate deliverables as listed in the Table below.

	MEETING DATES	VENUE	REPORTING DETAILS	COMMENTS (CHANGE IN CHAIR, ETC.)
Year 2020	27 March	by corresp/ webex		physical meeting cancelled - remote work
Year 2021	March	TBD		
Year 2022	March	TBD	Final report by 1 June to EPDSG	

ToR descriptors

TOR	DESCRIPTION	BACKGROUND	SCIENCE PLAN CODES	DURATION	EXPECTED DELIVERABLES
a	Evaluate the potential of molecular and morphological approaches for understanding zooplankton communities	Molecular methods are widely used for rapid assessment of species diversity, and can contribute to improving our understanding of the impacts of climate change and anthropogenic effects on marine ecosystems. Standardized protocols for assessment of pelagic biodiversity are needed to fulfil requirements defined in the Marine Strategy Framework Directive (MSFD). There is a need for inter-comparison of results to understand the impact of protocol choice. A range of molecular approaches, e.g., barcoding and metabarcoding, environmental DNA (eDNA), or proteomic approaches can be adopted to help to address some of the key applications of integrative taxomony.	1.6; 1.7	year 1,2,3 Year 2 Year 1,2,3	Review the current methods for integrative morphological and molecular taxonomy and evaluate the impacts of choosing different protocols. Construct an overview of case studies utilizing combined molecular and morphological approaches in zooplankton taxonomy. Compile a list of challenging zooplankton taxa which will include a top-ten list of zooplankton species complexes in the ICES area (including hidden diversity associated with cryptic, rare, and invasive species and species delimitation).
b	Continue development and enhancement of the WGIMT Resource Portal	Locating and accessing morphological and molecular taxonomic information can be difficult: classical taxonomic references are often out-of-print or in a	1.6; 1.7	Year 1 Year 1,2,3	Create a glossary of molecular taxonomy terms. Review and update the online WGIMT overview materials and resource

		non-digital format; many molecular data are not released prior to publication; and a broad variety of methodologies and approaches exist, possibly overwhelming potential new comers to the field. The WGIMT Resource Portal will provide informational overviews and links to relevant literature and web pages, with a special focus on the use of molecular technologies (and morphological verification) for the integrative taxonomy of zooplankton.		Year 2 Year 3	links. Create an overview summary and reference-links to meta-barcoding primer protocols. Update the WGIMT literature library, adding keywords indices.
c	Initiate and support provision of standards, training materials, and taxonomy workshops	Lab exchanges and 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. Co-sponsored workshops and meetings with other SCICOM EGs will increase impact and likelihood of adoption for advisory applications.	1.6; 1.8	Year 1,2,3 Year 2,3 Year 1,2,3	Ensure provision of training materials through the WGIMT resource portal, linking to ToR b) Design, organize and offer lab exchanges and integrative taxonomy workshops Promote best practices for DNA barcoding and metabarcoding of zooplankton
D	Continue to demonstrate leadership in promoting and encouraging use of integrative taxonomic approaches for assessment of pelagic biodiversity	Integrative taxonomy is a developing field; uses and applications for fisheries and ecosystem management should be explained in high-visibility settings in ICES and other organisations through special sessions. It is important to maintain a strong foundation and visibility in primary research literature in order to validate metagenetic approaches for analysis of zooplankton diversity. Publication in peer-reviewed scientific journals will demonstrate validity of data, protocols, and results, and allow dissemination	1.6; 1.7; 1.8	Year 1,2,3 Year 1,2,3	Organize & promote special sessions at national and international conferences: e.g. ICES ASC; ASLO/TOS Ocean Sciences Meetings. Publish peer-reviewed scientific papers on topics central to the WGIMT mission Publish peer-reviewed scientific papers on topics central to the WGIMT mission. To include two targeted review papers on 1) The crossover from microscopy to genes in marine diversity, illustrating the transition from traditional

	and new applications in ecosystem management.	morphological species identification using an integrated approach to full molecular genetic identification of marine plankton communities, demonstrated on marine pelagic coepods as model taxa; 2) Zooplankton biodiversity assessment by molecular methods.

Summary of the Work Plan

Year 1	Review and evaluate protocols available to promote and accelerate use of state-of-the-art molecular approaches for biodiversity assessment and applications for management and assessment goals (ToR a). Review and update all areas of web portal (ToR b).
Year 2	Carry out collaborative activities with other SCICOM EGs to promote integrative taxonomy and publish peer reviewed scientific articles on topics central to the WGIMT mission (ToR c).
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 a, b,).

Supporting information

Priority	The activities of 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 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	This Expert Group now includes 50 members from 17 countries, and has a balanced representation among experts in morphological and molecular taxonomic approaches and covering a good range of taxonomic groups and ICES geographic regions. The group's annual meeting is normally attended by some 17-20 members and guests. New members are welcome.
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	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), 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 organizatio	The work of this group relates to and is connected to a diversity of other projects and organisations, e.g. SCOR WG157 MetaZooGene, BONUS BIO-C3 project, NOAA COPEPOD and COPEPODITE, GOBI, and others.

Working Group on Cephalopod Biology and Life History (WGCEPH)

2019/FT/EPDSG02 The **Working Group on Cephalopod Fisheries and Life History** (WGCEPH), chaired by Ana Moreno*, Portugal; Daniel Oesterwind*, Germany; and Graham Pierce, 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 2020	2-5 June	by corresp/ webex		physical meeting cancelled - remote work
Year 2021	1-4 June (tbc)	tbc		
Year 2022	7-10 June (tbc)	tbc	Final report by DATE to SCICOM	

ToR descriptors

TOR	DESCRIPTION	BACKGROUND	SCIENCE PLAN CODES	DURATION	EXPECTED DELIVERABLES
a	Report on cephalopod fishery status and trends: update, quality check and analyse relevant fishery statistics (landings, directed effort, discards and survey catches).	A core ToR of WGCEPH since the inception of the group. It provides an overview of the current status of cephalopod fishing in the ICES area.	5.1, 5.2	Years 1-3	Fishery status reports (Annual)
b	Review relevant advances in stock identification, stock assessment methods (e.g., use of environmental predictors, development of Management Strategy Evaluation) and fishery management measures. Conduct preliminary assessments of the main cephalopod stocks in the ICES area, based on trends and/or analytical methods.	While catching cephalopods in large-scale fisheries in the EU is essentially unregulated, fishing pressure is increasing. There is a need to to define stocks / management units. Annual assessments will help to identify threats to stock status and are also relevant for MSFD descriptor 3 ; review of possible management measures will support formulation of advice, should this become necessary. .	5.1, 5.2, 6.1	Years 1-3	Stock status reports (Annual); Review of current cephalopod fishery management in the ICES area and possible future options (Y1)
c	Continue to review advances in knowledge of life history and ecology,	Cephalopods show high variation individual life history and population	1.7, 5.2	Years 1-3	Annual report on relevant new knowledge

	identifying knowledge gaps and research priorities	abundance; understanding this variation is essential to underpin assessment and management. In relation to the ecosystem role of cephalopods, few studies consider species interactions other than predation. We also need to better understand the roles of fishing and climate change in determining biodiversity.			
d	Review, develop and recommend tools for cephalopod species identification at all life stages (adults, juveniles, paralarvae and eggs) and update best practice for routine data collection.	Cephalopod species identification in fishery and survey catches remains inconsistent and incomplete. Current standard data collection may be insufficient to support routine assessment. There is a need for easy-to-use regional identification guides (e.g. for fishers, fishery inspectors, buyers, and scientists undertaking sampling).	1.6, 3.2, 5.2	Years 1-3	Updated data collection recommendations (Annual); Plan for ID guides (Y1); New and revised ID guides (Y3)
e	Evaluate the market drivers and socioeconomic importance of selected cephalopod fisheries.	More information is needed on the social and economic sustainability of cephalopod fishing.	5.8, 7.2	Years 1-3	Case study reports on Iberian octopus (Y1), English Channel cuttlefish (Y2) and squid fisheries (Y3)
f	Review advances in knowledge on environmental tolerance of cephalopods, develop simple climate envelope models of cephalopod habitat as a potential forecasting aid.	Despite high phenotypic plasticity, cephalopod distribution is limited by extremes of temperature, salinity, dissolved oxygen, etc. and it is expected that climate change will lead to range shifts.	1.3, 1.5, 2.5	Years 1-3	Paper on climate envelopes and forecasting range shifts (Y3)

Summary of the Work Plan

Year 1	Routine reporting on all ToRs. Plan for ID guides (ToR d). Reports on management options (ToR b) and socioeconomics of Iberian octopus fisheries (ToR e)
Year 2	Routine reporting on all ToRs. Report on socioeconomics of English Channel cuttlefish fisheries (ToR e).
Year 3	Routine reporting on all ToRs. Delivery of ID guides (ToR d) and report on socioeconomics of squid fisheries (ToR e). Paper on climate envelope models (ToR f)

Supporting information

Priority	The current activities of this Group will inform ICES about the status of cephalopod stocks and fisheries at a time when fishing pressure is increasing. Cephalopods are not covered by the EU Common Fisheries Policy but there is a need to identify sustainability issues and to be in a position to recommend management actions, should the need arise. Furthermore, the planned preliminary assessments of different stocks can support the MSFD reporting in several member countries. These activities are believed to have a very high priority. ToRs a-d are envisaged as standing ToRs. ToR a is fundamental to support stock assessment (ToR b) and will involve a Data Call. ToR a will also review stock definition, since past preliminary assessments have been based on arbitrary spatial units and there is a need to define more appropriate management units. ToR c provides a review of recent advances in knowledge of cephalopod biology and ecology; improved understanding of life history plasticity, ecological roles and the high year to year variation in abundance remains a priority. ToR d continues efforts to facilitate better routine identification of cephalopod catches to species level. ToR e aims to ensure that social and economic sustainability of cephalopod fisheries are better undeerstood, a key requirement for integrated ecosystem assessment. ToR f addresses effects of ocean warming on cephalopod distribution. Evidently, cephalopods show coniderable plasticity, and climate change may also affect larval transport and predator-prey relationships, which will also affect distribution. Nevertheless modelling likely physiological limits to distribution should contribute to forecasting.
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 staff of institutions which have no access to "national funds" for attendance at ICES meetings. Although there are no specific resource requirements, funding to assist wider participation would be beneficial.
Participants	Meetings of the Group are normally attended by around 10-15 members and guests, with wider participation via videoconferencing and e-mail.
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 ICES 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	WGCEPH maintains links with ongoing European and national research projects and with the Cephalopod International Advisory Council.

Working Group on Marine Mammal Ecology (WGMME)

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

2019/OT/EPDSG03 The **Working Group on Marine Mammal Ecology** (WGMME), chaired by Anita Gilles, Germany, and Anders Galatius, Denmark, will meet in Barcelona, Spain, 10–14 February 2020 to:

a) Review and report on any new information on seal and cetacean population abundance, distribution, population/stock structure, management frameworks (including indicators and targets for MSFD assessments), and anthropogenic threats (including cumulative effects) to individual health and population status;

b) Review foraging areas and estimate consumption by relevant seal and cetacean species in case study areas;

c) Review selected aspects of marine mammal-fishery interactions (details to be determined prior to the 2020 meeting);

d) Update the database for seals.

e) Address the special request from EU on emergency measures bycatch NE Atlantic by:

i) Evaluating population status and pressures and threats to harbor porpoises in the Baltic Sea and common dolphins in the Bay of Biscay.

ii) Evaluating whether the described conservation measures within the request are appropriate.

WGMME will report by 15 March 2020 for the attention of ACOM.

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, including cumulative effects of multiple stressors. Theoretical frameworks and approaches for assessing cumulative effects of multiple stressors were reviewed in 2019 (then ToR d) but new information can be provided. ToR b aims to review species-specific foraging distributions (considering horizontal and vertical dimensions depending on data availability) and estimate consumption by marine mammal species representative in case study areas. ToR b has been agreed between WGMME and WGBIODIV to support WGBIODIV's ToR "*Investigate mechanisms linking trophic guilds under contrasting levels of pressure and/or primary production in case study areas*". ToR c reflects common interests between WGMME and WGBYC, recognising that some aspects of marine mammal fishery interactions may otherwise not be covered by either group. As in 2019, detailed content of this ToR will be agreed between WGMME and WGBYC in consultation with the ICES Secretariat. ToR d 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, WGHARP, SCICOM, EPDSG
Linkages to other committees or groups	WGBYC
Linkages to other organizations	OSPAR

Workshop on Scallop Aging (WKSA)

2019WK/EPDSG04A **Workshop on Scallop Aging (WKSA),** focusing on age reading of the king scallop (*Pecten maximus),* chaired by David Palmer*, UK, and Karen Vanstaen*, UK, will meet in Aberdeen, Scotland, UK, 9–13 March 2020 to:

a) Review and compare current scallop age reading methodologies (including quality assurance) and agree on best practice; (Science Plan codes: 3.1);

b) Develop, agree and write a standard procedure for use in future scallop exchanges; (Science Plan codes: 3.1);

c) Assess the potential use of SmartDots for king scallops; (Science Plan codes: 4.1, 4.4);

d) Start a reference collection of scallop shells with a consensual age; (Science Plan codes: 3.1);

e) Discuss the benefits of future exchanges or workshops; (Science Plan codes: 3.1).

WKSA will report by 1 May 2020 (via EPDSG) for the attention of WGScallop, WGBIOP and SCICOM.

Supporting information

Priority	WGScallop review and undertake scallop stock assessments and a number of institutes utilise age based models. It is fundamental to get reliable age readings in order to contribute to accurate assessments and the issues surrounding aging methodologies are considered to have a very high priority. A scallop exchange program was undertaken in 2018 but one of the main problems identified was the lack of common procedures and that the various laboratories involved were utilising different methodologies. The results of the exchange will be discussed at WGScallop 2019 it is expected that the percentage agreement between readers will be very low.
Scientific justification	The aim of the workshop is to identify the current aging problems between readers and standardize the age reading procedures in order to improve the accuracy and precision in the age reading of this species.
Resource requirements	No specific resource requirement beyond the need for members to prepare for and participate in the meeting.
Participants	In view of its relevance to the DCF, and ICES WG, the Workshop will try to join international experts on growth, age estimation and scientists involved in assessment in order to progress towards a solution. The workshop is expected to be attended by some 20–25 researchers from United Kingdom, France, Norway, Iceland and interest has been received from Canada and the United States. Participants should announce their intention to participate in the WK no later than two

	months before the meeting.
Secretariat facilities	Standard support
Financial	No financial implications.
Linkages to advisory committees	There are no obvious direct linkages with the advisory committees.
Linkages to other committees or groups	WGBIOP
Linkages to other organizations	There is a direct link with the EU DCF.

Joint ICES/ PICES Working Group on Small Pelagic Fish (WGSPF)

2019/FT/EPDSG05 A Joint **ICES/ PICES Working Group on Small Pelagic Fish** (WGSPF), chaired by Myron Peck*, Germany (ICES), Ignacio Catalan*, Spain (ICES), Ryan Rykaczewski*, USA (PICES), and Akinori Takasuka*, Japan (PICES) will work on ToRs and generate deliverables as listed in the Table below.

	MEETING DATES	VENUE	REPORTING DETAILS	COMMENTS (CHANGE IN CHAIR, ETC.)
Year 2020	9-12 March	Copenhagen, Denmark	Final report by January 2023	Inter-sessional meeting, funding mechanisms being explored. Location dependent on success of funding raising efforts.
Year 2020	September	Copenhagen, Denmark		(ICES ASC)
Year 2020	October	Qingdao, China		(PICES AM)
Year 2021	September	TBA		(ICES ASC)
Year 2021	October	TBA		(PICES AM)
Year 2021	Late November/ Early December	Barcelona, Spain (proposed)		SPF Symposium (resolution to be submitted to ICES & PICES)
Year 2022	Spring	TBA		Synthesis writing workshop planned (depending on successful funding applications)
Year 2022	September	TBA		(ICES ASC)
Year 2022	October	TBA		(PICES AM)

ToR descriptors

TOR	DESCRIPTION	BACKGROUND	SCIENCE PLAN CODES	DURATION	EXPECTED DELIVERABLES
a	To review recent progress on understanding how various	a) Science Requirements	1.2, 1.3, 2.2	3 years	Review paper(s) within peer-reviewed

	drivers (environmental and/or anthropogenic) impact the population dynamics of SPF in different ecosystems and whether and how potential drivers shift with changes in ecosystem state.				journal
b	Create a networking environment for international and multidisciplinary collaboration to foster the establishment of similar study frameworks and comparative analyses of SPF across different social–ecological systems, based on updated time series data sets of climate indices, environmental factors and fisheries biology as well as ecophysiological information (feeding, growth and survival).	a) Science Requirements	1.9, 5.2	3 years	Meeting reports submitted to ICES and PICES, Perspective Paper(s) submitted to peer-reviewed journal(s)
c	Identify, prioritize and conduct research most needed to advance our knowledge and capacity to predict the population dynamics of SPF at both short (seasonal to inter-annual) and long (decadal to centennial) time scales.	a) Science Requirements	1.3, 7.6	3 years	Meeting reports submitted to ICES and PICES, Perspective Paper(s) submitted to peer-reviewed journal(s)
d	Recommend strategies of marine ecosystem monitoring and fisheries management of SPF which will contribute to sustainable ecosystem-based fisheries management, through biophysical, ecosystem and/or socio–economical models.	a) Science Requirements	2.5, 3.1, 4.1	3 years	Meeting reports submitted to ICES and PICES, Perspective Paper(s) submitted to peer-reviewed journal(s)
d	Propose topic sessions at PICES Annual Meetings and ICES Annual Science Conferences focused on advances in SPF science and to organize a joint ICES/PICES symposium on SPF at regular intervals (e.g., once every 4 years) leading to the publication of findings in special issues of primary journals.	a) Science Requirements	NA	3 years	Joint ICES-PICES theme sessions. An International ICES-PICES SPF symposium (follow-up to March 2017 Victoria meeting) Special issue(s) in peer-reviewed journal(s)

Summary of the Work Plan

Year 1	Initial meeting will take place in Spring 2020 of members from both ICES and PICES communities including a broader array of scientists from non-ICES and PICES regions (e.g. Humboldt EBUS, Mediterranean Sea). The ToRs will be discussed. Emphasis will be on summarizing ongoing work in various regions and scoping of joint research activities such as comparative analyses to be conducted by participants. A resolution for an international symposium on small pelagic fish will be submitted to ICES prior to the kick-off meeting. Two additional meetings will take place at the ICES ASC and PICES AM.
Year 2	An international Symposium will be convened (tentatively in late November / early December in Barcelona, Spain) immediately followed by a writing workshop to start producing synthesis articles stemming from activities in Year 1 and outcomes of the SPF symposium. The group will also meet at the ICES ASC and PICES AM.
Year 3	Meetings will take place at the ICES ASC and PICES AM. Final reporting of this first, 3-year phase of this group will be prepared. It is anticipated that a resolution will be submitted to extend the life-time of this joint group beyond this first, three-year phase.

Supporting information

Priority	Small pelagic fish (SPF) account for more than 30% by weight of the total landings of marine capture fisheries around the world. They also play an important role in the transfer of energy through mid-trophic levels in marine ecosystems and are key resources for the world's growing aquaculture industry. The oscillations in the populations of SPF are dramatic and cyclical in response to climate variability on multi-decadal time scales. However, mechanisms linking climate variability to population dynamics are still unresolved. Hence, there are many challenges to sustainable use of SPF production. As the population dynamics of SPF display basin-scale teleconnections, synthetic and multidisciplinary studies are required to understand the processes and mechanisms to build predictive capacity. International collaboration on SPF research was spearheaded by the GLOBEC Regional Program on Small Pelagic Fish and Climate Change (SPACC), launched in 1994 with a workshop in La Paz, Mexico. The SPACC program aimed to understand and predict climate-induced population dynamics of SPF in relation to physical and biological processes and included several major themes: long-term changes in ecosystems, retrospective analyses, comparative population dynamics, reproductive habitat dynamics, and economic implications of climate variability. The SPACC program culminated in 2010 with the publication of its review book. Since then, no international program specific to SPF has been launched, even though SPACC-II visions have been discussed (e.g., Alheit (2010) and van der Lingen et al. (2010)). In the following decade, there has been substantial scientific progress made in several ecosystems: different hypotheses of mechanisms of population dynamics of SPF have been proposed, data from long-term monitoring and stock-assessment efforts have accumulated, numerical modelling approaches have progressed, and technologies such as genome analysis have rapidly developed. ICES and PICES co-sponsored a symposium on "Forage fish interactions: Creating the tools for ecosystem-based management of marine resources" (Nantes, France, November 12–14, 2012) leading to publication of 12 articles in the ICES Journal of Marine Science (Peck et al., 2014). The need for a platform to organize intensive international collaboration was re-confirmed during the PICES/ICES Symposium on "Drivers of dynamics of small pelagic fish resources" (Victoria, BC, Canada, March 6–11, 2017). This symposium led to special issues in Deep-Sea Research Part II (Alheit et al., 2019; 15 articles) and Marine Ecology Progress Series (Alheit and Peck, 2019; 22 articles). The platform for international collaboration will allow the marine science community to more rapidly address challenging goals such as to:

1. Perform a synthesis of mechanisms linking climate variability to population dynamics of SPF among different ecosystems to reconcile various recruitment hypotheses;

2. Gain an holistic, ecosystem-level view of the causes and consequences of fluctuations in SPF populations such as how different factors (physical forcing, trophodynamics, and fishing pressure) interact to control the dynamics of populations;

3. Unite various fields (climate science, oceanography, plankton and fish ecology, quantitative fisheries stock assessment, sociology and economics) to build interdisciplinary approaches to examine SPF in social–ecological systems;

4. Incorporate new monitoring (e.g., environmental DNA) and modelling (e.g., end-to-end) technologies to better understand and manage pelagic ecosystems;

5. Provide projections of the effects of climate change on the distribution and productivity of SPF;

6. Propose strategies to safeguard marine ecosystem services stemming from SPF including conservation concerns related to SPF and their predators.

Because small pelagic fish (SPF) are highly valued by society and exhibit variability associated with changes in climate forcing, ecosystem structure, and fishing pressure, efforts to understand their dynamics require an integration of knowledge across oceanographic disciplines. Human society cannot expect to prepare a plan for sustainable development of the oceans unless we can improve our understanding of the largest component of ocean fisheries—the small pelagic fish. Consideration of the dynamics of these species, their sensitivity to exploitation and climate change, and the implications of such changes for the human populations that they support is essential to promote ocean sustainability and guide adaptation. The activities of the proposed joint working group will contribute primarily to the first three of the six goals identified in the PICES Strategic Plan (https://meetings.pices.int/About/PICES-Strategic-Plan-Oct-2016.pdf): (1) Foster collaboration among scientists within PICES and with other multinational organizations; (2) Understand the status and trends, vulnerability, and resilience of marine ecosystems; and (3) Understand and quantify how marine ecosystems respond to natural forcing and human activities (Goals 2 and 3 are similar to the two research themes in the PICES integrative scientific program on Forecasting and Understanding, Trends, Uncertainty and Responses of North Pacific Marine Ecosystems (FUTURE)). The activities of the joint working group also align with at least five of the seven ICES science priorities set in the ICES Strategic Plan (https://issuu.com/icesdk/docs/ices_stategic_plan_2019_web), including: (1) Ecosystem science, (2) Impacts of human activities, (3) Observation and exploration, (4) Seafood production and (5) Conservation and management science.

The activities of this joint WG are considered to have a very high priority for both ICES and PICES.

References:

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Alheit, J., Rykaczewski, R.R., Sundby, S., and Di Lorenzo, E. (2019) Drivers of dynamics of small pelagic fish resources: environmental control of long-term changes. Deep Sea Research II (special issue), 159: 1–3

Alheit, J. and Peck M.A. (2019) Drivers of dynamics of small pelagic fish resources: biology, management and human factors. Marine Ecology Progress Series (special issue), 617/618: 1–6.

Peck, M.A., Neuenfeldt, S., Essington, T.E., Trenkel, V.M., Takasuka, A., Gislason, H., Dickey-Collas, M., Andersen, K.H., Ravn-Jonsen, L., Vestergaard, N., Kvamsdal, S.F., Gårdmark, A., Link, J., and Rice, J.C. (2014) Forage Fish Interactions: A symposium on "Creating the tools for ecosystem-based management of marine resources". ICES Journal of

	Marine Science (special issue), 71: 1–4.
Resource requirements	Some resources to support travel of key group members to PICES Annual Science Conferences will be requested (see below).
Participants	The group is expected to attract between 25 to 35 members and guests with broad coverage of ecosystems within and outside ICES and PICES regions.
Secretariat facilities	The group will request meeting rooms/ times associated with the ICES ASC. This will require some assistance from members of the secretariat organizing those events. Similar requests will be made of the PICES secretariat.
Financial	Funds will be requested to support travel of key participants to the PICES ASC.
Linkages to ACOM and groups under ACOM	The group will identify how environmental drivers influence the productivity of SPF within ICES areas. This information will be useful to ACOM.
Linkages to other committees or groups	It is anticipated that very close working relationships will be created with other groups within the Ecosystems, Processes and Dynamics Steering Group such as those working on predators (e.g. JWGBIRD) and prey (WGZE) of SPF. Similarly, the work conducted will be useful to food web modelling (e.g. WKEWIEA) and to state-of-the-art biophysical modelling (e.g. WGIPEM) within SG Integrated Ecosystem Assessments.
Linkages to other organizations	Joint partnership between ICES and PICES: the proposal is simultaneously submitted to PICES; FAO General Fisheries Commission for the Mediterranean (GFCM; http://www.fao.org/gfcm): Working Group on Stock Assessment of Small Pelagic Species; North Pacific Fisheries Commission (NPFC; https://www.npfc.int/): Technical Working Group on Pacific Saury Stock Assessment (TWG PSSA) and Technical Working Group on Chub Mackerel Stock Assessment (TWG CMSA); UN Decade of the Oceans: The mandate of this joint ICES/PICES activity is relevant to the objectives of the UN Decade of Ocean Science for Sustainable Development and UN Strategic Development Goals (*e.g.*, SDG 14, Life Below Water).

Joint ICES/ PICES Working Group on Impacts of Climate Warming on Growth Rates and Fisheries Yields (WGGRAFY)

2019/FT/EPDSG06 A Joint **ICES-PICES Working Group on Impacts of Warming on Growth Rates and Fisheries Yields** (WGGRAFY), chaired by C. Tara Marshall*, UK (ICES), Paul Spencer*, USA (PICES), Alan Baudron*, UK (ICES), Shin-ichi Ito*, Japan (PICES) and John Morrongiello*, Australia (Guest) will work on ToRs and generate deliverables as listed in the Table below.

The ToRs describe a programme of co-ordinated research to be undertaken by a global network of scientists. The ToRs have been developed jointly through discussions at an earlier workshop (Aberdeen 2018). Given the specific nature of the ToRs it is the intention of the co-chairs to minimise the need for face-to-face meetings. Instead work on the ToRs is progressed via remote working and communicated via technological means, including email and skype. WG meetings will be timed to coincide with other international meetings that the co-chairs are attending. Meetings will use video conferencing to allow other WG members to participate remotely. This has several practical advantages. It minimises the requirement for WG participants to secure the substantial funding required for international travel. Secondly, it minimises cumulative carbon emmissions of the WG thereby constituting a more climate-friendly programme of research. This working practice will be challenge but is logical given that the WG concerns climate impacts.

	MEETING DATES	VENUE	REPORTING DETAILS	COMMENTS (CHANGE IN CHAIR, ETC.)
Year 2019	September	ICES ASC, Sweden		Information meeting with co-chairs and prospective members attending the ASC. Develop strategy for securing participants meeting WG needs.
Year 2020 (Year 1)	7-10 September	Copenhagen, Denmark		(ICES ASC- progress reporting on ToR activities; chairs attend, optional attendance by member)
Year 2021 (Year 2)	October	TBA		(PICES ASC- progress reporting on ToR activities; chairs attend, optional attendance by member)
Year 2022 (Year 3)	September	TBA		(ICES ASC- progress reporting on ToR activities; chairs attend, optional attendance by member)
Year 2022	November	Seattle, Washington (proposed)		Final meeting to complete publications (ToRs a,b,c) and strategy document (ToRd)
			Final report by January 2023	

ToR descriptors

TOR	DESCRIPTION	BACKGROUND	SCIENCE PLAN CODES	DURATION	EXPECTED DELIVERABLES
a	Assess the capacity of statistical models to incorporate temperature-dependency of growth, and then compare their predictions of growth variation across specific warming scenarios and locations		1.3, 1.7, 2.5	Year 1	Paper suitable for peer-reviewed fish journal
b	Analyse long-term growth patterns across multiple large marine ecosystems that are experiencing different trends in temperature, using a common modelling approach		1.7, 5.2, 6.1	Years 1, 2 and 3	Papers suitable for peer-reviewed, high impact generic journal
c	Assess the impacts of warming on past yield per recruit of commercial fisheries, and forecast trends in future yield given plausible warming scenarios		1.3, 5.2, 6.1	Year 3	Paper suitable for peer-reviewed, high impact generic journal

d	Identify options for expanding scientific community access to global length-at-age data that are routinely collected by fisheries agencies worldwide.	3.2	Years 1,2,3	Strategic plan assessing options for widening access to length-at-age data collected routinely (similar to how data can be accessed via Datras)

Summary of the Work Plan

Year 0	Initial information meeting will take place in September 2019 at the ICES ASC which will be attended by all four co-chairs and interested individuals. The meeting will present and discuss the long term goals of the WG, the individual ToRs and the specific requirements for prospective WG members. Following on from this meeting targetted email will be sent to individual scientists who are felt to have access to relevant data and/or valuable modelling skills. Members of the WG will come from both ICES and PICES communities but also a broader array of global scientists from regional seas experiencing warming, cooling or upwelling who hold long term length-at-age data (e.g., Chile).
Year 1	A meeting may take place at the ICES Annual Science Conference to review progress towards ToRa and ToRd. Sub-groups meet remotely as required; full WG remotely meets once per year for progress reporting
Year 2	A meeting may take place at the PICES Annual Science Conference to discuss progress towards ToRs a, b and d. Planning for an international theme session will be convened (tentatively in Year 3 at ICES ASC). Sub-groups meet remotely as required; full WG remotely meets once per year for progress reporting
Year 3	A week-long meeting of the full WG will be held to complete writing of papers and will possibly be held at the University of Washington (UW). This location will facilitate discussion of data archiving using the arrangements for maintenance of RAM Legacy database UW as an example.

Supporting information

Priority	The Temperature Size Rule (TSR) proposes that fish at warmer temperatures have rapid early growth and lower adult size (Forster et al. 2012). Several North Sea fish stocks have exhibited a synchronous, common trend towards smaller maximum body sizes that was correlated with increasing temperature. This "shrinking" decreased per-capita yields of those stocks by ca. 23% (Baudron et al. 2014). Similarly, it has been projected that by 2050 global fish yields will decrease by 14-24% due to shifting biogeography and the TSR (Cheung et al 2012). The aim of WGGRAFY is to determine whether temporal trends in individual growth rates of marine fish are consistent with the TSR and, if so, evaluate the impacts for fish yields. Length and age have been routinely measured for many commercial fish stocks on time scales that are associated with warming. These substantial data have never been compiled as a single, analytical resource for climate change research on global scales. The WG will compile length at age datasets for large marine ecosystems experiencing differential rates of warming or cooling or no overall trend (e.g., upwelling regions). A customised statistical approach for modelling growth will be developed to specifically test whether there is a component of the total variation in growth rates that can be attributed to temperature. This knowledge could provide a empirical foundation for forecasting the impacts of future climate warming on yields. The unique spatial and temporal scale of length-at-age data are valuable resource for ecological research. The WG will also develop a strategic plan for archiving length-at-age data similar to how ICES archives data for European waters (Datras) or how global data on recruitment and catch are reported and maintained (e.g., RAM Legacy). This will require

	engaging with various agencies (ICES, EMODnet, FAO, universities, tech specialists) and national fisheries laboratories as well as potential funding sources. References Baudron, A.R., Needle, C.L., Rijnsdorp, A., Marshall, C.T. 2014. Warming temperatures and smaller body sizes: synchronous changes in growth of North Sea fishes. Global Change Biology 20: 1023-1031. Cheung, W. W. L., et al. 2012. Shrinking of fishes exacerbates impacts of global ocean changes on marine ecosystems. Nature Climate Change, 3:254–258. Forster, J., Hirst, A.G., Atkinson, D. 2012. Warming-induced reductions in body size are greater in aquatic than terrestrial species. PNAS 109:19310 LP-19314.
Resource requirements	None anticipated due to nature of remote working.
Participants	The WG is expected to attract between 25 to 35 members including guests giving broad coverage of large marine ecosystems within and outside ICES and PICES regions.
Secretariat facilities	The group will request meeting rooms/ times associated with the ASC. This will require some assistance from members of the secretariats organizing those events. It is envisioned that video conferencing facilities will be required such that non-attending WG members can participate.
Financial	Funds may be requested to support travel of key participants to the final and only meeting.
Linkages to ACOM and groups under ACOM	The group will identify how climate has influenced the productivity and yields of commercial fish stocks within ICES areas retrospecitively. In addition, it will develop knowledge relavant to forecasting future impacts on fish growth rates. This information is compatible with the evolving knowledge base relating to climate-driven distributional shifts. This information will be useful to ACOM in recommending adaptation options for fisheries management.
Linkages to other committees or groups	Unknown but ICES WG related to otolith and aging, fish population dynamics and climate change would be relatively straightforward linkages.
Linkages to other organizations	Joint partnership between ICES and PICES: the proposal is simultaneously submitted to PICES; UN Decade of the Oceans: The mandate of this joint ICES/PICES activity is relevant to the objectives of the UN Decade of Ocean Science for Sustainable Development and UN Strategic Development Goals (*e.g.*, SDG 14, Life Below Water).

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

The **Working Group on the Biology and Life History of Crabs** (WGCRAB), chaired by Carlos Mesquita*, 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 2020	10–12 November	online meeting/ by corresp.		
Year 2021				
Year 2022			Final report by DATE to SCICOM	

ToR descriptors

ToR	Description	Background	SCIENCE PLAN CODES	Duration	Expected Deliverables
a	Compile data on landings, discards, effort and catch per unit effort (CPUE) to provide standardised CPUE, size frequency and research survey data for the important crab and lobster (*Homarus*) fisheries in the ICES area, Atlantic Canada and Greenland. Maps will be produced to synthesise the data. Part of this data will be submitted to the ICES Data Centre.	Crab and lobster fisheries are economically important for many coastal populations in Europe and Canada and more specifically where the demise of fin fish occurred.	5.4; 4.1; 3.2	3 years	Landings, discards, effort and catch data on listed species from each country. WG report.
b	The EG will collate stock-assessment data for areas where the information is available. The working group will review methodologies to develop suitable standardized reference points for the management of the different stocks. Explore and apply common assessment methods for crab and lobster stocks using available data including length distributions and abundance indices.	The data available for each fishery vary greatly. In some, the main management rules are quotas, licences and limitation of fishing gears to control the effort. The status of many stocks remains uncertain. Thus, developing robust evaluation methods for many fisheries is necessary.	5.1; 5.3	3 years	Report on evaluation of assessement methods.
c	Review the impact of environmental drivers (temperature, ocean acidification, climate change), diseases and pollution on important crab and lobster stocks within the ICES, Atlantic Canada and West Greenland; studying the effects on reproduction, recruitment, growth and distribution.	Crabs and lobsters, as many other species are impacted by environmental paramaters. In the actual situation of climate change, WGCRAB must investigate the main importance on the recruitment and biomass trends.	5.2; 2.1	3 years	Highlight important issues to be basis for research on effect of climate changes on important crab stocks. WG report chapter.
d	Review research and genereate new knowledge on vital crab and lobster population biology parameters and food safety.	Biological paramaters are important for stock assessments and improved data will lead to more reliable outputs.	1.7; 1.8	3 years	Updated any new knowledge on crucial stock parameters for any crab and lobster stocks. Any updates or new knowledge will be outputted into summary tables.

Summary of the Work Plan

Year 1	Annual standard outputs for a) and b). Continue analysis for c) and d).
Year 2	Annual standard outputs for a) and b). Continue analysis for c) and d).

Year 3	Annual standard outputs for a) and b). Complete report on analysis, research and report incuding all work for ToRs c) and d).

Supporting information

Priority	High. In Canada as in Europe, fishermen activities are highly dependent of crab and lobster stocks. Morevover, available data vary depending on the country, which is why work on the assessment methods need to be continued, particularly on those countries where fishing data exist allowing the development of new approaches. The aim is to ensure statistically sound assessments of the main crab and lobter stocks in order to provide suitable conditions to develop good management practices and stability of all dependent fleets. The activity of the Group is therefore considered to be of high priority in particular if its activity can move towards resource assessment without losing biological inputs.
Resource requirements	The research programmes which provide the main input to this group are underway, and resources are already committed. The additional resources required to undertake activities in the framework of this group is not expected to be significant.
Participants	The Group is normally attended by some 10–15 members and guests.
Secretariat facilities	Standard support to WG
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	Potential linkages to some EGs under ACOM
Linkages to other committees groups	
Linkages to other organizatio	

Joint ICES/ PICES Working Group on Ocean Negative Carbon Emission (WGONCE)

To be submitted

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

To be submitted Oct/Nov 2019

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

Pending

Resolutions approved in 2018

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		
Year 2020	10–14 February	Barcelona, Spain		
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 working due 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 mortality (consumption)	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 pressure in regional seas where	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.

	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	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	There is a linkage to ACOM/SCICOM steering group Integrated Ecosystem assessments

groups under ACOM	(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 Raul Primicerio*, Norway, 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	19–21 November	Kristiansand, Norway		
Year 2020	DATE December (tbc)	online meeting/ by corresp.		**Change of Chair**: Outgoing: Bruno Ernande, France Incoming: Raul Primicerio, Norway
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		Meeting in association with WGZE and WGIMT
Year 2020	28–30 April	by corresp/ webex		physical meeting cancelled - remote work
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.	a) Potentially harmonize methodological approaches (e.g. molecular tools) b) Provide more precise phytoplankton descriptors (MSFD)	1.3; 4.1; 4.4	3 years	The group will review and evaluate available science dealing with indicator development as needed. National updates on the topic will be requested from EG members.
c	Conduct an integrated analysis of phytoplankton and microbial plankton	Understand consequences of long-term changese.g. in phenology and body size for foodweb func-tioning and	1.3; 2.5	3 years	Papers producrion depending on the key outcomes.

	re-sponses to global warming.	associated eco-system services.			
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		
Year 2020	28–29 October	online meeting/ by corresp.		physical meeting cancelled - remote work
Year 2021	DATE Sept/ Oct (tbc)	Bilbao, Spain	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 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.	1.3; 1.9	Years 1-2	Peer-reviewed publication
b	Identification of key	The identification of the ecological,	1.7	Years 1-3	A database compiling

	ecological, biological and behavioural traits of *Pseudodiaptomus marinus*.	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.			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 groups 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		
Year 2020	5–9 October	by corresp/ webex		physical meeting cancelled - remote work
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 II, IV, V, 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 method-ologies; including compari-sons with fishery dependant indicators.	The aim is to assess the status of scallop stocks and contribute to Integrated Ecosystem Assessment and Management and de-scriptor 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 assess-ments 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)

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

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

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

The **Working Group on *Crangon* fisheries and life history** (WGCRAN), chaired by Claudia Günther, Germany, 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	8–10 October	IJmuiden, Netherlands		
Year 2020	17–21 August	by corresp/ webex		physical meeting cancelled - remote work
Year 2021			Final report by DATE	

TOR	DESCRIPTION	BACKGROUND	SCIENCE PLAN CODES	DURATION	EXPECTED DELIVERABLES
A	Data collection of the status of the Crangon stock.	To 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	1.1; 2.1	year 1,2,3	A time-series analysis of the standardized stock indicators shall be delivered by all WGCRAN members within

		standardized lpue time-series and provide a detailed description of the process of collecting the dataseries effort, landings & LPUE for WGCRAN.			each annual report.
B	Compilation of Logbook information & VMS analysis	To combine VMS, landings and effort data to gain a population distribution indicator and to monitor regional distribution and regional shifts in fishing effort.	2.1; 2.4; 3.5; 5.4	year 1,2,3	Results will be summarized in a peer-reviewed paper.
C	To develop a suite of decision-support tools	To develop and evaluate brown shrimp-specific management decision-support tools to evaluate strategies on how to sustainably and efficiently harvest the brown shrimp stock.	2.1; 2.2; 5.1; 5.4 6.1	year 1,2,3	The results will be presented in technical reports and shall be summarized in a peer-reviewed paper.
D	To evaluate the effects of the efficiency of new gears on shrimp catches	To evaluate the effects of new gears (e.g. pulsetrawl, combined pulse-trawl and standard gears, large or new mesh types, pumpsystem, letterboxetc.) and their implications on the Crangon stock, the bycatch, the catch efficiency and the possible lpue based management strategies.	2.1; 2.2; 5.4	year 1,2,3	An overview of the considerations shall be summarized in the WGCRAN reports.
E	To synthesise the status of research of bottom impact of Brown shrimp fishing practices	To review the status and results of research of bottom impact and consider the implications for management.	2.4; 3.2	year 1,2,3	This work will be compiled and the results will be summarized in a peer-reviewed paper.
F	To optimize and harmonize national by-catch sampling programs.	To review the status and results of research on bycatch timeseries and consider the implications for management. Evaluate methods and procedures used on board for collecting data on bycatch. Gather, compile and evaluate information on the onboard and ashore sieving fractions and processes and new national bycatch/discards data from e.g. DCF.	3.1; 3.2	year 1,2,3	To standardize the available and agreed sampling procedures and compile results in the WGCRAN report.
G	To examine the life cycle dynamics of brown shrimps	To gain a better understanding of the life cycle dynamics and life history of brown shrimp in order to optimize models of population dynamics that are used for management purposes.	1.7; 5.2; 6.1	year 1,2,3	Results shall be summarized in a peer-reviewed paper.
H	To analyze	The analysis of spatio-temporal	3.1; 3.2	year 1,2,3	The results

	German, Belgian and Dutch survey data	trends of survey based stock indicators (biomass, distribution, mortality, etc.) will be conducted. Additionally the ground-truth of VMS derived lpue estimates will be used as complementary information. The inclusion of Belgian survey data will help to complement this analysis.			overview will be presented in each annual report.
I	To facilitate information exchange	Information on national legislation, laws (e.g concerning Natura 2000) and developments (MSC process) concerning the brown shrimp fisheries in the whole North Sea will be synthesised.	7.1	year 1	An overview of relevant legislations will be included in the report.
J	To provide supporting information on ongoing research	To present and review ongoing brown shrimp research in the ICES area, which can help to support and consider management implications.	6.1	year 1,2,3	The summaries of updates will be included in the annual report(s)

Summary of the Work Plan

Year 1	Stock status indicators (ToR a) shall be udated and harmonized between countries. German and Dutch survey data will be analysed and reported, Belgian data will be included in the analyses (ToR h) Information on national legislation, laws (e.g concerning Natura 2000) and developments (MSC process) concerning the brown shrimp fisheries in the whole North Sea will be summarized (ToR i). Data used for the compilaiton of manuscripts in support of ToR b, c, e, g will be made available. New information generated from ToRs d, f, j will be reported
Year 2	Stock status indicators (ToR a) willbe udated and harmonized between countries. German, Belgian and Dutch survey data will be analysed and reported (ToR h). Data for manuscripts related to ToR b, c, e, g will be made available. New information from ToR d, f, j will be reported.
Year 3	Stock status indicators (ToR a) will be updated and harmonized between countries. German, Belgian and Dutch survey data will be analysed and reported (ToR h). Data for Manuscripts related to ToR b, c, e, g will be made available. New information from ToR d, f, j will be presented and 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. WGCRAN is the only expert group to evaluate the Brown Shrimp Fisheries Management Plan which was developed by the industry in the course of the MSC certification.
Resource requirements	The research programmes that 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 and tools to evaluate management strategies have been developed (ToR a, b, c).
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 these groups.
Linkages to other organizatio	CWSS = Common Wadden Sea Secretariat; TMAP = Trilateral Monitoring and Assessment Programme; RCM –NSEA

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	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	11–15 May	by corresp/ webex	Final report by 30 June	physical meeting cancelled - remote work

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 distribution of 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 drivers**	A wide suite of benthic quality indicators were developed, intercalibrated and applied within	1.5; 2.4		

	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	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 review the role of benthic ecology in MPAs**	Understanding ecological issues associated to the development/proposal of MPAs and how effective MPAs are going to be for the conservation of	6.1; 6.2; 6.4	Years 1-3	Review paper

	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.	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 processes in 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 to invite 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 organizatio	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		Meeting in association with WGIMT and WGPME.
Year 2020	23–26 March	by corresp/ webex	Final report by 15 May	physical meeting cancelled - remote work

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 jelly fish 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. Jelly fish 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 organizatio	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.

ICES/ IOC Working Group on Harmful Algal Bloom Dynamics (WGHABD)

2017/MA2/EPDSG03 The ICES/ IOC **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	2–4 March	Gdynia, Poland	Final report by 1 May	Joint meeting with WGBOSV and WGITMO

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	HAB events may affect human activities and marine ecosystems at different levels. Understanding can	5.5; 5.6; 5.7	Year 1,2,	Summary of national reports in Annex in WGHABD report.

	and 2019.	best be achieved by integrating multiyear data sets.			Contribute with reports to HAE-DAT.
B	There are a number of fish killing 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	The WG identified a need for a detailed assessment of the scale of the problem and the identification of key knowledge gaps.	2.7; 5.5	Year 1	Work with chair of IP-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	WGHABD will review the pending EU commission decision and how	1.5; 6.3	Years 1,2,3	Year 1: A section in the WGHABD 2018

	(MSFD). Currently there is no consistent approach in Europe to including HABs in the assessment of GES for the MSFD. A commission decision on the MSFD is pending. .	HABs are included in the MSFD.			report reviewing the the EU commission decision in relation to 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		
Year 2020	24–26 March	by corresp/ webex	Final report by 15 May	physical meeting cancelled - remote work

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	The contributors to the WGOH bring together a wide range of observations taken by various national programmes. Here we	1.1; 1.2; 1.9	3 years	Annual interim reports will include details of national programmes and

	and drivers in the region.	annually monitor developments in the environmental conditions that they sample.			most up to date findings.
b	Standard Sections and Stations summarized into the production of the IROC report and submitted to IROC data portal.	The Working Group recognises the need for disseminating 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.	1.1; 1.2; 1.9	3years	Annual. IROC report for 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.	NA	3 years	WGOH Final Report under multiannual ToRs 2020

	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

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		**Change in Chair:** **Outgoing**: Gonzalo Macho Rivero, Spain **Incoming**: Andrea Belgrano, Sweden
Year 2020	24–27 November	by corresp/ webex	Final report by 15 January 2021 to SCICOM	

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 and various forms of social, human, financial	4.1; 5.4; 7.7	2 years	-Interim report -Special Session at ASC 2019

		and technological capital. Human intervention in the co-creation of marine ES is a key driver in ES delivery,			-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 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 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;	The field of operational 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.	25,28	3 years	At each year-end – 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

	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.
Year 1	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.

EGs dissolved in 2019