Theme Session G Report 2024

Ecosystem outcomes of co-existence with offshore renewable energy

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Session synopsis

Theme session G brought together experts to share experience and knowledge on the outcomes of co-existence between the environment and offshore renewable energy, specifically how marine and coastal ecosystems responded to the development of offshore renewable energy installations. It aimed to set out the key elements of change that defined the offshore renewable–marine and coastal environment relationship. Co-existence was defined in different ways, and the topic of co-location (considered designed or managed co-existence) was of considerable interest, with specific actions by some nations to promote it.

The session provided a platform for researchers to share their experiences of co-existence/co-location, ranging from individual site aspects to greater spatial scales. Furthermore, defining the outcomes considered focal species, habitat, ecological function, and/or ecosystem service. The evidence base had commonalities regardless of location, critical for future multidisciplinary and transboundary research and strategic monitoring.

The development of a renewable energy site included the construction of devices, power cable installation over months to years, and operation over decades. The outcomes of co-existence for these periods of development could be different and change over time and across spatial scales. The installation of offshore renewable energy hard structures could affect different components of the ecosystem, which in turn might affect ecological processes and functions.

Outcomes for other existing marine uses could be negative (e.g., fisheries displacement) or potentially positive (e.g., removing existing human pressures, leading to artificial reef/no-fishing zone effects); however, the evidence was variable. Given the scale and potential system-wide consequences to the ecosystem and society of offshore renewable energy development, there was a pressing need to determine the relevant knowledge base and gaps in research and data to determine the ecosystem outcomes of co-existence.

Introduction

The ICES Working Groups (WGs) – Offshore Wind Development and Fisheries (OWDF), Marine Benthal and Renewable Energy Development (MBRED), and Offshore Renewable Energy (ORE) are currently the only ICES WGs focused specifically on offshore renewable energy (ORE). We sit within the Human Activities, Pressures and Impacts Steering Group (HAPISG), where there are several other WGs that either have a Term of Reference (ToR) or a case study involving ORE. Furthermore, some WGs within other Steering Groups are increasing their consideration of ORE with regards to their ToRs. Evidently ICES, as a community, has to look at the ORE topic right across our WGs and expertise, particularly given the spatial scale of development and the pace of marine planning, ORE development installation and ORE technological advances.

The importance of ORE in the context of ICES was recently recognised through the ICES ORE Roadmap, which sets the ICES response to the regional industrial expansion of ORE in the fisheries. It focuses on how ICES should address the need for data, science and advice with regards to ORE-related ecosystem change and the consequences for fishery resource species and their fisheries.

There are several important ecosystem changes that are predicted to occur with ORE, and one of those that is a hot topic is co-existence (and co-location). The terms co-existence and co-location are often used interchangeably, and we suggest that this can confuse such an important issue and therefore should be taken into account.

This context formed the basis of the three sister WGs proposing theme session G - Ecosystem outcomes of co-existence with offshore renewable energy.

Definitions

Prior to the session, participants were asked two questions to gauge their existing thoughts on co-existence and co-location:

1. What individual word(s) come to your mind when you think of co-existence?
2. What individual word(s) come to your mind when you think of co-location?

The session began with a review of the results from these two questions, captured in two word clouds.

Figure 1. Word cloud of responses to the pre-session question: What individual word(s) come to your mind when you think of co-existence? (29 responses).

The need for working together in a positive, respectful and coordinated manner is the main message from the audience for co-existence. There is also a recognition that there are trade-offs and some compromise in outcomes that should not be forgotten about.

Figure 2. Word cloud of responses to the pre-session question: What individual word(s) come to your mind when you think of co-location? (29 responses).

The need to do things together in the same space with some purposeful planning is evident. This will require actions to ensure that whatever is co-located can be done with respect to potential conflict, living and working together in agreement and mutual cooperation. Without these elements, the outcome may be unbalanced and negative involving competition, conflict and protection against such consequences.

The word clouds (above) show that the audience had a variety of words and terms in their mind for both co-existence and co-location. It is evident that we require clear and agreed definitions.

For the purposes of the session, we set out two clear definitions that we had taken from a project that the Centre for Environment Fisheries and Aquaculture Science (CEFAS) had conducted on behalf of DEFRA (UK Government's Department for Environment, Food and Rural Affairs Department). These definitions were based on a review of the literature and a workshop with other UK Government agencies and interested stakeholders.

Co-existence

- Same time – same space.
- No specific management needed.

Co-location

- Active management between activities to facilitate sharing space either at the same or different times.
- It is a form of co-existence.

For the categorisation of the talks and the session discussions we referred to these definitions.

Summary of the three session slots

Theme session G was split into three categories: (a) a broad slot on co-existence and co-location of offshore renewables with other sectors; (b) a slot on co-existence of offshore renewables with nature and the marine environment; and (c) a slot explicitly on co-location with other sectors.

During the first slot, both co-location (fixed structures) and co-existence (floating wind turbines) of fisheries with offshore wind farms were discussed, when potential benefits and disadvantages to the fishing industry were highlighted. Fishing activities have been shifted due to the installation of offshore wind farms and the subsequent loss of fishing grounds in multiple locations in the North Sea and the northeast Atlantic. Furthermore, the incorporation of ecological knowledge (i.e., spatial-temporal patterns of pelagic fish species and mammals) and coordination of research to manage future offshore wind developments was indicated as a necessity.

The second slot on co-existence with nature and the marine environment focused on the effects that offshore renewables inevitably have on the marine ecosystem. During this slot, it became clear that offshore renewables (and particularly wind) have an effect on fish distribution, on the habitat availability for the benthic communities on and around these structures, on the food-web structure of both hard- and soft substrate communities and on primary production. The significance of ecosystem models and indicators, vulnerability assessment of marine species to offshore energy installations and long-term monitoring was also highlighted to properly inform management of offshore wind energy deployments.

The final slot focused on co-location of offshore renewables with other-sectors and particularly bivalve aquaculture, the effects of offshore solar energy and its potential co-location with offshore wind on the marine environment and the already existing co-location of offshore wind with nature-inclusive design. The presenters indicated that co-location of offshore wind with aquaculture or with offshore solar energy will have an effect on the entire water column and the local hydrodynamics, while climate change effects together with potential co-location will impact the marine ecosystem functioning. Co-location of bivalve or kelp aquaculture will require public and stakeholder support and economic considerations are important.

Nature restoration of terrestrial ecosystems seems more successful than that of the marine ones, since from a green forest, we can turn our cities to green cities, with gardens and green roofs. However, when we are talking about nature restoration in the marine environment, we mainly consider adding more artificial structures to natural soft-sediment environments (especially in the case of the North Sea). We, therefore, create habitats suitable for particular species of interest, instead of promoting the natural, soft-sediment biodiversity. The installation of more artificial reefs, thus, needs further attention to properly identify its necessity and the outcomes, and site-specific aspects should be incorporated into consideration of nature inclusive design.

Across all the three slots, it was evident that appropriate management should be a critical element of any co-existence or co-location considerations.

Polls – Summaries

As part of wrapping up the final session, the audience were asked for their views via Slido on what key aspects ICES should focus on in the future, given what they had heard in Session G on co-existence and co-location. Fifty-two responses were received. The five main themes that emerged from the responses were:

1. Cumulative and Ecosystem Impacts: Many respondents stressed the importance of understanding the cumulative effects of offshore wind farms (OWF) on ecosystems, particularly regarding long-term impacts, hydrodynamics, biodiversity, food webs across different trophic levels and the effects of OWF adding to biomass or relocating it (the attraction-production question). There is concern over how multiple developments affect the marine environment at a broader scale rather than individual project assessments.

2. Nature-Inclusive Design (NID) and Marine Net Gain: A recurring theme is the need for nature-inclusive designs that incorporate ecosystem restoration and biodiversity enhancement into ORE projects. Participants emphasized balancing infrastructure with ecosystem protection and questioned whether such designs truly serve nature or if dedicated spaces are needed for conservation.

3. Long-Term Monitoring and Data Collection: There was a strong call for hypothesis-led, long-term ecological monitoring of ORE projects. This includes establishing standardised methodologies for assessing impacts, addressing knowledge gaps, and using offshore infrastructure for ongoing scientific data collection to better inform future projects.

4. Co-existence of different ocean users: Fishing, aquaculture, and other renewable energy were highlighted as key aspects to consider. Participants noted the importance of finding ways for various sectors to share space while minimizing conflicts and ensuring sustainability for both human users and the environment.

5. Climate Change Considerations: Finally, integrating climate change predictions into ORE planning was another significant focus. Respondents pointed out that climate change impacts must be factored into decisions about offshore infrastructure placement and management, emphasising the need for adaptive and responsive strategies as new challenges emerge.

These themes reflect a desire for ICES to lead efforts in research coordination, adaptive management, and balancing ocean resource use with ecological protection. [The raw responses to the question are shown in Appendix 1].

Finally, the audience were asked to complete a multiple-choice question asking: "*Given co-location is being proposed, which of the following categories would you prioritise for ICES?*".

The focus was on co-location (i.e. the active planning or management of activities together, rather than just co-existence) and therefore did not cover fishing displacement as a result of ORE development, as the convenors felt that would have dominated the results. Figure 3 shows the summary of responses which were not analysed during the session, instead they are discussed here.

The desire for ICES to look at co-location between offshore renewables and aquaculture and with other renewables was low at 13% and 16% respectively. The convenors speculate that the audience may have felt co-location between renewables and aquaculture was unlikely to occur in many areas and that co-location with other renewables was simply an increase in existing pressures in the development area rather than anything scientifically new. It was not unexpected to see renewables and fishing highlighted given the ICES audience. However, the convenors were surprised to see such a strong preference to focus on co-existence between renewables and nature, particularly when compared to nature recovery and enhancement. There could be many reasons for this result, such as the geographical spread of the audience (there was a strong representation from the USA where nature conservation is high on their agenda), or that the audience felt that there were still many unknowns on the impacts of offshore renewables. Given that there are numerous other possible reasons for these results, the convenors feel that ICES should conduct a more in-depth survey of its community to better understand the future research needs relating to ORE and co-existence.

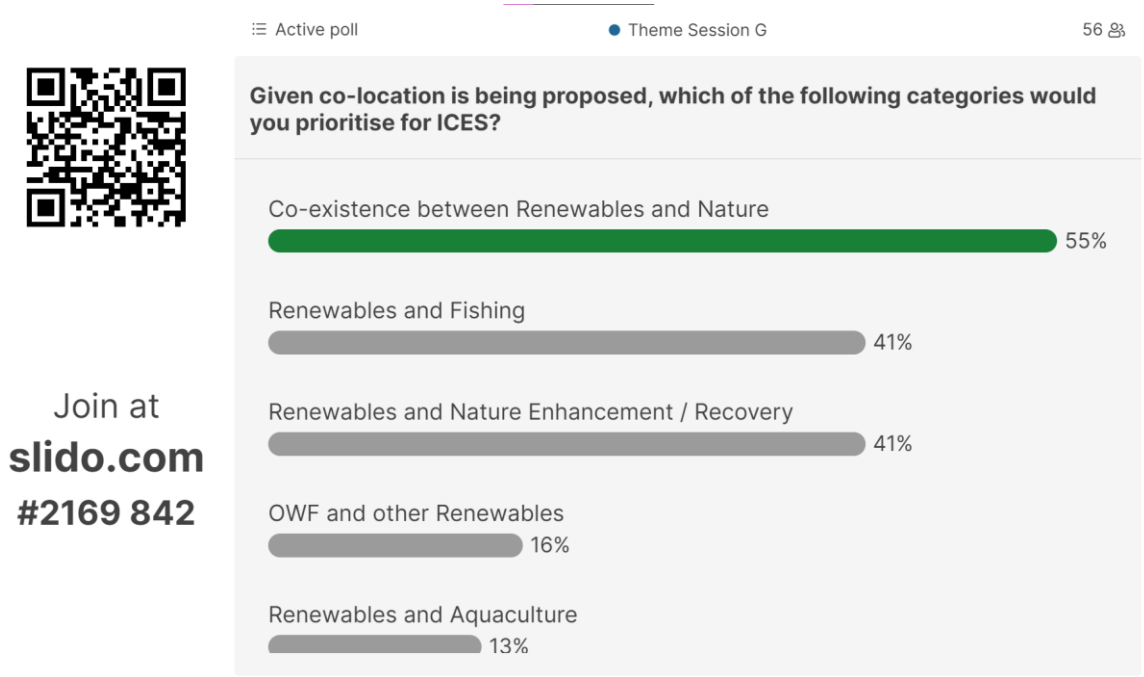

Figure 3. Results of the final audience poll (56 responses).

Concluding remarks

Theme Session G was a great success. We have received excellent feedback relating to the breadth of the topics covered, the structuring of the session in the slots, and the facilitation for the discussions (including the audience participation). We conclude that the topic of co-existence and also co-location (as a purposeful form of co-existence) is very important for ICES. There are several key knowledge gaps that we have highlighted above, and these relate mainly to the need for ICES science to understand the outcomes and consequence of the development of ORE across the region and its implications for the ecosystem and in particular fisheries. Furthermore, the outcomes of ORE installation for the environment and other users requires targeted data collection and subsequent management for sustainability. There are tried and tested methods and approaches and some novel ones, as exemplified through this session, that can be recommended to apply to provide the science evidence to those seeking advice. However, the changes to ecosystems, fisheries and other users still requires more evidence as ORE continues in its expansion across the regional seas and coasts. The output of this session provides excellent food for thought to the ongoing delivery of the ICES Roadmap. We recommend that the topics of co-existence and co-location are the subject of a targeted survey of the wider ICES community to determine if the messages we concluded from the session are a true reflection of the science and advice needs.

Appendix 1: Raw answers to the question "*Given what you've heard in Session G on co-existence and co-location, what are the key aspects for ICES to focus on in the future?*" (52 Responses)

- More on climate change predictions in combination with OREs
- Best practices for management and mitigation offshore renewables
- Maintaining nature inclusive designs in dynamic successive ecosystem to maximize local commercial harvests (fishers being part of that design).
- Make sure to stop, think and scrutinize, are we doing the right thing? Continue be critical.
- Who should decide? Is coexistence with OSW farms better for solar? Aquaculture? Nature exclusive designs to enhance fisheries?
- Upscaling impacts to hydrodynamics and ecosystems
- What have we learned about where wind developments should go? Are there no-go areas or no-go construction/operation methods?
- Ocean users are being asked to sacrifice in some measure their interests for the common good of reducing climate change. We must emphasize the reduction of impact to those historic and cultural providers of food
- ICES should also think about how to work with industry to utilize the emerging offshore infrastructure for long term monitoring and observing. Wind turbines and floating solar platforms present access to sustained power and telecommunications. How can we instrument these arrays to meet our scientific needs?
- How do we account for climate change impacts when considering the risks and opportunities associated with OWF expansion?
- Nature-inclusive designs
- Hypothesis led monitoring- at a strategic scale
- That considerable knowledge gaps remain and so advice and guidance produced for OW developers must be adaptive and reactive so that as issues (declines in biodiversity, alterations of hydrological processes) can be managed proactively
- Standardization in evaluating compensation that developers use for impacted ocean users.
- Avoid duplication with other conventions
- Focus on co-existence and co-location of measurements for monitoring and mitigation.
- Can areas set aside for OWF really be called "nature" even if we use nature inclusive designs, or should we find space for offshore renewables AND for nature separately to meet EU targets? And if so, will there still be room to fish?
- There appears to be very little work presented on some trophic grounds - e.g. higher predators. Appears to be a focus within ICES regarding impacts to fish, benthos, primary production and hydrodynamics but not much consideration of impacts to marine mammals, seabirds, sharks, turtles etc.
- Long term monitoring
- Impact assessment on stock (population) level instead of individual wind farms level
- How can we balance the expansion of offshore infrastructure and nature protection
- Reenforcing the idea that the less enigmatic habitats and communities are not necessarily the least important in terms of ecological function.
- MSP
- Baseline data
- Co-location sets a range of long-term expectations among sectors. In a way similar to a developing fishery. Do we run the risk of setting up for sector collapses given our level of understanding on the stability of created OWF ecosystems?
- MAP future locations of structures for scenarios

- Focus on answering the “production vs attraction” question that will be universal across all sampling studies around OSW and co-located projects and whether changes/impacts have happened.
- Ecosystem function
- Restorative Nature-inclusive design
- Long term monitoring/ data collection of the ecological impacts of marine renewable energy. Key knowledge gaps around floating offshore wind and cumulative effects.
- Ecosystem impacts; trade offs; decommissioning regulations and is OSPAR 98/3 correct? Is Net Gain natural in offshore renewables?
- Taking into account new offshore renewable energy structures (such as offshore photovoltaic installations)
- Questions where the answers could directly improve future renewable project design. This is the ‘so what’ question.
- Standard methodology for the impact assessment
- Valuing and weighing different NID options
- Need strategic approach to the squeeze on the fishing industries - cannot be left to one development at a time
- Incentives and policy mechanisms for co-location of sectors
- Work across different trophic levels
- ICES should lead in the identification of these key aspects across countries and regions. After coordinating, we can prioritize our research efforts.
- Fishing and data acquisition (e.g. surveys) co-existence with offshore wind
- Collaboration
- Cumulative effects
- How can co-location help to deliver Marine Net Gain to ensure it is actually a gain in biodiversity
- Consideration of different compartments of the ecosystem
- In-combination effects and assessment
- Estimate PP & faunal biomass change
- Cumulative impacts
- True evaluation of benefits, revenues, costs etc. of activities. Potential cumulative impacts from the perspective that offshore wind will have enormous significant environmental impacts
- Ecosystem based approach
- Nature inclusive design needs to consider what the natural/baseline environment and ecosystem is to really mitigate the addition of artificial structures
- Cumulative impacts
- Operationalisation
- Increase multi-use between activities, not only co-location
- How to implement concepts such as marine net gain in offshore developments (or any marine infrastructure)
- Planning
- What impact topics can we retire? Are there any topics we know enough about now to say they’re low risk?
- Cumulative impacts of offshore wind farms on fisheries
- Value of marine artificial structures and benefits for nature, economy, society
- Changes from the base of marine ecosystems
- Ecosystem impacts
- Decommissioning advice of offshore wind structures
- Consider the impacts of climate change on the environmental impacts we already know for a better spatial management in the future

- Integrate oceanography and biology
- Cumulative impacts of multiple windfarms covering large expanses of marine space and seabed
- Relocation of marine and coastal ecological functions
- Nature restoration
- Understand change in ecosystem functioning
- The impact of wind farms on small scale fisheries and how to mitigate/remove them.
- Interactions between fish and offshore renewable structures
- Concerns/aims of the industries involved
- Connection of photovoltaics and deep sea mining
- Role of marine planning in co-existence and co-location
- Critical habitat - such as feeding habit for a range of ecologically important fish