WORKING GROUP ON OFFSHORE WIND DEVELOPMENT AND FISHERIES (WGOWDF)

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i Executive summary

The Working Group on Offshore Wind Development and Fisheries (WGOWDF) examines interactions between fisheries and offshore wind energy development, comprising 62 members from 14 countries. The Working Group addresses potential interactions affecting fish stocks as fisheries resources, fishers and their communities, and fisheries assessment data (both independent and dependent).

During the reporting period, the WG addressed five terms of reference examining: fisheries access and operational impacts from Offshore Wind projects (ToR A); effects on fishery-independent and fishery-dependent data collections (ToR B); cause-and-effect pathways affecting fisheries species through habitat changes (ToR C); strategic framework development for evaluating cumulative regional impacts (ToR E); and cross-cutting linkages with other ICES expert groups (ToR D).

In the three-year period, the WG's major scientific output was publication of the ICES Journal of Marine Science article "Fisheries Independent Surveys in a New Era of Offshore Wind Energy Development" (Lipsky *et al.*, 2024), which demonstrated that the majority of fisheries-independent surveys interacting with Offshore Wind development will be disrupted, posing serious challenges to resource monitoring and stock assessments. This work is now informing wider ICES activities on monitoring and stock assessment implications. Another significant science advancement was the WG developed a comprehensive set of Pressure-State-Impact (PSI) tables using the widely used DAPSIR framework (Drivers-Activity-Pressure-State-Impact-Response), synthesising evidence and identifying critical evidence gaps on cause-and-effect pathways between Offshore Wind infrastructure and fisheries species. These tables were utilised by ICES in their advice to the European Commission DGMARE following the ICES Workshop to compile evidence on the impacts of offshore renewable energy on fisheries and marine ecosystems (WKCOMPORE). More recently, the WG developed an innovative five-domain sustainability framework using systems mapping to assess cumulative impacts of Offshore Wind on fisheries, categorising outcomes across ecological, social, operational, and economic dimensions. Ongoing case study analysis across gear types continues to build evidence on fisheries access challenges, while systematic tabulation of fisheries-dependent data across regions supports methodological consistency for future impact analyses. Key uncertainties remain regarding long-term population-level effects on fisheries stocks and the effectiveness of compensatory measures for fishing communities.

WGOWDF members contributed substantially to the ICES Offshore Renewable Energy (ORE) Roadmap development and its deliverables, including a series of dedicated workshops, while maintaining active liaison with relevant expert groups. Future work will focus on decommissioning implications, strategic regional planning frameworks, and continued evidence synthesis supporting ICES advisory requests.

These activities of the WG are laying the groundwork for cross-disciplinary publications, workshops, and future science highlights, particularly in relation to co-existence for offshore wind development, fisheries access, and sustainability.

ii Expert group information

Expert group name	Working Group on Offshore Wind Development and Fisheries (WGOWDF)
Expert group cycle	Multiannual
Year cycle started	2023
Reporting year in cycle	3/3
Chairs	Andrew Gill, Australia
	Ed Willsteed, United Kingdom
	Andrew Lipsky, United States
Meeting venues and dates	10-13 July 2023, Bridlington, England (hybrid)
	3-6 June 2024, New Bedford, United States (hybrid)
	2-5 June 2025, Madrid, Spain (hybrid)

1 Introduction

Scope of Work

The Working Group on Offshore Wind Development and Fisheries (WGOWDF) focuses on the interactions between fisheries and offshore wind (OSW) energy. The WG meets annually and currently comprises 62 members representing 14 countries. The WG has terms of reference that examine potential interactions of offshore wind and fisheries, which specifically focuses on the fish as the fisheries resource, the fishers and their communities, and the data that are used or required for fisheries assessment and management (both independent and dependent data). Therefore, the WG considers a wide range of topics from OSW habitat change and effects on fisheries species to physical access to marine areas for fishing and fisheries data collection vessels. WGOWDF has a broad range of experts covering the fisheries species, fisheries data, social and economic aspects of fisheries from across the ICES countries who meet, exchange ideas and scientific understanding, and collectively work on addressing the need for impartial evidence on the state of interactions between offshore wind development and fisheries. The WG has advanced knowledge of OSW-fisheries interactions via peer-reviewed publications, reports and contributing to advice centrally to ICES in response to request, and the WG is developing further papers on the effects of the interactions of interest to all nations seeking coexistence between the two sectors. The WG has published on the impacts of offshore wind on fishery-independent surveys in ICES JMS. An iterative approach to mapping Pressure-State-Impact relationships is advancing understanding of population-impacts and linkages with stock assessment. To support the science-policy relationship, the WG is advancing a systems approach to understand strategic impacts of offshore wind for fisheries. The WG is actively engaged in promoting the importance of the ORE topic and collaborating with other WGs, contributing substantially to the ICES Offshore Renewable Energy Roadmap (ongoing), WKOMRE (Workshop on a Research Roadmap for Offshore and Marine Renewable Energy), WKCOMPORE (Workshop to compile evidence on the impacts of offshore renewable energy on fisheries and marine ecosystems), and WKOMO (Workshop to scope for Harmonized Regional Monitoring Schemes to Assess the Impact of Offshore Wind Farms on Fish, Pelagic and Benthic Communities and Ecosystem Functions). Collectively, these efforts, the achievements to date, and the breadth of the expertise engaged demonstrate that WGOWDF and its members are significant contributors to the ICES mission.

Background

Worldwide, countries are looking to meet the increasing need for more electricity, and energy security interests and aspirations to meet low or net zero carbon goals has raised the interest and adoption of renewable sources, with many countries identifying offshore wind as a key component in their future energy programs. In 2022, OSW provided on average 16% of electricity consumed in the European Union per day and has often reached more than 30% per day (EUR-Lex - 52023DC0669 - EN - EUR-Lex). At the end of 2024, the worldwide installed capacity of offshore wind, reached 79.4 GW with a European contribution of 37 GW (47% approximately and currently a small contribution of 171 MW from the US (Europe: cumulative offshore wind capacity 2024| Statista). Most of the ICES region is coincident with the current extent of OSW development and with the potential for 351 GW by 2030 with more countries entering the picture to meet national and regional climate change policies, the marine space will become more crowded and potential impacts could manifest on fisheries species and fishers.

The extent of development of OSW currently varies greatly among the different European sea basins (Baltic Sea, North Sea, Atlantic, Mediterranean Sea and Black Sea). Northern European countries, such as the UK, Germany, Denmark, Belgium, the Netherlands, and Sweden currently have the highest numbers of installed offshore wind farms (Hoeser & Kuenzer, 2022). However, Norway, France, Ireland, Spain and several Baltic states have advance plans for OSW development. According to the International Energy Agency (IEA), offshore wind is set to become the main source of power generation in Europe by 2042 (made up of fixed and floating turbines and the associated power cabling).

In the United States, offshore wind development is still in an early phase of development. As of December 2025, the U.S. had 11 federally approved commercial-scale offshore wind projects, with 1 project operational and 1 partially operational in Southern New England waters located within the Northwest Atlantic region and another 3 under construction.

With the ongoing and expanding planning and installation of OSW development in the marine environment across sea basins managed by countries with adjacent waters there is a requirement for regional and ecosystem-based science to understanding the scale of the changes and the consequences for the other major user of marine space, the fisheries sector. WGOWDF focuses on the nexus between the OSW and fisheries topics and has ToRs that specifically consider the science and evidence for the interaction between the two sectors. Such evidence is transboundary, multidisciplinary and of critical importance when considering the sustainability of the marine environment for fisheries and renewable energy interests (Gill *et al.* 2020).

2 Findings towards a coherent assessment of offshore wind farm effects on fisheries and fishery resource species

2.1 Fisheries Access

The process of siting, surveying, and construction of offshore wind projects can result in limited levels of fisheries access to fishing grounds overlapping with individual projects. Through ToR A, the WG reviewed and reported on fishing industry interactions with offshore wind developments via a case study analysis. This work was progressed over the past 3 years through group work sessions carried out with the whole WG and benefited from industry engagement sessions where local fishery representatives visited our WG annual meeting and discussed issues and pressures acting on fisheries. In the group sessions, the case studies developed using the Padlet software were reviewed leading to additional focus and work on the regulatory and fishing operational access components for the case studies. The intersessional work conducted by a subgroup of WGOWDF has advanced the development of a journal paper including a matrix comparing case studies focused on curtailed access, gear restrictions, and insurance limitations.

2.2 Impacts to Data Collection

WGOWDF expert members collaborated over the last three years to publish "Lipsky *et al.*, 2024 Fisheries Independent Surveys in a New Era of Offshore Wind Energy Development" (https://doi.org/10.1093/icesjms/fsae060). This paper, published in ICES J Mar Sci., provides an initial assessment and description of offshore wind energy development effects on fishery independent surveys in the U.S. and Europe. Findings indicate that most fisheries independent surveys that interact with offshore wind energy development will be disrupted, posing serious challenges to fishery and protected species resource monitoring and stock assessments. This important output has been raised centrally in ICES and is now feeding into wider activities in WGs dealing with monitoring, fisheries data, and implications for stock assessment.

The WG discussed next steps for ToR B, including deciding to further advance ToR B's efforts to address offshore wind impacts on fisheries dependent data (FDD) collections. An intersessional group began on the topic of FDD and revisited the language that had been developed during the general discussions in the early stages of ToR B, before the focus on the fisheries independent aspect that subsequently formed the published paper. The WG also fed into wider discussions with the Human Activities, Pressures and Impacts Steering Group (HAPISG) Chair to propose a workshop to develop standardised fisheries monitoring methods. The chair of ICES Ecosystem Observation Steering Group (EOSG) joined the discussion and together a proposal to convene an ICES workshop (Workshop to Develop an ICES Survey Mitigation Strategy (WKDISM)) was submitted and approved. The wider engagement and the activities in WKDISM contributed to the ICES ORE Roadmap, to address impacts on scientific surveys from large spatial extent human activities of Offshore Renewable Energy (ORE) and Marine Protected Areas (MPAs). Further, the WG discussed the use of offshore wind infrastructure as observational platforms and this work will be further scoped and advanced by a small intersessional team, recognizing WGOWDF possesses unique expertise on this topic.

2.3 Habitat

ToR C set out to understand the Cause-and-Effect pathways that can affect fisheries species resulting from OSW development. The WG used the Drivers-Activity-Pressure-State-Impact-Response (DAPSIR) framework to set out Pressure-State-Impact (PSI) tables, which furthered an approach originally developed by WGMBRED. These PSI tables considered plausible C-E pathways that could affect fisheries species as a result of the habitat change associated with OSW infrastructure in the water. We then looked for published evidence and where there was no evidence, this was recorded too. The PSI tables compilation and literature searching and reviewing took place in specific sessions at the WG annual meeting and were completed intersessionally. We found that there is a critical stage in the process of determining the effects of OSW habitat change on fisheries, that of understanding the ecological effects first (which we had set out in the PSI tables), which then provides the evidence towards defining the impacts of OSW on fisheries species at the population level. The literature review proved very important as a state of knowledge to feed into WKCOMPORE (Workshop to compile evidence on the impacts of offshore renewable energy on fisheries and marine ecosystems) outputs. A journal paper based on the PSI table assessment was developed and written and has been submitted to the ICES J Mar Sci special 100th anniversary edition (Gill, Gilmour *et al.*, *Subm*.). This research topic will be developed in the new session of WGOWDF to examine the requirements of defining and evidencing population-level impacts and the subsequent linkages with effects on stock assessments. The WG agreed that a species case study approach will be developed to assist with the population level considerations of species in relation to OSW.

2.4 Systems Analysis

In this period, the WG addressed ToR E through a series of exercises using online whiteboard software that resulted in a system map that compiled the features and connections between the features to represent a generic fishery system. Through subsequent group sessions, a process of refinement led to features being categorised into those that are associated with sustainability outcomes spanning ecological, social, operational, and economic outcomes, with a view to developing a tool to assist understanding the cumulative impact of offshore wind development on fisheries operations and communities. ToR E also benefited from the discussions with representatives of local fisheries from the USA, Scotland and Spain (via our three WG Annual meetings) to inform the continued refinement of the cumulative impact system map. A subgroup of WG members agreed to work on ToR E through intersessional work that will be reported back to the broader WG at the next annual meeting.

2.5 Collaboration across Working Groups and Outreach

The WGOWDF Chairs have continued to interact monthly with the Chairs of WGMBRED and WGORE to ensure activities are complementary and integrated (ToR D). Together with WGMBRED and WGORE the WG lead a Theme Session on how multiple offshore renewable energy installations affect both the marine ecosystem and society across large geographical areas for the Annual Science Conference (ASC) 2023 in Bilbao, Spain. The WG was also involved in co-convening a Theme session at ICES ASC 2024 in Gateshead, U.K. which looked at Ecosystem outcomes of co-existence with offshore renewable energy. At ICES ASC 2025 in Klaipeda, Lithuania the WG assisted in the development and delivery of the Theme Session titled Global evidence on effects of offshore marine artificial structures to inform resource management decisions, which was a combination of presentations and a workshop in the last session.

The WG has made considerable progress in relation to working to improve communication and the relevance of the ORE-related activity of our WG and our sister WGs, WGORE and WGMBRED. The progress has come about through the WKOMRE, which led to the ICES ORE Roadmap (Energy transformation: ICES publishes offshore renewable energy roadmap) and WKWIND (Workshop to develop guidelines on how to approach the ecological, economic and social trade-offs between offshore renewable energy developments (wind farms) and fisheries) as the first Roadmap deliverable.

A sub-group of WG members met to discuss the European Commission DGMARE request "Economic and social impacts of offshore renewable energy (ORE) on fisheries and methodologies to assess (ecological and cumulative) impacts in the Celtic Sea, Greater North Sea and Baltic Sea (ICES ecoregions)." Volunteers from the working group collaborated with the WGSOCIAL and WGECON leads for the social, economic and cultural aspects, and other WG members worked with WGMBRED and representatives from WGs working on cumulative assessment and spatial aspects of fisheries data to provide information and resources relevant to the request from DGMARE. The final output was the Workshop to compile evidence on the impacts of offshore renewable energy on fisheries and marine ecosystems (WKCOMPORE) and associated report. The literature review undertaken by the WG as part of ToR C was used in the ecological section of the WKCOMPORE final report, which formed the basis for ICES Advice to the EC DG-MARE.

Our WG members were invited to share their experiences from Europe through contributing to a two-session Symposium on Research updates on Fisheries, Offshore Wind Energy, and Ocean Planning: Experiences from Europe. The symposium was organised by a local committee, led by the University of Rhode Island, and held at their Narragansett Bay Campus. Several WG members gave views of their area of expertise and then joined a Q&A panel. The first session focused on how the Scottish/European commercial fishing industry engages in the offshore wind energy development siting, implementation, and research/monitoring. Discussion about how in Europe fishermen have effectively and/or unproductively engaged in this process were highlighted. We also discussed strategies, such as how perhaps co-management, cooperative research, could assist in minimizing effects on the seafood industry and culture. The second session focused on sharing the latest research from Europe on potential impacts on fish and crustaceans from OWF activity and how the international scientific community is responding to information gaps. In the afternoon, there was a very active, informal discussion session based on the questions asked by the commercial fishing community. This was a great opportunity to communicate the work of the WG members and the ICES WGs in relation to ORE.

The activity within the ToR B fed directly into the development and delivery of WKUSER (Workshop on unavoidable survey effort reduction) and WKDISM (Workshop to Develop an ICES Survey Mitigation Strategy), which had WGOWDF members taking part.

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Annex 2: WGOWDF resolution

The **Working Group on Offshore Wind Development and Fisheries** (WGOWDF), chaired by Andrew Lipsky, USA; Andrew Gill, UK; and Edward Willsteed, 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 2023	10–13 July	Bridlington, UK		
Year 2024	3–6 June	New Bedford, Massachusett, USA		**Change in chair**: Outoing: Antje Gimpel, Germany Incoming: Edward Willsteed, UK
Year 2025	2–5 June	Madrid, Spain	Final report by 31 August to SCICOM	

ToR descriptors

TOR	DESCRIPTION	BACKGROUND	SCIENCE PLAN CODES	DURATION	EXPECTED DELIVERABLES
a	Review and report on fishing industry interactions with offshore wind developments, define and determine effects on fishing operations and communities	*ToR A continued and developed further from 2020-2022 ToR a.* We will identify case studies to demonstrate effects on fishing communities; assess the potential of fishing community compensation and mitigation as well as adaptation and co-existence in practice. We further want to review and develop methods to assess fishery changes due to offshore wind.	2.2, 2.7, 6.6, 7.3	3 years	Review paper: Case Studies
b	Develop and report on methodologies to assess and mitigate impacts of offshore wind energy on fishery data collections, including fisheries independent surveys and fisheries dependent data	*ToR B - continued from 2020-2022 ToR.* We will review tools and report out on solutions to measure and address effects and impacts of fisheries, conservation, and wind energy interactions on fisheries independent and dependent data collections. With this ToR we aim to advance sampling methods such as the use of wind infrastructure as observation platforms or nodes for observation platforms (power supply for automated survey vehicles, use of fiber cables to send data to land). Develop and report on methods to measure fisheries changes due to offshore wind (link to ToR C).	2.2, 2.3, 2.7, 3.2, 3.3	3 years	Method development papers; Case Studies
c	Assess the effects of habitat alteration by	*ToR C continued and adapted*	2.2, 2.4, 2.7, 6.6	3 years	Review paper

	offshore wind developments on fisheries resources	This ToR will focus on the effects of fixed and floating devices. Here we will examine population level effects and impacts as well as ecosystem effects and impacts. We further focus on oceanographic wind and ocean wake effects on fish habitats. In addition, we will consider trophic effects including lower trophic level production in OWF areas (and methods to determine) and multi-stressor effects on fish populations as well as climate change considerations.			
d	Review gaps and identify opportunities for cross-cutting links and communication between ICES groups in relation to renewable energy and marine ecosystems and sustainability	The focus is on cross-cutting links and communication. We will focus on communication database on fisheries and OWF interactions and the tracking /capturing where changes are happening as a result of OWF-fisheries. This includes transboundary issues, OWF with restoration and social issues (link to WGMP-CZM; Scallops – WGScallop) and survey interactions with WKUSER2 outputs. We will coordinate with WGSOCIAL and WGECON to support their OWF research survey to identify existing and ongoing OWF-fisheries research (link to ToR a). Another focus is liaison with Spatial Fisheries Data WG using OWF as case study (WGSF) and the continuation of working together with WGs MBRED and ORE. Other topics include assisting in future ICES ORE strategies/workshops and to determine if any WGs are active in relation to: ● Shifting fisheries species distributions relating to climate change? ● Fisheries tools adaptation - WGFTFB - Fish Technology and Fish behaviour	6.6	Year 3	Report to ICES Recommendations of additional studies linked to other WGs
e	Evaluating and addressing the impact of strategic plan-level development of OWFs within a region on fishery operations and communities	The ToR looks at the bigger picture of evaluating and addressing cumulative impacts of OWF activities on fishery operations and communities at the scale of regional or national management and policy (i.e. the lessons learned). The topic sits alongside the more detailed consideration of interactions at OWF level (which is more a focus of ToR a, b and c). As part of the ToR we would evaluate look at what OWF expansion plans mean at a regional/national level for fisheries, including the socioeconomic consequences of	2.7, 6.4, 7.6	3 years	Systems framework paper/report

	privatization of marine space. This will assist in the determination of why the more specific outputs of ToR a, b and c impacts on the policy and planning objectives that decision makers are working towards. It would increase the potential impact of WGOWDF work, as it will be placed in context of the wider policy picture and showing why the WG research matters at scale and will draw on the wide range of membership in the WG. The ToR would use a system thinking approach to assist with strategic level thinking within WGOWDF such as strategic compensation.

Summary of the Work Plan

Year 1	The WG will meet and exchange ideas on the ToRs. The WG will then develop a plan as to how to address each ToR in the 3-year time frame. The content of papers will be planned and worked on during Year 1, at the workshop and intersessionally. The WG Chairs will continue to regularly interact with the Chairs of WGMBRED and WGORE to ensure activities are complementary.
Year 2	The WG will make progress on all deliverables and will plan the WG workshops to achieve this. The WG Chairs will interact with the Chairs of WGMBRED and WGORE to ensure activities are complementary.
Year 3	The WG will complete the ToR papers and submit them for publication. The WG will also discuss next steps for the WG. The WG will complete a review of ICES expertise related to renewable energy and marine ecosystems and sustainability working with WGMBRED and WGORE. A report will be produced for ICES.

Supporting information

Priority	Offshore wind energy development continues in Europe and is beginning in earnest in North America. Sustainable fisheries are critical to global food security and renewable energy is critical to energy security and climate change mitigation. Coexistence requires an understanding of the interactions between offshore wind energy development and fishing. This understanding can be used to foster the exchange of information, collaboration in addressing science questions, and support decision-making. Consequently, these activities are considered to have a very high priority across the ICES area especially as wind energy development continues.
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 around 30–40 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.
Linkages to other committees or groups	There is a very close working relationship with all the groups HAPISG, in particular WGMPCZM, WGMBRED, WGORE and WGSFD. It is also very relevant to the EOSG.

Linkages to other organizations	There are linkages to fishing organizations and wind developers in the USA and similar linkages in Europe, including wider links to licencing/permitting authorities and other relevant stakeholders.

Annex 3: List of abbreviations and acronyms

DAPSIR - Drivers-Activity-Pressure-State-Impact-Response
EC DG-MARE – European Commission Directorate-General for Maritime Affairs and Fisheries
FDD - Fisheries Dependent Data
ORE - Offshore Renewable Energy
OSW - Offshore Wind
PSI - Pressure-State- Impact
WG - Working Group
WGECON - Working Group on Economics
WGMBRED - Working Group on Marine Benthal and Renewable Energy Developments
WGOWDF - Working Group on Offshore Wind Development and Fisheries
WGORE - Working Group on Offshore Renewable Energy
WGSOCIAL - Working Group on Social Dimensions
WKCOMPORE - Workshop to compile evidence on the impacts of offshore renewable energy on fisheries and marine ecosystems
WKDISM - Workshop to Develop an ICES Survey Mitigation Strategy
WKOMO - Workshop to scope for Harmonized Regional Monitoring Schemes to Assess the Impact of Offshore Wind Farms on Fish, Pelagic and Benthic Communities and Ecosystem Functions
WKOMRE - Workshop on a Research Roadmap for Offshore and Marine Renewable Energy
WKUSER - Workshop on unavoidable survey effort reduction
WKWIND - Workshop to develop guidelines on how to approach the ecological, economic and social trade-offs between offshore renewable energy developments (wind farms) and fisheries