WORKING GROUP ON OFFSHORE RENEWABLE ENERGY (WGORE; outputs from 2023 meeting)

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ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

Contents

i Executive summary

The Working Group on Offshore Renewable Energy (WGORE) focuses on coordinating scientific knowledge application for offshore energy installations. It aims to optimize ICES service in managing tidal, wave and offshore wind energy by assessing environmental impacts, regulatory processes, and future challenges.

In this report we give an overview of the work done on cumulative effects assessment of offshore renewables, chemical usage impacts, and environmental effects of emerging marine renewable energy technologies. As well as progress on the review of emerging and re-emerging environmental issues associated with offshore wind, wave and tidal energy developments. Collaborative efforts in drafting peer-reviewed journal papers addressing each Term of Reference are ongoing. Future work will include a review on the effectiveness and transferability of management measures to reduce, mitigate or compensate damage of the natural environment.

ii Expert group information

Expert group name	Working Group on Offshore Renewable Energy (WGORE)
Expert group cycle	Multiannual
Year cycle started	2021
Reporting year in cycle	3/3
Chairs	Bob Rumes, Belgium
	Daniel Wood, UK
Meeting venues and dates	27 September 2021; online meeting.
	15-18 February; 6 December 2022; online meeting. A number of intersessional subgroup meetings throughout 2022.
	12 September 2023; Bilbao, Spain (ASC 2023). A number of intersessional subgroup meetings throughout 2023.

1 Background

The Working Group on Offshore Renewable Energy (WGORE) coordinates the flow of science between certain working groups and its application in relation to offshore energy installations.

The group's remit includes correlating the science from groups on specialist topics such as seabirds, benthic ecology, and fish ecology and its application in planning, consenting and regulatory processes in relation to tidal (in-stream and barrage), wave and offshore wind energy.

WGORE aims to optimize the service ICES provides for applied scientific knowledge relating to management of these increasingly important and rapidly developing energy activities.

The group provides information on the state of development of marine renewable energy and identifies future issues that will require environmental assessment. It also reports on consenting procedures and assessment methods, fosters work across scientific disciplines, and improves understanding across human activities, for example interactions with fishing. As such, WGORE was well placed to assist in the drafting of the ICES offshore renewable energy roadmap.

2 ToR A: Cumulative Effects Assessment of offshore wind, wave and tidal farms in the ICES area

2.1 Background

Renewable energy devices are currently licenced on a development by development (farm by farm) basis in most countries. There has been little work carried out to assess environmental effects at ecosystem and regional scales. The aim is to provide a detailed assessment of ORE at these scales. Individual countries are largely focused on their offshore renewable energy developments with regulatory systems only set up to deal with internal assessment but not cross border. The work would provide an ecosystem approach for dealing with cross border discussions between member states. WGORE sought advice from the ICES Working Group on Cumulative Effects Assessments in Management (WGCEAM) during the initial scoping of the paper and plans to consult with members of WGCEAM as the paper develops.

2.2 Aim

The aim of ToR is to produce a peer-reviewed journal paper.

2.3 Outputs to date

The initial challenge for the group was working out where to position the paper amongst the existing research papers on cumulative effects methodology. The group decided focus on examining the gap between the state of cumulative effects assessments currently being carried out and where approaches needed to improve to meet the increasing scale of offshore renewable energy deployments. We wanted to understand what would be required in order to determine whether the proposed targets for offshore renewable energy were feasible in terms of the marine

environment's ability to absorb the impacts. By the end of 2023, WGORE had begun drafting the peer-reviewed paper but with more work required to get it to a stage ready for internal review.

The working draft abstract is: *Society's need for energy is driving an exponential expansion of offshore renewable energy devices, however, so far, society's need for essential ecosystem services has been considered secondary. We must determine if the natural environment has enough ecological headroom to accommodate all of the renewable energy we want to deploy if we are to avoid damaging the ecosystems and their services. We examine the steps that need to be taken for us to carry out ecologically meaningful environmental assessments of offshore renewables. Firstly, a shift in focus from development-led to receptor-led assessments is needed. Secondly, assessment baselines are currently set at the level of the development resulting in a constantly eroding baseline. Instead, baselines need to focus on the environmental receptors against which significant impacts to ecological components can be accurately assessed. Thirdly, considerable methodological advances are needed in cumulative impacts assessments to achieve this, with more focus needed on how pressures interact, how effective management measures are and, critically, how impacts on food web and ecosystem processes link to protected receptors. Methods to combine non-standardised data sets are needed. Finally, we need to explicitly link environmental assessments of receptors to ecosystem services and assessments of environmental status. In doing so, we will better understand why we value protected receptors and rebalance our needs for energy and essential ecosystem services.*

3 ToR B: Review of the use and environmental effects of chemicals in offshore wind, wave and tidal farms

3.1 Background

There is growing evidence that large quantities of chemicals and metals are being used in offshore renewables. The goal is to identify the chemical groups being used, quantify their usage and the associated environmental risk. The widespread distribution of ORE means chemical contaminants can have an impact across a very wide area. Chemical contaminants can impact all levels of receptors in the ecosystem. The widespread distribution of ORE means contaminants can have an impact across a very wide area. Understanding this new source of contaminants is key to effective management. This work is conducted in collaboration with the ICES Marine Chemistry Working Group (MCWG), ICES Working Group on Marine Benthal and Renewable Energy Developments (WGMBRED) and the ANEMOI project (https://www.interreg-northsea.eu/anemoi).

3.2 Aim

The aim of this ToR is to produce a peer-reviewed journal paper.

3.3 Results

This paper is in the process of being written collaboratively online between members of the ICES WGORE, ICES MCWG, ICES WGMBRED and the ANEMOI project. The paper has been divided into sub-sections led by separate working groups that deal with identifying potential chemical emissions and contaminants, potential effects on the marine ecosystem, and the availability of standards to minimize emissions. The aim is to have a draft of the paper by September 2024.

4 ToR C: Evaluate and report on the environmental effects of emerging marine renewable energy technologies and devices

4.1 Background

There is a growing number of new technologies being trialled to extract energy from the marine environment. These include floating solar farms, Ocean Thermal Energy Conversion (OTEC) and Pressure Retarded Osmosis (PRO), as well as energy storage at sea. There is a need to understand what the environmental effects/impacts of these devices could be, and to identify research gaps. Regulators and advisors require prior information on new devices so that they can firstly prepare for licensing deployment and secondly to prepare re-search funding for emerging issues.

4.2 Aim

The aim was to produce a list of the emerging marine and coastal renewable energy technologies and examine them to determine the likely environmental considerations could be. The aim is to produce a peer reviewed journal review paper.

4.3 Outputs

Between 2022 and 2023 the group researched and collated information of the various technologies that looked likely to be deployed in the next 5–10 years. In most cases there was little information on the potential environmental interactions of the technologies. The group therefore made comparisons with existing technologies to draw conclusions on where issues could lie and where further research may be needed.

The paper was prepared and submitted initially to the ICES Journal but was rejected as not being within the scope of the journal. The paper was subsequently submitted to Ocean and Coastal Management. Review comments were very positive. The authors are awaiting the editor's final decision after responding to the comments.

The current version of the abstract is given below:

Offshore renewable energy technologies are being tested and deployed around the world to mitigate climate change and to bring clean sustainable energy to remote locations. The trend is being led by the development of offshore wind, with energy from waves, tides, and large run of the river turbines also increasing. However, there are additional marine renewable energy technologies that will help to fill in gaps of availability and location for power production. These emerging technologies are generally less well known, including ocean thermal energy conversion, seawater air conditioning, power from salinity gradients, and floating solar photovoltaics (floatovoltaics). Coupled with each of these power production systems is the need for energy storage at sea to aid in storage and transport of the energy. There is little known about the potential environmental effects of these emerging technologies or undersea energy storage, or how they might best be managed. This paper describes the new technologies and explores the potential effects on the marine environment and wildlife and recommends approaches to their management.

5 ToR D: Review and report on (re)emerging environmental issues for offshore wind, wave and tidal renewable energy technologies

5.1 Background

Offshore wind farms are now a well-established feature. Wave and tidal devices are being deployed in an increasing number of areas. New issues such as bat collision risk and the use of chemicals are emerging. Other pressures such as Electro Magnetic Fields (EMF) are re-emerging with the development of floating offshore wind. These issues often emerge because of individual interest within a member state and outcomes are not always well distributed. This work will allow transfer of this knowledge across and beyond ICES member states. For this work we link up with work from the ICES Workshop on Transboundary issues in Marine Spatial Planning (WKTBIMP), Working Group on Offshore Wind Development and Fisheries (WGOWDF) and associated groups.

5.2 Aim

The aim is to review and classify the (re)emerging environmental issues for offshore wind, wave, and tidal renewable energy technologies. The goal is to produce a peer-reviewed journal paper identifying those knowledge gaps that need to be addressed and suggest others that can be downgraded or even retired based on existing information.

5.3 Results

Over the course of 2022 and 2023 we identified those emerging environmental issues for offshore wind, wave, and tidal renewable energy technologies as well as several re-emerging issues mostly related to the expansion of these technologies either geographically (i.e. into new areas) or in magnitude of developments. A draft outline of the paper has been presented and collaborators have been identified who are working on the separate sections.

Annex 1: List of participants

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Annex 2: WGORE resolution

The **Working Group on Marine Renewable Energy (WGMRE)** will be renamed **Working Group on Offshore Renewable Energy (WGORE)**, chaired by Daniel Wood, UK, and Bob Rumes, Belgium; will work on ToRs and generate deliverables as listed in the Table below.

	Meeting dates	Venue	Reporting details	Comments (change in Chair, etc.)
Year 2021	27 September	Online meeting		
Year 2022	15-18 February	Online meeting		
	6 December	Online meeting		
Year 2023	12 September	Bilbao, Spain (ASC 2023)		

ToR descriptors

ToR	Description		Background	Science Plan Codes	Duration	Expected Deliverables
a	Cumulative Effects Assessment of offshore wind, wave, and tidal farms in the ICES area.	a)	Renewable energy devices are currently licenced on a farm by farm basis in most countries. There has been little work carried out to assess environmental effects at ecosystem and regional scales. The aim is to provide a detailed assessment of ORE at these scales.	2.1, 2.2, 2.4	3 years	Peer-reviewed journal paper
		b)	Individual countries are largely focused on their ORE developments with regulatory systems only set up to deal with internal assessment but not cross border. The work would provide an ecosystem approach for dealing with cross border discussions between member states.			
		c)	Link up with WGCEAM			
b	Review of the use and environmental effects of chemicals in offshore wind, wave, and tidal farms	a)	There is growing evidence that large quantities of chemicals and metals are being used in offshore renewables. The goal is to identify the chemical groups being used, quantify the usage and the environmental risk.	2.1, 2.4, 2.6	3 years	Peer-reviewed journal paper
		b)	Chemical contaminants can impact all levels of receptor in the			

			ecosystem. The widespread distribution of ORE means contaminants can have an impact across a very wide area. Understanding a new source of contaminants is key to effective management. c) collaboration with the ICES WG Marine Chemistry and WGMBRED			
c	Evaluate and report on the environmental effects of emerging marine renewable energy technologies and devices.	a) b) c)	There is a growing number of new technologies being trialled to extract energy from the marine environment. These include floating solar farms, Ocean Thermal Energy Conversion (OTEC) and Pressure Retarded Osmosis (PRO). There is a need to understand what the environmental effects/impacts of these devices could be, and to identify research gaps. Regulators and advisors require prior information on new devices so that they can firstly prepare for licensing deployment and secondly to prepare research funding for emerging issues. Ad-hoc requests if required to other WG. Particularly WGMBRED.	2.1, 2.7	3 years	Peer reviewed journal paper. Most likely a review paper.
d	Review and report on (re)emerging environmental issues for offshore wind, wave, and tidal renewable energy technologies	a) b) c)	Offshore wind farms are now a well-established feature. Wave and tidal devices are being deployed in an increasing number of areas. New issues such as bat collision risk and the use of chemicals are emerging. Other pressures such as Electro Magnetic Fields (EMF) are re-emerging with the development of floating offshore wind. Issues often emerge because of individual interest within a member state. This work will allow transfer of knowledge across and beyond ICES member states. Link up with work from WKTBIMP, WGOWDF and associated groups	2.1, 2.7	3 years	Short report with WG final report. (Possible journal paper if sufficient content)

Summary of the Work Plan

Year 1	ToR A: Identify pressures to be included, data sets to be used and define methodology(ies) to be used. Link up with WGCEAM to help define the parameters. It is anticipated that the methodology will build on spatial approaches developed by Halpern et al., 2012 and used by HELCOM. ToR B: Refine scope of work, define data sources and chapter structure for reporting. Make contact with ICES WG Marine Chemistry to agree workload. ToR C: Define chapter structure, identify emerging technologies. ToR D: Review status on known and newly emerging environmental issues. Define chapter structure for reporting.
Year 2	ToR A: Compile datasets, carry out main analysis. Drafting of report e.g. methods, introduction etc. ToR B: Analyse the data and begin draft report. ToR C: Review emerging technologies in a workshop. Draft report. ToR D: Link up with WKTBIMP and associated groups via online workshop on cross border. Draft report.
Year 3	ToR A: Finalise analysis and complete reporting. ToR B: Finalise analysis and complete reporting. ToR C: Update and finalise report. ToR D: Update and finalise report

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.
Participants	The Group is normally attended by some 20–25 members and guests.
Secretariat facilities	Standard EG support.
Financial	No financial implications.
Linkages to ACOM and groups under ACOM	There are no obvious direct linkages currently.
Linkages to other committees or groups	There is a very close working relationship with MCWG, WGMBRED, WGCEAM and WGOWDF.
Linkages to other organizations	None currently.