WORKSHOP TO DEVELOP AN ICES SURVEY MITIGATION STRATEGY (WKDISM)

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i Executive summary

The Workshop to Develop an ICES Survey Mitigation Strategy (WKDISM) convened to assess impacts of marine area designations (e.g. OREs and MPAs) on scientific surveys used to inform marine resource, ecosystem, or species management. The workshop aimed to first identify the interactions of MPA and OREs on long-term scientific surveys across ICES regions, review approaches to address the impacts from MPAs and OREs on long-term scientific surveys, and begin developing an ICES Strategy that aims to mitigate the impacts of MPAs and OREs on scientific surveys, assessment, and advice. ICES regions began with current knowledge and assessment of how OREs and MPAs, both present and proposed, spatially interact with current survey enterprises. The workshop next reviewed both analytical and methodological strategies (alternative and advanced technologies) to either account for survey losses or address sampling gaps created from OREs and MPAs precluding sampling in these areas. Lastly, the workshop reviewed the mechanisms or frameworks that would allow for mitigating loss survey coverage into the future. Recommendations were primarily based on a current United States model of collaboration and support for directed survey mitigation that requires ORE developers to mitigate their impacts and should not rely on pre-existing ORE or MPA monitoring given the differences in survey goals, designs, and adequacy of methods. ICES scientists agreed that further development of analytical and new survey methods must be continued, with the former working through the estimated impacts on stock and ecosystem assessments from loss survey coverage, and the latter including how to maintain such new long-term programs in concert with current long-term surveys..

ii Expert group information

Expert group name	Workshop to Develop an ICES Survey Mitigation Strategy [WKDISM]
Expert group cycle	Annual
Year cycle started	2025
Reporting year in cycle	1/1
Chair(s)	Andy Lipsky, United States
	Conor McManus, United States
	Pia Schuchert, United Kingdom
	Duane Stevenson, United States
Meeting venue(s) and dates	23-28 June 2025, Copenhagen, Denmark (50 participants)

1 Introduction

The Workshop to Develop an ICES Survey Mitigation Strategy (WKDISM) was convened to assess and strategize how to address the loss of long-term scientific survey areas and strata due to offshore renewable energy installations (OREs), marine protected areas (MPAs) and other large scale designated areas. The loss of available scientific information from such preclusion has the potential to have subsequent impacts on the quality, precision and accuracy of scientific fisheries and ecosystem assessments, and resulting science-based management advice. As per the ORE Roadmap, ICES must develop a strategy to address those impacts as many ICES member countries are experiencing large-scale offshore renewable energy and MPA developments (such as "30 by 30") and will require tools and methods to understand and mitigate against the impacts.

The work necessary to achieve this is initially to quantify the areas being lost, the impacts of the loss of those areas on the individual surveys and the consequently impact on the final advice products. The collation of those survey areas and the impact that those areas will have on the survey quality and data is difficult for many countries as spatial data and associated metadata (such as the type of access) are not readily available or kept updated. There is still little communication with the data users to understand the full impact of the survey change on work like fisheries stock assessments or ecosystem analyses and resulting shifts in the advice.

There needs to be communication at the earliest marine spatial planning stage to involve survey and assessment scientists as well as statisticians to pre-empty the impact of loss of areas on survey and subsequent data products. Discussions with industry and managers of MPAs are essential to ensure the best options are chosen to minimize impact through ORE/ MPA design, provision of data equivalent to the scientific survey, supplementary or alternative survey data, and other allowances. A mitigation plan needs to have a legal requirement and standing and need to be in place for the full life-time of the closed area (30+ years).

WKDISM used a combination of presentations by participants and active work in break-out groups to discuss and shape the future recommendation and necessary work. This report is structured in the way that it addresses the three terms of reference (ToRs) which form the building blocks, and gives a summary of the discussions and questions dealt in the break-out groups as well as a short summary of the presentations that were aligned with a specific ToR.

2 Term of Reference A: Describe and evaluate the interactions of MPAs and OREs on long-term scientific surveys across ICES regions.

2.1 Discussion synthesis

Part (a)

What surveys are impacted by ORE/MPAs?

Almost all fisheries independent surveys conducted in Europe, as well as many regions of the U.S. and Canada (Lipsky et al., 2024), are being or will be affected in some way by ORE/MPA expansion. Several examples of affected surveys were discussed, including the IBTS and other beam trawl surveys. The issues faced are dependent upon the survey design and surveying protocols, but surveys with fixed stations or dredge gear were identified as being particularly vulnerable. It was noted that trawl surveys were well represented at this workshop compared to other survey types, however many issues were thought to be common across most survey types (eg., loss of access).

What methods/steps need to be taken to identify surveys that interact with ORE/MPAs?

The discussion around methods and steps to take identified a need for spatial mapping data to check for conflicts and areas of spatial overlap between survey areas and ORE/MPA sites (https://gis.ices.dk/sf/index.html?widget=Datras). Electronic aids such as ECDIS (Electronic Chart Display Information System) allow survey planning onshore using the same technology as research vessel navigation but can also be used to identify sampling sites that interact with ORE/MPA areas before sampling begins. There is a recognized need to be proactive and forecast ahead to understand the location of ORE/MPAs that are in the pipeline, and which surveys these areas have the potential to affect. Communication between marine spatial planners and survey managers is essential to ensure that survey loss due to ORE is being considered at the appropriate stage in the planning process. The U.S. has largely dealt with ORE impacts through survey mitigation work (spearheaded by NE Region). Canada is just beginning to grapple with this issue for both ORE & MPAs.

What methods could be used to quantify potential costs of these impacts, including loss of biological data, and downstream impacts on stock assessments?

There is a clear need for current and potential future impacts to be quantified in terms of stations moved or lost, and what proportion may be lost permanently specifically due to ORE/MPA. For stratified surveys, what proportion of each stratum overlaps with ORE/MPA areas (either as km2 or %) to understand how much the strata are reduced. This will provide a starting point for understanding which indices are most at risk from ORE/MPA expansion and understanding how resilient each of the surveys (based on methods, scope, aims etc) is to expansion.

Quantifying the impacts of ORE/MPAs to surveys requires the compilation of a list of both ICES and national scientific surveys. This could be accomplished through ACOM representatives providing lists of surveys from member countries. Discussions about the costs of impacted surveys are complicated by the definition of the term 'cost'. For our purposes, the term 'costs' was considered a catch-all term for the financial and logistical costs of operating the surveys (quantified through financial forecasting), as well as the cost of losing access to stations on the data quality and integrity of long-term time series and their associated indices and assessments. There is an associated need for an inventory of data uses and data users. In most cases, there are clients other than stock assessors that should be considered. Once we have a comprehensive understanding of clients and data uses, we can begin to quantify the impact.

Additional costs that may be considered include the cost of developing and implementing new monitoring methods and applications needed, as well as costs associated with integrating new data types and sources into existing datasets. Perhaps impacts on survey performance (via metrics such as CV, etc.) should be used to quantify costs. The risks of using uncertain data to make decisions, and the potential existential cost of making bad decisions, may be important. Furthermore, the downstream effects of impacted or reduced scientific survey effort will likely become prevalent in other areas of marine management, including policy implementation, ecosystem assessments, and economic opportunities (through impacts to stock assessment and quota allocation).

Part (b)

Identify advice setting processes that may be impacted by ORE and MPA survey disruptions.

Conducting sensitivity analyses for survey indices will be important for impacted surveys, although other types of data products may be impacted as well. The relative robustness of data products impacted by survey changes is expected to vary by species. For example, sedentary species may be more impacted than widespread mobile species, impacts to nursery areas or spawning grounds may impact different life history stages of some species. Although most stock assessments happen over large areas, cases in which the impacted area is a larger proportion of an overall species distribution may be more problematic, so the spatial impacts of ORE/MPAs should be quantified.

What steps or methods can be taken to understand the interactions of ORE/MPAs on survey activity/assessment advice?

To the extent possible, scientific surveys should be included in marine spatial planning. ICES should be proactive in the assessment of area loss, MPAs should be monitored for effectiveness, and the monitoring data should be accessible. Adaptive management strategies should be implemented where possible, and stock assessment models should be developed to specifically look at data changes due to ORE/MPAs. Forecasting of ORE/MPAs in the pipeline needs to happen to allow for proactive survey management. Communication between marine spatial planners and survey managers is important to ensure that survey loss due to ORE/MPAs is being considered at the appropriate stage in the planning process.

The development and use of a spatial HUB for ICES members to collaborate was suggested. The term 'Spatial hub' was not fully defined but could refer to a 'hub' of experts or a data platform/tool. The need for access to spatial data of current and future ORE/MPAs sites was identified.

Can we develop lists of stock assessments that will be impacted and if so what methods/prioritization processes could be used?

The first step is to develop a list of the surveys impacted. It is then important to identify data users and relay information about impacts to those users, including discussions about data access and appropriate uses of the data. For some surveys, it can be challenging to identify which stock assessments are using the survey data, but early and frequent consultations with stock assessors are critical to determining which stocks and stock management advice may be impacted. In the U.S., NOAA Fisheries and BOEM have developed a Federal Survey Mitigation Strategy (Hare et al., 2022) that identifies four main impacts of wind energy development on surveys.

Part (c)

Can ORE or MPA monitoring activities supplant or contribute to long-term scientific survey effort?

The current monitoring for OREs is not adequate to replace long-term surveys (Methratta et al., 2023). The activities required from the operators of OREs are not meant for long-term monitoring and are requirements for Environmental Impact Assessments (EIA) conducted by consultancies. There are no standardized or harmonized methods across countries, the methods are not peer-reviewed, and data sets are not publicly available (ICES 2025). The data collected by the ORE operators does not cover the full time that the ORE is in operation. To date, monitoring of MPAs is even less documented. Many MPAs are not being monitored at all, or current monitoring is a by-product of some of the long-term scientific surveys.

What needs to happen to do so?

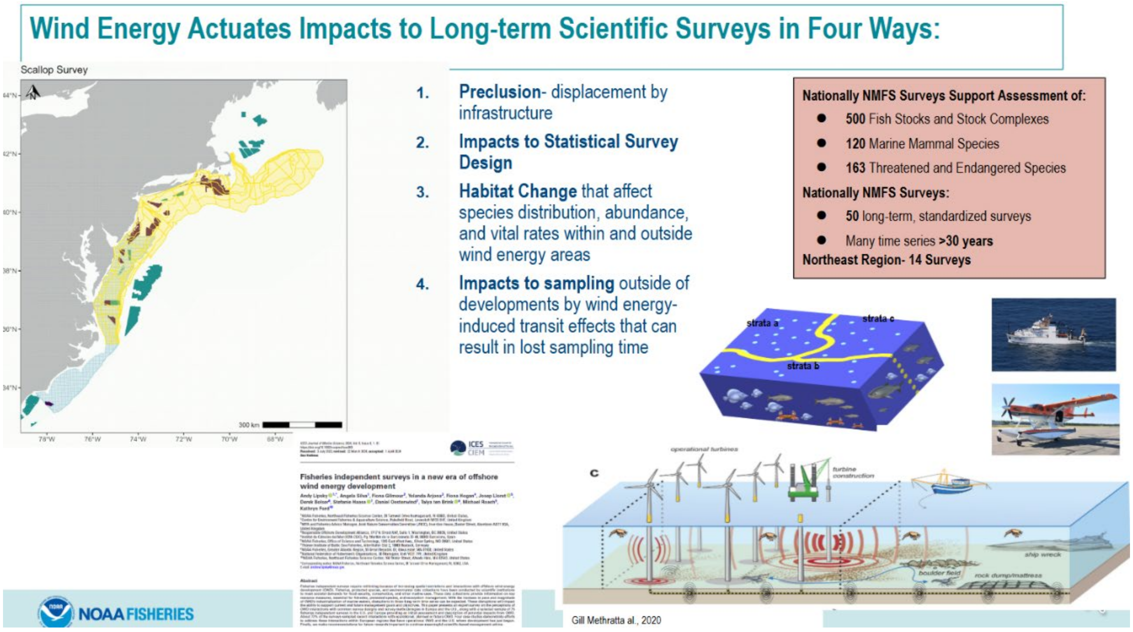
An approach similar to the one being developed in the northeastern U.S. was suggested, in which the operators would be legally bound to pay for alternative monitoring efforts (see abstract "Approach and Status of NEFSC Survey Mitigation" below). These efforts would be conducted in a scientific and statistically sound methodology to fulfill the role of the long-term scientific surveys in the area. Investigations originally meant to serve as environmental impact assessments of the OREs could also be used to supplement scientific surveys which originally used the area of the ORE sites as part of their survey area. To do so, it is essential that monitoring gets co-designed for the purpose of long-term surveys and data are openly accessible and stored for end users. Future monitoring of ORE operators will ideally be co-designed with ICES scientists in order to maximize the utilization of the data for scientific surveys and should be designed with the explicit intention of being compatible with long-term survey efforts.

When possible, a seabasin approach could also be considered. As an example, the Great North Sea Basin Initiative (GNSBI) is carrying out study work on the effects of ORE deployment on various sectors, including fisheries, i.e. Member States will be encouraged to move from a national approach to a sea basin level approach. In this respect, they will be encouraged to cooperate with neighboring countries (European Commission, 2025).

2.2 Abstracts

WKDISM Introduction & Survey Mitigation Strategy Recommendations

Authors: **Andy Lipsky**, Madison Hall, Catherine Foley, M, Abigail Tyrell, Elizabeth Methratta, Jon Hare, Mike Jech, Chris Orphanides, Joshua Hatch, Jason Morson and Angela Silva



Offshore renewable energy development will consist of multiple types of infrastructure, including both floating and fixed turbine foundations, submarine cables, offshore substations, and related activities. This development will occur over various phases and over long time periods. The U.S. has evaluated the impacts of proposed offshore renewable energy development on scientific surveys through a regulatory process led by the Department of the Interior Bureau of Ocean Energy Management. Because these impacts were determined to result in major impacts to NOAA Fisheries and the provisioning of scientific advice with consequent impacts on marine resources and marine resource users, the two agencies co-developed a scientific survey mitigation strategy. The strategy describes the issue and impacts; proposes an implementation strategy framework; goals, objectives, and actions; partners, stakeholders, and other ocean users; communications and outreach, and necessary resources. In addition, results were reported from WGOWDF authors who published a *Quo Vadimus* manuscript entitled "Fisheries independent surveys in a new era of offshore wind energy development" were also presented (Lipsky et al. 2024). This journal article reports the results of a survey of ICES experts on the perceptions of survey impacts and proposes a number of goals and recommendations that ICES and EU member states could consider in the development of a larger international strategy to address both ORE and Marine Protected Areas.

Many questions and some perspectives

Author: Espen Johnsen

Norway currently lacks a clear strategy to mitigate the impacts of losing long-term scientific survey areas due to offshore renewable energy (ORE) projects, other offshore industries, and marine protected areas (MPAs). However, national geodata map catalogues are available for download (https://www.geonorge.no/en), and tools for map visualization (e.g., https://www.barentswatch.no/en/) facilitate the mapping of overlaps between these areas and historical survey stations and transects. While all historical trawl stations and acoustic transects can be accessed through the Institute of Marine Research (IMR), there is no existing catalogue for survey area maps. Additionally, the access conditions for research vessels and the resulting capability to employ standard survey methods in individual OREs and MPAs are not well documented. A comprehensive description of access regulations by area is essential before conducting impact studies related to the loss of survey areas. Although access considerations remain somewhat ambiguous, it appears that smaller Uncrewed Surface Vehicles (USVs) may face fewer barriers to accessing ORE areas compared to larger research vessels. Hence, these new USVs could help compensate for potential access limitations for larger vessels. Regardless of the survey area restrictions, the IMR is actively developing and implementing cost-effective methods to substitute ship time and automate data analyses in standard surveys (Handegard et al. 2025 https://doi.org/10.1093/icesjms/fsaf069). USVs are positioned to replace research vessel time for echosounder data recording (Handegard et al. 2024 https://doi.org/10.1093/icesjms/fsae130; Komiyama et al. 2024 https://doi.org/10.1093/icesjms/fsae159). However, USVs do have weather limitations, and biological sampling is still necessary. A first fully integrated acoustic trawl survey for coastal sprat combining USVs for echosounder recording and a research vessel for trawling is scheduled to take place in August 2025.

MPA and Wind Development in the Maritimes Region of Canada

Authors: **David Keith**, Jessica Sameoto, Raphael McDonald, Nancy Shackell

This presentation explores the intersection of marine protected areas (MPAs) and offshore wind development in Canada's Maritimes Region, including the potential impact on fisheries, surveys, and species at risk. With federal goals targeting 30% ocean protection by 2030 and provincial initiatives advancing offshore wind—particularly in Nova Scotia—the overlap of conservation and energy development is intensifying. Spatial conflicts, survey coverage, and potential preclusion zones emphasize the need for the development of survey mitigation plans to ensure the integrity of long-standing data streams and our understanding of the health of Canadian marine ecosystems. Research presented includes highlighting how sub-optimal survey allocations can bias biomass estimates, especially when the distribution of the species is shifting over time, an example of how an MPA impacted biomass indices, and the use of spatial modelling for abundance estimation and bycatch vulnerability inside and outside closure zones. Overall, we underscore the importance of developing a plan to mitigate the impact of MPA expansion and ORE development on our ability to manage species and marine ecosystems in Canada.

The Narrowing Future of the IBTS: with a focus on the NS IBTS Q1

Author: Patrik Börjesson

This case study examines the spatial overlap between current and projected OREs and the International Bottom Trawl Survey in the North Sea (NS-IBTS). The NS-IBTS is a multispecies bottom trawl survey that has been conducted for over six decades. It provides abundance indices and biological data essential for stock assessments of demersal and pelagic fish species in the North Sea. Additionally, it contributes to biodiversity indicators and environmental quality assessments under the OSPAR Convention and the Marine Strategy Framework Directive. The survey design is based on ICES statistical rectangles, each approximately 30 by 30 nautical miles, and has been conducted biannually, during Quarter 1 and Quarter 3, since 1991. Currently, active OREs occupy roughly 1% of the total NS-IBTS survey area in Quarter 1, including the Channel, and intersect with less than 1.5% of clean trawl hauls conducted since 2004. However, evidence suggests that some previously used set and haul locations have already been abandoned. Projections for ORE development from 2030 to 2050 indicate a substantial increase in spatial overlap with the survey area: from 3.1% in 2030, to 6.9% in 2040, and 8.6% by 2050. The projected overlap with available historical clean trawl hauls increases accordingly—from 3.9% in 2030 to 9.9% in 2040, and 12.9% by 2050. Other constructions and regulatory constraints, such as underwater cables and marine protected areas (MPAs), further reduce the available survey area, as illustrated in the presentation. The impact of these additional factors needs to be evaluated on a case-by-case basis.

Exploring the impact of area exclusions on stock assessment indices using multi-objective optimisation

Authors: **Eleanor MacLeod**, Ciprian Zavoianu, Harriet Cole

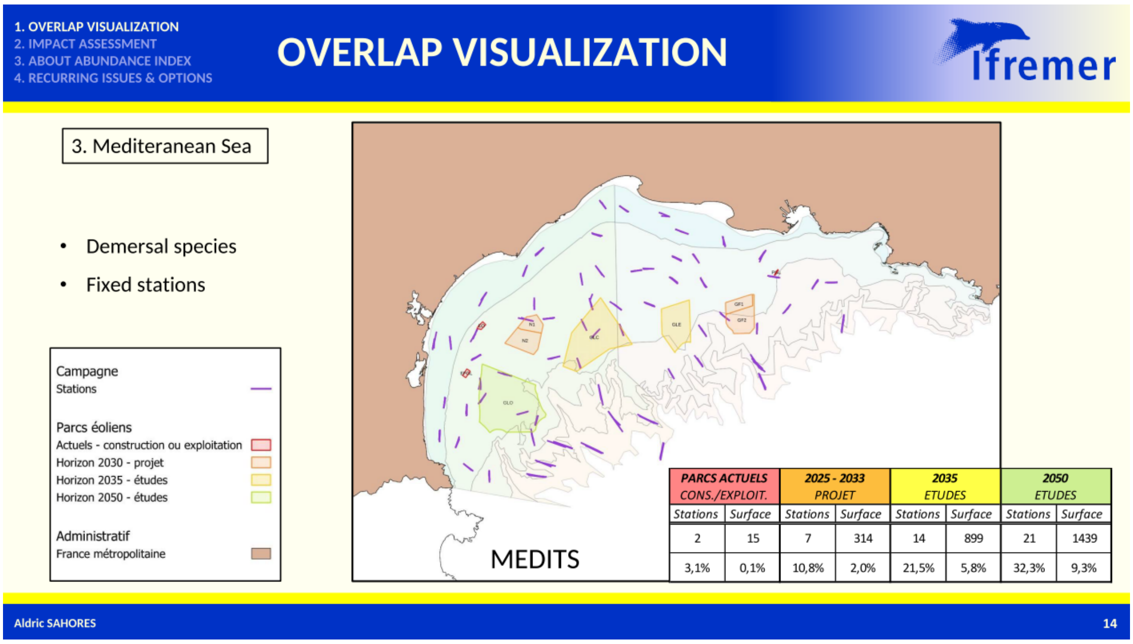
With the expansion in offshore renewables and MPAs, there is an increasing need to define the impact of such area exclusions on specific indices of abundance. As these surveys provide multiple indices of abundance, multi-objective optimization (MOO) is a useful computational approach that can be used to investigate which areas are most important for maintaining survey indices. This work implements MOO methods to examine the impact of area exclusions on both the Q1 and Q3/4 indices of abundance used in the Northern Shelf Haddock stock assessment. These indices of abundance were recreated as used in the latest assessment (2025) but constrained to 2010-2023 and the survey area was split into 0.5 x 0.5-degree grid cells. As a first step, leave-one-out runs were conducted, removing survey hauls from each individual grid cell and calculating the resulting difference in each index. This run demonstrated that removal of hauls from individual cells in north and northeast Scotland had a larger difference on the index than elsewhere across the survey area. The second step was to run a Greedy algorithm – this starts by removing the cell that has the largest impact on both objectives (both indices) and then sequentially removes the next most impactful cell. The goal of this was twofold: generates a baseline cumulative impact of removing combinations of grid cells and helps tune a non-dominated sorting genetic algorithm (NSGA II) – this is an evolutionary MOO algorithm that takes an initial set (‘population’) of potential solutions to the problem (combinations of grid cells to be removed) and subsequently improves it through a process inspired from natural evolution. Thus, solutions closest to the objective (maximizing the difference to both indices with removal of the fewest cells) are given a higher probability to ‘reproduce’ using specialized array splicing (‘crossover’) and on/off flip (‘mutation’) operators. This process generates a new set of ‘offspring’ solutions.

The best performers from the combined set of 'parent' and 'offspring' solutions are selected as the 'parents' of the next iteration ('generations'). After a number of iterations, NSGA-II is able to discover solutions that significantly outperform the original Greedy baseline. Results highlighted areas in the north and northeast of Scotland for maintaining the survey indices used in this assessment, and emphasized the potential cumulative impacts area exclusion will have – marine planners should be aware of these potential implications. MOO has been shown to be a useful tool for exploring this wider issue and the proposed methodology could be applied to other species to look at a range of different species.

Assessing the impact of O.R.E. on French Scientific Surveys

Authors: **Aldric Sahores**, Morgane Travers-Trolet, Nina Grandrémy

As the development of wind farms in French EEZ is starting to increase, a first assessment of potential impacts between O.R.E. and scientific surveys has been conducted, at four temporal horizons: current situation with existing wind farms (in operation or under construction), upcoming projects (2025-2033), and projects under study for 2035 and for 2050. First, spatial overlap was quantified in terms of percentage of lost survey area and percentage of lost sampling stations for 10 scientific surveys. Impacted surveys include bottom-trawl surveys from the North Sea to the Bay of Biscay and in the Mediterranean Sea (NS-IBTS-Q1, CGFS-Q4, WCGFS-G3, EVHOE-Q4 and MEDITS), beam-trawl survey (ORAGHO) and video survey (LANGOLF-TV) in the Bay of Biscay, pelagic acoustic surveys in the Bay of Biscay and in the Mediterranean Sea (PELGAS and PELMED), dredge survey in the English Channel (COMOR), and aerial survey in the Mediterranean Sea (SURVOL). Current overlap is still limited and concerns mostly the English Channel (maximum 3% of surveyed area, for the COMOR, and maximum of 6% of sampling stations, for the CGFS). Expected overlap in 2050 will reach 10% of surveyed area for PELMED and 32% of sampling stations for MEDITS, both in the Mediterranean Sea. Based on interviews with surveys' operators, an impact score has been developed to reflect the diverse flexibility of survey to adapt to the loss of access, and take into account the sampling gear, the vessel size, the sampling design and the spatial overlap. Several options for mitigation have been gathered, from reallocation of stations to definition of new strata and use of alternative monitoring equipment (drones, satellite sensors…). Finally, the effects of the loss of sampling stations have been explored on several abundance indices and indicate effects ranging from no effect to positive/negative bias according to the stocks, and in all cases an increase in the uncertainty.



The Portuguese Context for ORE

Authors: **Corina Chaves** and Inês Machado

Portugal is preparing for the installation of offshore wind farms (OWFs) through the Plan for Offshore Renewable Energy (PAER), which was launched in May 2023. The first part of the presentation focused on the current status of the PAER, which aims to achieve an installed capacity of approximately 9.4 GW by 2030, covering a total area of 2,711 km² across five zones along the west coast of mainland Portugal, mostly north of Peniche. The designated installation areas vary significantly in depth, ranging from 50 to 550 metres, and pose challenges related to seabed geology. The OWFs are mainly planned as floating wind farms, requiring extensive infrastructure such as submarine cables and substations. The criteria for the sustainable implementation of OWFs include environmental impact assessments addressing potential effects on seabirds, marine mammals, habitats, fisheries, aquaculture, navigation, tourism, and underwater cultural heritage. They also include mitigation, compensation and restoration measures, and cumulative impact assessments. IPMA is conducting comprehensive baseline studies covering geology, energy, biodiversity, and ecosystem functioning, under the EU-funded project *Technical studies for offshore energy potential*, with expected results to be published by 2026. The second part of the presentation highlights the expected disruptions to long-term scientific surveys coordinated by IPMA. Currently, four fisheries surveys are conducted by IPMA, all funded by the DCF: the Spring Acoustic Pelagic Survey and the Autumn Acoustic Juvenile Survey (both under WGACEGG), the Summer Crustacean Survey (being converted to UWTV under WGNEPS), and the Autumn Groundfish Survey under IBTSWG. Of these, the most impacted will be the PT-Q4-IBTS, with significant portions of survey strata affected (8 out of 36 strata), and up to 65% of the strata area impacted. At present, there is no mitigation plan in place. Ongoing efforts aim to assess and develop strategies to minimise these impacts and safeguard the integrity of long-term monitoring and scientific assessment programmes.

3 Term of Reference B: What scientific and management approaches are being taken and are needed to address the impacts from MPAs and OREs on long-term scientific surveys?

3.1 Discussion synthesis

The general discussion revolved around the methods and tools that would be available to address the changes to surveys. It was clearly understood that, while similar, the approaches taken towards MPAs and OREs will be different, however, similar approaches and guidelines should be considered.

The highlighted points are that any new methodologies need to be fully quality controlled, provide robust information about populations given certain patterns of distribution, and consider the same spatial and temporal resolution as the survey data that is being lost. Data needs to be reviewed and stored in a way that it is accessible and standardized. Common challenges to these are the cost of the new equipment and infrastructure, as well as the need to “up-skill” scientists' knowledge.

It needs to be taken into account that this takes time and that scientists should be involved at the earliest planning stage for OREs, MPAs and other possible developments.

Part (a)

How can sampling designs be adapted to address changes to areas no longer accessible to existing surveys and changing habitats due to ORE and MPA establishment?

Clear guidelines and considerations to ensure survey design is fit for purpose has been considered in detail previously by ICES (WKSAD 2004, 2005). A key consideration being that the population(s) being estimated must be available to the survey. Where that is not the case the design assumptions are likely to be contradicted, and alternate methods need to be sought and evaluated to fill in data gaps and allow population level advice to continue. This is particularly important where the distribution of the underlying target population(s) is unknown or likely to change. Equivalency between designs and sampling methods are not trivial and we highlight below key considerations across a range of existing survey approaches. However, it is important to note that national sampling requirements are evolving quite rapidly with the introduction of new regulations such as the Nature Restoration Law (NRL). The impact of restricting national sampling in these areas may have resource impacts and therefore is not considered here as new questions and sampling techniques continue to expand.

Sampling designs are generally developed and selected to provide robust information about populations given certain patterns of distribution. While different designs may not be exclusive, each design has its own unique assumptions and not all will be optimum for the target population or objectives.

For OREs, multifarious issues, both design and sampling method, combined with various infrastructures being used (e.g., fixed or floating) enhance the complexity and magnitude of the issue being faced. Losing access to regions compromises survey data time series, which in turn creates several consequential effects e.g., impact on scientific advice.

The break-out groups suggested a range of sampling design adaptations but the feasibility of these suggestions depend on a number of factors.

Initially it is important to formulate clear survey objectives, which consider the final product (i.e. the fisheries advice, ecosystem advice etc).

Survey re-designs were explored with a move towards employing multiple, inter-calibrated methods and a nested survey design for project level monitoring (short term, such as during the implementation period, before and after) and long term surveys.

It was discussed that there is potential to gain access to OREs using a smaller vessel with smaller/ adapted gears, however, this would require gear trials, data calibration and safety considerations.

Part (b)

What are the challenges in calibration, cost, time, methods?

The breakout groups discussed this section and formulated a vast number of challenges

Calibration:

Calibration applies to both instruments and survey methods, especially when comparing inside vs. outside exclusion zones. There is variability and unpredictability of available time to obtain a meaningful inter-calibration of old and new methods and the spatial and temporal cover of the employed methods. The calibration needs to be clearly designed and managed and be done ahead of time when the area is being closed, rather than once the site has been closed and likely altered by development.

Cost:

There are considerable amounts of cost, starting from increased vessel and sea-time for staff when OREs will have to be circumnavigated, the cost of researching, introducing, and calibrating new survey designs or methods (in staff and sea times as well as in the actual cost of the technology). New and novel techniques e.g., genetics and eDNA may require outsourcing to contractors e.g., due to facilities required, staff capacity or staff expertise and further costs will also arise from staff training.

Down-stream extended staff time is needed to develop new methodologies to give sustainable fisheries and ecosystem management advice, new databases and data storage systems need to be considered, as well as the up-keep of those and further training. Additionally long-term maintenance costs need to be considered.

Further challenges arise from time frames and the methods to be employed.

While “shiny new methods” are attractive to some stakeholders, they cannot completely and immediately replace traditional ones; this needs the consideration of spatial and temporal cover, the selectivity of different species, especially since scientific surveys now try to monitor a considerably larger number of species than those initially targeted, and the challenges in actually developing new survey technologies to a standard that they are actually employable and setting up new infrastructure. All this needs careful planning for long-term monitoring.

Making changes to scientific surveys in general is challenging, this includes finding support and resources from policy makers and management to implement the necessary changes as well as the required reviews to ensure data is robust and usable. If a new survey index has to be created following the introduction of new methodologies or sampling designs, this can take about five years until the index is usable for stock assessments. Changing survey methods and the resultant data collected also has secondary effects: There will be subsequent impacts e.g., to stock assessments. Adjustments to existing stock assessments take time, as all data needs to be reviewed, possibly additional data needs to be collected, the alternative data needs to be fully investigated with respect to the usefulness for the assessment of a specific species or population. Resourcing staff for those processes will be an additional limiting factor.

Another challenge lies in the communication between the different stakeholders involved; there exists a lot of "techno-optimism" while there is also the desire to "not change anything".

The need for robust technologies to ensure the continuation of high quality, quality-controlled survey indices/ survey data is not yet taken into account by many of the people involved in the planning process of MPAs and OREs, clear communication is the first step to get stakeholder buy-in.

Part (c)

What scientific sampling methods and approaches, including traditional and new sampling technologies, are being considered to address survey compatibility with ORE and MPAs?

It was discussed that most approaches take time and are costly; any methods taken forward will have to be clearly understood, designed and calibrated against existing surveys prior to being fully implemented. To successfully do this, scientists (i.e. survey scientists, fisheries/ stock assessment scientists and statisticians) should be included from the very first planning stages of the ORE or MPA to minimize the risk of losing data and maximising the long-term monitoring success.

A range of alternative methods have been considered in the break-out groups, and it was considered that a multi-method approach, combining methods to leverage their strength and minimize the weaknesses should be considered. Those methods fall largely into two categories: independent ones and alternative platform approaches.

Independent ones include methods such as acoustics, telemetry, application of eDNA or, particularly in MPAs, video footage-based methods. The platform-based approaches largely focus on how the data could be collected, such as shifting from a research vessel to smaller vessels, drones, divers or fixed equipment.

Specific access points / sampling corridors / monitoring spots within the ORE/MPA were a preferred idea by several group members. Those corridors would be areas within OREs where the use of traditional survey gears would be possible, complementing sampling in the (remaining) survey area outside with survey stations inside the ORE/MPA. The advantage would be the application of the same methods as previously, allowing for uniform sampling and joint data analysis. These stations could give valuable information through the comparison with the existing long-term survey datasets. However, multiple considerations must be considered with potential impact of this on commercial fisheries and the statistical impact of changing sampling to only a single corridor within the ORE site.

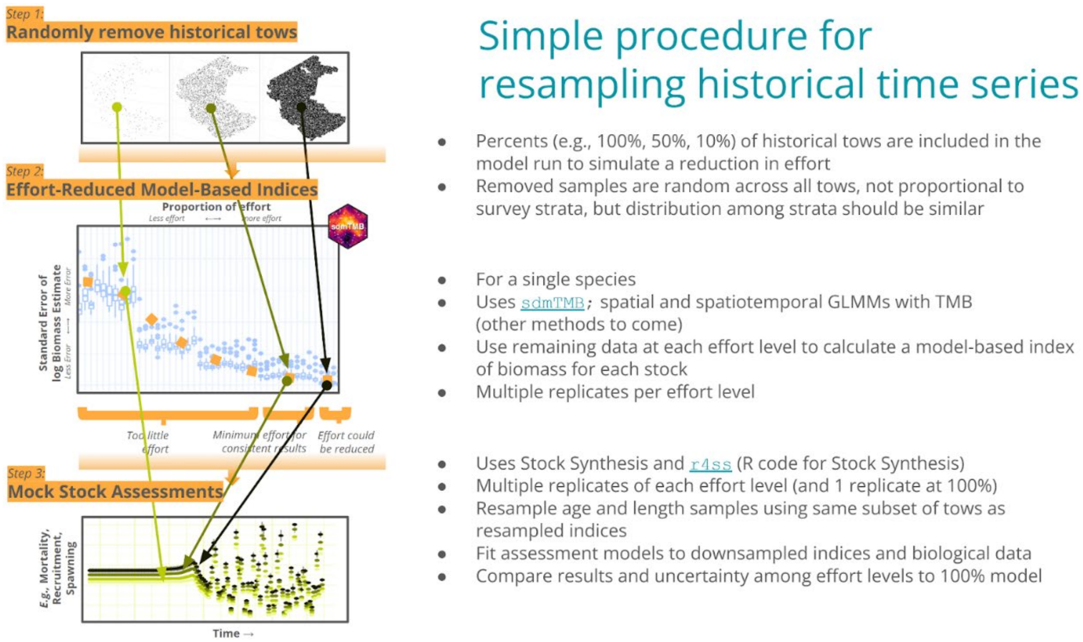
All approaches and methods should be selected based on the element of survey mitigation one is trying to address (e.g. exclusion, logistics, survey statistical design) and the tool(s) that allow for meeting that need.

Additionally, statistical tools should be developed/ improved to combine multiple data sources into the assessments, however this requires overlap of coverage in space and time.

3.2 Abstracts

surveyresamplr: Quantifying survey effort and stock assessment uncertainty relationships

Authors: **Emily H. Markowitz**, Derek D. Bolser, Elizabeth Pearl, Ian Taylor



Fishery-independent surveys are a critical source of data on fish stock biomass, composition (e.g., size, age, sex), and broader ecosystem dynamics, forming the backbone of many stock assessments. These surveys play a key role in tracking ecosystem changes and supporting sustainable fisheries management under increasing climate pressures. However, their implementation is vulnerable to disruptions from weather, institutional shifts, and resource limitations such as rising operational costs or reduced funding—factors that can undermine their consistency and reliability over time. While these challenges are often acknowledged, their impacts on stock assessments are rarely quantified. Given the high investment in survey programs, understanding these effects is essential for optimizing survey effort.

To help fill this gap, we present a case study examining how changes in survey effort influence uncertainty in stock assessments, focusing on species monitored by the U.S. West Coast Groundfish Bottom Trawl Survey and assessed by the Northwest Fisheries Science Center (NWFSC).

Recognizing the broader utility of our approach, we developed an open-source R package, {surveyresamplr}, to support others exploring similar questions in survey design. This presentation will share preliminary findings from our case study and introduce the features and applications of {surveyresamplr}. By offering both analytical insights and reproducible tools, this work aims to support more adaptive, efficient, and climate-resilient fisheries science and management.

Disclaimer: This project, findings, and R package are still in very early stages of development. We are working on streamlining the process before focusing on best model, parameter, etc. choices.

Development of a multimethod pilot survey to monitor trends in abundance and demographics of fish associated with wind turbine foundations, scour protection, and other structured habitat off the coast of the Northeast USA

Authors: **Jason Morson**, Katie Viducic, Elizabeth Alonzo, Dave McElroy, Joe Letourneau, Madison Hall, Anna Mercer, Andy Lipsky

Fishery-independent surveys are the primary data source for many stock assessment models. Offshore wind construction and operation will preclude some long-term, fishery-independent surveys from accessing areas within or around offshore wind farms due to operational limitations and safety concerns. In order to ensure continued collection of data on fish abundance, biomass, and demographics, modifications to survey designs, methods, gears, and analyses may be necessary.

Hook-and-line fishing and optical surveys are two potential alternative gears that can be used to sample fish in places where traditional fishery-independent survey gear, like bottom trawls, cannot be deployed. In close collaboration with the fishing industry, we piloted a fishery-independent survey in the northeast USA in spring and fall 2024 and spring 2025 using a combination of automated jigging machines, traditional hook-and-line gear, and a benthic stereo camera system. Video analysis showed diverse, high-density communities of fish aggregated around wind turbines. The two standardized hook and line methods caught a wide variety of species, but most of the total catch consisted of just a few species, confirming the highly selective nature of this sampling gear. Multimethod, complementary approaches like this could address multiple survey objectives simultaneously.

Adapting Scientific Surveys to Offshore Renewable Energy Expansion: A Spatial Simulation Approach to Bottom Trawl Surveys in the Northeast US

Authors: **Catalina Roman**, Gavin Fay, Angelia Miller

An emerging issue in the U.S. and Europe is the interactions between the growing offshore wind development sector and the scientific monitoring of fisheries. Quantifying the effects of wind development to scientific sampling, as well as understanding and mitigating the impacts to data products is critical for fisheries management. We developed a spatially explicit multispecies simulation framework for the US NOAA Northeast Fisheries Science Center multi-species bottom trawl survey to evaluate wind area driven changes to surveys and test changes in the performance of sampling strategies for information used for stock assessment and management advice. The modelling framework emanated from two stakeholders workshops whose outputs included prioritizing elements of interest in the model, simulation scenarios, and a list of case study fish stocks. The simulation testing consists of a population dynamics operating model; an observation model to reproduce survey sampling designs; estimation models to assess survey data and its products; and performance measures to compare data products among different simulation scenarios and stocks, including bias and precision and accuracy of perceived uncertainty. Our previous simulation work identified that annual relative abundance estimates were changed when survey effort was assumed to be precluded from wind energy areas, but that the overall magnitude of effect was dependent on species and had high interannual variability. Our study aligns with ICES objectives by contributing to the broader discussion on how ORE affects long-term scientific surveys. By providing a reproducible framework for evaluating flexible fishery-independent survey designs, our research supports the advancement of methods that mitigate ORE-related disruptions and sustain the integrity of long-term data products for robust fisheries and ecosystem management.

New technologies for maintaining and augmenting fisheries and ecosystem surveys in marine development and conservation areas.

Authors: **Conor McManus**, Cameron Fairclough, Marinna Martini, Mike Jech, Chris Orphanides, Peter Chase

Ecosystem monitoring in marine development and protected areas can be challenging due to a myriad of factors, including vessel preclusion, regulatory requirements, and remoteness. The development of uncrewed systems is sought to meet these challenges and collect required data for stock and ecosystem assessments. Here, we present two endeavors of the Northeast Fisheries Science Center (NEFSC) to mitigate new and future survey challenges related to marine development areas. The first case study is the application of autonomous underwater vehicles with optical payloads to allow for continuation of a towed-sled optical survey for Atlantic Sea scallops in marine development areas where larger research vessels are precluded. The second case study is expanding the utility of uncrewed surface vehicles equipped with active-acoustic systems to understand fish and zooplankton biomass in and around marine development areas, as well as regions where current data streams are lacking. As these technologies are developed further, we plan to provide a path forward for mitigating the current challenges we face with marine ecosystem sampling, providing data directly useful for stock and ecosystem assessments, and building out the applications of these tools for additional marine ecosystem research and monitoring needs.

Biodiversity and ecosystem functioning on and around offshore renewable energy devices

Author: Ninon Mavraki

During this presentation, the research that we conduct at the Benthos/Reef team of Wageningen Marine Research in the Netherlands was presented. We are a team of benthos scientists focusing on the effects of offshore artificial structures (such as shipwrecks, offshore renewable energy devices, etc.) on the marine environment. We investigate these effects by exploring the biodiversity and functionality of invertebrate species that attach to the newly introduced habitats, known as fouling fauna. We are also interested in exploring the invertebrate biodiversity and functionality on natural rocky reefs in the North Sea and comparing them with the artificial substrates. To identify biodiversity and ecosystem functioning, we usually try to collect physical samples, mainly by diving on location and collecting scrape samples. In case this is not possible, we conduct image analyses, or we use our innovative ROV tool that can collect quantitative samples from hard structures. This tool is still being developed to assure that it can collect data comparable to those collected by divers, while we wish to advance it by adding a mechanism that can collect entire rocks from scour protection layers of offshore wind turbine foundations. Finally, we can measure nutrient fluxes by using a hemisphaerical dome that can enclose the fouling fauna attached on a hard substrate and see how the enclosed organisms can affect their surrounding water properties, such as oxygen concentration, chlorophyll a, etc. With the results of our analyses, we can make estimates on the biodiversity found on different structures, different ages of the structures and geographic locations, while we can also do meta-analyses and investigate functional traits or food-web complexity.

The second part of the presentation was focused on the results of my PhD (Mavraki 2020: On the food-web ecology of offshore wind farms, the kingdom of suspension feeders). During my PhD, I investigated the food-web ecology around offshore wind turbine foundations. I indicated that food-web complexity increases with increasing depth, while it is the largest at the soft substrates surrounding the offshore wind turbine foundations, as the accumulation of organic matter may attract an array of different species, belonging to multiple trophic levels. Furthermore, it was observed that the blue mussel, *Mytilus edulis*, was the species with the highest biomass-specific carbon assimilation, which was not surprising as it is a very dominant and heavy organism on offshore wind turbine foundations. Finally, I presented my PhD results on the feeding activities of five fish species that can be frequently found close to the foundations. The results indicated that benthic and benthopelagic fish utilize offshore wind turbine foundations as feeding grounds for a prolonged period of time. Pelagic fish, however, seem to be attracted by the foundations but they do not feed on the fouling fauna that is attached there.

The last part of the presentation was dedicated to the Working Group on Marine Benthal and Renewable Energy Developments (WGMBRED). This is an active working group that consists of scientists from multiple European countries and the USA. It exists since 2012 and meets once per year. The group's goals include: (a) ToR A - aims at identifying opportunities for cross-cutting links and communication between ICES groups in relation to renewable energy and marine ecosystems to support the implementation of the ICES ORE Roadmap (ICES, 2024) ; (b) ToR E - it is the continued expansion of the joint BISAR database with case study on non-indigenous species, which we are further interested in further advancing and adding fish species; and (c) ToR G - aims on strategic collaboration to support and update the consequences and trade-offs between various offshore renewables and the biodiversity benefits derived from MPAs.

Can fisheries independent survey data be used to assess the effect of offshore wind development on fish abundance?

Authors: **Fiona Gilmour** and ICES WGOWDF

The DaPSIR (Driver, Activity, Pressure, State, Impact, Response) framework, commonly used for ecosystem assessments and adapted by ICES WGOWDF was outlined. How this framework was used to map cause-effect relationships, linking habitat change associated with offshore wind (OSW) development and the potential consequential impacts on fish, was briefly discussed. Another short-term, pilot project, part of which explored the use of DATRAS fisheries independent survey data base to assess the impact of OSW construction and operation on fish abundance, was summarised. The key take home messages from this were:

- the need for monitoring of fish abundance, biomass and distribution within OSW sites and adjacent waters, as their role in wider fisheries species population dynamics and subsequent potential consequences at a stock level is unknown
- the importance of the spatial and temporal scale of data collection
- basic site level data associated with OSW developments were difficult to compile
- evidence of the loss/ movement of survey stations within and around operational OSW sites.

4 Term of Reference C: Develop a work plan to establish an ICES Strategy to mitigate the impacts of OREs and MPAs on scientific surveys and scientific assessment and advice.

4.1 Discussion synthesis

A strategy document was discussed, which will form part of the output of this workshop. The document will (in its draft form) be added as an annex and further developed to be presented at ICES Science Committee meeting in September 2025.

Recommendations for ICES Strategy Development (25 May 2025)

1. **Workshop Participants determined that it is useful for ICES to have a Survey Mitigation Strategy that addresses the disruption of scientific surveys from ORE and MPAs**

2. **This Workshop can provide a suggested framework for what this strategy would include and steps to develop the strategy with ICES**

3. **Outline the scope and level of granularity of the Strategy and Workshop Recommendations**
   - Overarching Goals that would be common and useful to ICES participants,
   - Objectives,
   - Suggested Principles,
   - Operational Definitions,
   - Recommended Design, Methods, and Modeling Approaches
   - Groups or workshops that should be engaged

   Consider the scope of this strategy to also address other increasing ocean uses that may have similar effects as ORE, MPAs---this would include deep-sea mining, other energy facilities/infrastructure, e.g., hydrogen; marine carbon dioxide removal (mCDR). Consider regulatory constraints or needs - how to enable survey activities

4. **Who is the audience for this Strategy?**
   - ICES member nations (scientific institutions and consenting agencies)
   - Indigenous/First Nations, co-management partners
   - Fishing industry and fisheries collaborators
   - Conservation organizations and ORE developers proposing offshore renewables or proposing MPAs
   - Other users of ocean space, including aquaculture
   - mCDR and deep-sea mining

5. How does this ICES Strategy intersect other ICES or other scientific efforts outside of ICES?

- ACP Regional survey?
- WKUSER
- All EOSG WGs
- ORE WGs
- MPA WGs
- DGMARE

6. Useful links and approaches to draw from to populate a draft strategy framework

A.

Reports from previous work

1. U.S. Northeast Survey Mitigation Strategy
2. WKUSER1 report
3. WKUSER2 report
4. Planned TORs for upcoming WKUSER3

Suggested ORE (& MPAs) impact scientific surveys in four ways - Following Lipsky et al. (2024); Hare et al. (2024)

1. Exclusion
2. Impacts on statistical design
3. Changes in habitats that are unmonitored
4. Loss of sampling efficiency

Elements/Steps for Mitigation

1. Evaluate survey designs: Evaluate and quantify effects and impacts
2. Identify and develop new survey approaches: statistical designs, platforms, and methods
3. Calibrate new survey approaches: Ensure continuity, interoperability, precision, and accuracy of data collections.
4. Develop interim provisional survey indices: Bridge the gap in data quality and availability
5. Address monitoring to fill scientific survey data needs for the operational life-span of project developments.
6. Develop and communicate new regional data systems: New data analysis, management, dissemination and reporting systems. Collaboration with fishery management, fishing industry, scientific institutions and others
7. Establish Survey Mitigation Programs at the appropriate political and spatial scales to ensure consistency and effective implementation.

B.

ICES Quo Vadimus Survey Mitigation Paper
https://digital.csic.es/bitstream/10261/386444/1/Lipsky_et_al_2025.pdf

The five goals of an ICES Strategy could be adapted from those of the US, acknowledging that in order to achieve these goals they must be coordinated with neighboring jurisdictions:

1. Mitigate impacts of OWD on fisheries surveys;
2. Evaluate and integrate, where feasible, OWD monitoring studies with fisheries surveys;
3. Collaboratively plan and implement fisheries survey mitigation with partners, stakeholders, and other ocean users using the principles of best scientific information available and co-production of knowledge,including fishermen's local ecological knowledge;
4. Adaptively implement this strategy recognizing the long-term nature of the surveys and the dynamic nature of OWD, survey technology and approaches, marine ecosystems and human uses of marine ecosystems; and
5. Advance coordination between countries and ICES in the execution of this strategy and share experiences and lessons learned with other regions and countries where OWD is being planned and underway

Consider adapting these following Recommendations from Lipsky et al. (2024)

1. Complete an inventory and evaluation of fisheries independent surveys that are, or will be, impacted by existing or proposed OWD (see for example Haase et al. 2023 for the Baltic Sea); and leverage existing data and communications to establish web-based portal(s) for conveying this information.
2. Design, apply, and report out on standard methodologies for evaluating risks or impacts to surveys impacted by ORE and MPAs
3. Communicate and report on statistical and sampling methods and approaches for mitigating impacts to fisheries data collections
    a) Evaluate and report current approaches and survey mitigation success/evaluations
    b) Consider establishing transboundary/transnational set of performance metrics for assessing the impacts of MPA/OREs and other types of survey disruptions.
4. Develop standards and regional guidance that improves applicability of environmental monitoring conducted where there are overlaps with OWD for fish population assessments, including collaborative knowledge co-production as a guiding principle.
5. Create or use existing tools to test how changes in data collections affect stock advice and management, e.g. through simulation modeling or sensitivity analyses
    a) Cumulative effects of OWD and other spatial management designations, such as MPAs, that also may exclude fisheries data collections
    b) Test through management strategy evaluation various fisheries management risk policy decisions associated with increased uncertainty due to impacts in fisheries data collections
    c) Conduct research and simulation modeling to better understand the consequence on ecosystem services such as food provisioning if fisheries independent surveys are excluded from OWD areas.

6. Following on findings from ICES Workshop on Unavoidable Survey Effort Reduction 2 Design, test, implement, and report findings on flexible survey designs

for new surveys that are resilient to changes caused by long-term or short-term survey disruptions.

7. Establish and share consistent monitoring approaches and standards at the project, regional, and ecosystem levels in order to effectively monitor potential habitat changes due to OWD that have the potential for population level consequences with the following priority foci:
   a) Data should follow Findability, Accessibility, Interoperability, and Reusability (FAIR) guiding principles for scientific management and data stewardship (Wilkinson et al. 2016)
   b) Statistical design
   c) Survey methods
   d) Calibration & Integration of Monitoring Approaches
   e) Linking across spatio-temporal scales (Individual turbines to OWD to Large Marine Ecosystems) and
   f) Modeling approaches, including use of project and regional survey information to account for cumulative impacts on populations, habitats, and ecosystems
8. Within an overarching offshore renewable energy strategy, organizations could leverage their extensive interdisciplinary expertise in marine science and data collections to ensure timely, precise, and accurate information for assessments is maintained.
9. Inventory and conduct research on the interactions of OWD on fisheries dependent data collections. Fisheries dependent data is data derived from fishing activities (i.e. vessel logbooks, observer data, and vessel monitoring systems). Displacement of fishing vessels from OWD could affect the time series of these data sources and their use in fisheries management.

C.

Spatial Survey Mitigation Hub (see NEFSC example)
Interactive spatial layer data tool

- Survey footprints
- Precluded areas (planned and executed)
  - Offshore developments
  - Marine protected areas
  - Define access constraints
  - Critical habitats
  - Fishing closures?

D.

What are the steps or Work Plan that needs to happen, including who and when?

- ICES establishes working group and workshop to finalize
- Consider WKUSER 3 for ideas

4.2 Abstracts

Approach and Status of NEFSC Survey Mitigation

Authors: **Madison Hall**, Kathryn Ford, Andy Lipsky, Jon Hare

NOAA's Northeast Fisheries Science Center (NEFSC) has developed survey mitigation plans across our survey enterprise, and is in the process of finalizing the Northeast Survey Mitigation Program. From May 2025 - May 2026, we will be negotiating and entering into agreements with offshore developers in order to satisfy the requirements of survey mitigation as outlined in each project's Construction and Operations Permit (COP). This presentation gives an overview of the NEFSC survey enterprise, the requirements for survey mitigation as described in the project COPs, and how we built our survey mitigation Plans/Program/Budgets. We also lay out the survey mitigation options that are available to developers in order to meet mandates, including the Regional Survey Mitigation Program option, and how we used a cost model and the Survey Mitigation Program budget information to calculate Lessee Contributions for developers that wish to meet their obligations by participating in the Regional Program.

5 Conclusions

WKDISM sees the need for ICES to play a key role in future planning and coordination of survey activities covering the areas of OREs and MPAs, otherwise the costs of losing those areas to the surveys down-stream in the assessment of fish stocks and ecosystem states will be high.

In principle, this would occur via two different routes, depending on the stage of implementation of the sites.

I. For ORE sites and MPAs yet to be planned: In order to minimize the loss of survey information from the sites, survey and fisheries scientists should be involved in an early planning stage, before the sites are designed in detail. Ideally, scientists, marine spatial planners, and ORE operators would co-design the future monitoring activities inside the site, both in terms of sampling stations, and in terms of methods used. This also includes the agreement on conditions for access, such as time periods and vessels or platforms to be used.

   This co-design should become a standard procedure linked to the approval of new OREs and MPAs, where it also helps the operators by defining their own monitoring schemes for environmental impact assessment (EIA) and having it approved through a common agreement.

   Co-design will require a site-by-site approach, yet in many cases copying the agreements from previously approved sites may be possible.

   Comment: A similar approach may be considered for MPAs as far as possible under the respective legislation.

II. For ORE sites and MPAs already in operation, WKDISM proposes that the workplan for the ICES strategy involves the following steps on the level of the individual surveys affected by the loss of survey area through access restrictions: (1) Assessment of survey area lost, (2) estimation of the impact on the quality of the survey products, (3) exploration of the options for supplementing and improving the survey products with ongoing EIA surveys conducted by the ORE operators. Public access / access to ICES scientists to the EIA monitoring data is required here, and needs to be achieved through agreements between ICES and the relevant national authorities of the member states. (4) If needed, addition of new survey elements inside the existing sites should be considered to complement scientific surveys outside and mitigate the impact on those surveys. These new monitoring elements will ideally be co-designed between ICES scientists and ORE operators, and can be included in the operators' EIA reports. Thus, the resulting data need to be exchanged and made available for both purposes (ICES surveys and EIA of OREs).

   Comment: An analogous approach can be taken for MPAs where instead of the EIA, the procedure addresses the periodic assessment of and reporting on the effectiveness of the MPA.

Both routes require a strategic involvement of ICES. For (I), ICES would take the role of partner in the planning stage of the sites, working in close collaboration with the authorities granting the approval of the respective ORE sites in the Member States. For (II), ICES would collaborate with the authorities evaluating the environmental impact assessments of OREs, or the periodic assessments of MPAs. This would also need to include legal bindings and costs for mitigation being planned ahead for approximately 30-50 years.

In addition to the ICES strategy on survey mitigation, a number of future directions were discussed relative to the planning, implementation, and mitigation for OREs and MPAs. There are clear needs for further research on the impacts of ORE/MPA sites on marine ecosystem surveys. It would be useful to develop specific guidelines on how to measure the impact of lost survey area, and how to prioritize sampling areas for surveys impacted by lost area. Similarly, specific tools and guidelines for evaluating the quality of surveys and survey data sets, and therefore the impacts of data loss, are also needed. These tools and guidelines should form the basis for a standardized approach to impact assessment. One specific need that was discussed is a tool for simulating acoustic survey data, which could be used to investigate the impacts of reduced hydroacoustic survey effort in the same way that simulation tools are currently used to model trawl data. In order for these tools, protocols, and strategies to be effective, communication and coordination between site developers, permitting agencies, and survey scientists must happen early and often throughout the process. Finally, it is important that planning and mitigation strategies consider long-term effects and impacts, often over several decades.

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Annex 1: List of participants

First name	Last name	Affiliation
Kelly	Andrews	NOAA/National Marine Fisheries Service/Northwest Fisheries Science Center
Elena	Balestri	Scottish Fishermen's Federation
Patrik	Börjesson	Swedish University of Agricultural Sciences (SLU Aqua)
Finlay	Burns	Marine Directorate, Scottish Government
Peter	Chase	NOAA Northeast Fisheries Science Center
Corina	Chaves	IPMA - Portuguese Institute for the Sea and Atmosphere
Kenneth	Coull	Commercial Fishing Science Officer
Peter	Croker	The M Horizon (UK) Limited (Director)
Rufus	Danby	Scottish White Fish Producers Association
Annica	De Groote	Swedish University of Agricultural Sciences (SLU)
Catherine	Foley	NOAA, Northeast Fisheries Science Center
Kathryn	Ford	NOAA Fisheries NEFSC
Clive	Fox	Scottish Association for Marine Science
Martina	Gaglioti	IUCN/SER
Fiona	Gilmour	Cefas
Nina	Grandrémy	
Madison	Hall	NOAA - Northeast Fisheries Science Center
David	Hanisko	NOAA Fisheries
Keith	Hankowsky	University of Massachusetts Dartmouth - School for Marine Science and Technology (SMAST)
Ben	Hatton	Cefas
Charlie	Hobbs	Centre for Environment, Fisheries and Aquaculture Science/Member of ICES WGORE
Ian	Holmes	Cefas
Espen	Johnsen	Institute of Marine Research, Norway
David	Keith	Fisheries and Oceans Canada
Andrew	Kenny	CEFAS
Rob	Kynoch	Fish survey and Senior Fishing gear technology scientist

Laura	Lemey	ILVO Belgium
Andy	Lipsky	NOAA Fisheries
Inês	Machado	WavEC - Offshore Renewables
Eleanor	Macleod	Robert Gordon University
Emily	Markowitz	NOAA Alaska Fisheries Science Center
Ninon	Mavraki	Wageningen Marine Researc
Conor	Mcmanus	NOAA Fisheries Northeast Fisheries Science Center
Jason	Morson	NOAA Fisheries
Hans	Polet	ILVO
Yves	Reecht	IMR, Norway
Charlotte	Reeve	Cefas, UK
Catalina	Roman	University of Massachusetts Dartmouth
Juan	Ronco Zapatero	Kuleuven (Belgium) Faculty Social Sciences
Aldric	Sahores	Ifremer
Pia	Schuchert	EOSG chair
Anne	Sell	Thünen Institute of Sea Fisheries, Germany
Margaret	Siple	NOAA AFSC
Guldborg	Søvik	Institute of Marine Research
Dominique	St.Amand	NOAA/National Marine Fisheries Service
Mariana	Steen	Bureau of Ocean Energy Management (USA)
Duane	Stevenson	US National Marine Fisheries Service
David	Stokes	The Marine Institute
Morgane	Travers-Trolet	IFREMER
Paula	Valcarce Arenas	Spanish Oceanographic Institute

Annex 2: Resolutions

Workshop to Develop an ICES Survey Mitigation Strategy (WKDISM), chaired by Pia Schuchert, UK, Andrew Lipsky, USA, Duane Stevenson, USA and Conor McManus, USA, will be established and meet in Copenhagen, Denmark, 23-27 June 2025, to:

a) **Describe and evaluate the interactions of MPA and OREs on long-term scientific surveys across ICES regions**
   i. Identify spatial and temporal overlaps between multi-annual scientific survey programmes and existing and future proposed OREs and MPA's
   ii. Review the types of potential impacts caused by ORE developments and MPAs on surveys and the potential cosquences for assessments and advice

   (Science Plan codes: 3.2, 3.3,3.4,3.5, 4.4);

b) **What scientific and management approaches are being taken and are needed to address the impacts from MPAs and OREs on long-term scientific surveys**
   i. Identify the scientific survey needs to adjust to large scale ORE and MPA development, including:
   ii. Inventory mechanisms, strategies and programs, including regulatory or nonregulatory approaches, to mitigate the impacts (as described in ToR A) on scientific surveys, including on case studies where survey mitigation is being implemented

   (Science Plan codes: 2.7, 3.1, 3.2,3.3,3.4,6.27.4);

c) **Develop a work plan to establish an ICES Strategy to mitigate the impacts of OREs and MPA on scientific surveys and scientific assessment and advice**

   (Science Plan codes : 2.7, 3.2, 3.4,3.6,4.5, 5.1, 7.3);

WKDISM will report by the 11th July 2025 for the attention of the SCICOM/ACOM.

Supporting information

Priority	ORE Roadmap released in 2023 identifies goals, objectives, and priority actions This workshop addresses multiple goals and objectives in the roadmap with a particular focus on Priority Action 4 for 2024: the assessment of OMRE developments on fishery and ecosystem observation surveys, fisheries management advice, and recurrent ICES advice.

Scientific justification	The loss of long term survey areas and the required adjustmentst needs to be carefully considered within the ICES member countries. As per the ORE Roadmap, ICES needs to develop a strategy to address the impacts of ORE and MPAs on long-term scientific surveys in order to continue to provide timely, accurate, and precise scientific advice to support fisheries and ecosystem management. Many ICES member countries are experiencing large-scale offshore renewable energy development and will require tools and methods to modify and modernize scientific surveys. Specific activities for each of the above ToRs would include the fillowing: **ToR A** 1. What is the impact of losing survey activity in the area or changes in the productivity of areas on the assessment of a stock 2. Assess if and in what cases ORE or MPA monitoring activities can supplant long-term scientific survey effort 3. Identify assessments and advice setting processes that maybe impacted by ORE and MPA survey disruptions 4. Identify and advance methods,to quantify potential costs of these impacts, including loss of biological data, and downstream impacts on stock assessments 5. Describe new survey and monitoring demands due to the creation of new habitats and or sampling strata due to ORE/MPAs **ToR B** 1. How can sampling designs be adapted to address changes to areas accessible to existing surveys and changing habitats due to ORE and MPA establishment. 2. What scientific sampling methods and approaches, including traditional and new sampling technologies, are being considered to address survey compatibility with ORE and MPAs 3. Identify methods to quantify potential downstream impacts due to increased uncertainty in assessments and advice **ToR C** 1. Develop goals, objectives, and priority actions to guide efforts to understand and mitigate the impacts from ORE and MPAs on scientific surveys 2. Coordinate across expert working groups to address this cross-cutting topic, including coordination with ORE WGs and efforts to standardize methods and data availability from ORE and MPA monitoring programs 3. Identify actions to increase communication and dataflow between ICES and other parties with regard to institution for survey mitigation programs and activities. 4. Develop ICES engagement and stakeholder engagement plan to advance ToRs
Resource requirements	None

Participants	• SCICOM Country Representatives • Survey working group representatives, WKUSER • HAPISG Working ORE Groups, WGOWDF ToR B leads • Key expertise, e.g., statisticians (WKUSER/WGISDAA) • Members of planning groups/with ORE/MPA/ spatial planning knowledge • Members of the ORE industry, including ORE experts from WGOWDF/ Conservation/MPA scientists
Secretariat facilities	ICES HQ as meeting place and support
Financial	No financial implications.
Linkages to advisory committees	The loss of and changes to survey areas and the loss of extraction of animals will have considerable impact on the future of fisheries and ecoysystem advice
Linkages to other committees or groups	This workshop straddles already different commitiees and groups, such as EOSG, HAPI, as well as FRSG and HUDI
Linkages to other organizations	The work should be closely linked with the work of ORE and MPA managers and specialists.