ICES replies to the questions by the North Western Waters Advisory Council horizontal working group meeting (held on 13 March 2023) on the Celtic Seas Ecosystem Overview

Data source and methodology for calculation of invertebrate benthic biomass, and how it is assigned to fisheries.

ICES uses an impact indicator to estimate the amount of benthic biomass (relative to carrying capacity). It is based on a widely used population growth equation, which is generally applied in ecology and fisheries to describe how populations change in size in response to exploitation. The variable is the relative whole community benthic biomass, relative to carrying capacity (i.e. the sum of the biomass of fauna of all different longevities relative to what it would have been with no fishing).

These parameters are estimated from all globally available trawl impact studies for infauna and epifauna. ICES is working to further refine these for region variability through the Working Group on Fisheries and Benthic Impact and Trade-offs (WGFBIT). For the calculation of the impact, the depletion of benthos depends on Swept Area Ratio intensity and on métier type based on the penetration depth of the métier. All calculations and analysis are performed centrally by R-code with the process being embedded into Transparent Assessment Framework (TAF).

The following data are used in the modelled indicator:

- *Biological data input (e.g. monitoring program, time series, sampling method):* Spatial datasets of benthic communities by genus with biomass over environmental gradients, including stations with no or minimal trawling. Longevity trait categorization by genus (default option is 10y);
- *Environmental data input (e.g. empirical/modelled, source, time series):* Environmental data layers are needed to match the biological samples and fit statistical models of the biomass-longevity distribution. These models are combined with the data layers to create the sensitivity layer.
- *Pressure data input (e.g. time series, empirical/modelled, source, national/international):* Bottom trawling swept-area-ratio by metier, derived from VMS and logbooks. ICES member states submit VMS data (vessel position and speed, supplemented with catches) through an annual ICES data call. Working Group on Spatial Fisheries Data (WGSFD) and ICES data center evaluate the submitted data.

Further reading:

ICES. 2022. Working Group on Fisheries Benthic Impact and Trade-offs (WGFBIT; outputs from 2021 meeting). ICES Scientific Reports. 4:9. 133 pp. http://doi.org/10.17895/ices.pub.10042

Technical guidelines document for assessing fishing impact from mobile bottom-contacting fishing gears. Version 2 in ICES. 2022. Working Group on Fisheries Benthic Impact and Trade-offs (WGFBIT; outputs from 2021 meeting). ICES Scientific Reports. 4:9. 133 pp. http://doi.org/10.17895/ices.pub.10042

ICES. 2023. Working Group on Fisheries Benthic Impact and Trade-offs (WGFBIT; outputs from 2022 meeting). ICES Scientific Reports. 5:16. 106 pp. https://doi.org/10.17895/ices.pub.22123193

ICES. 2022. Advice on methods for assessing adverse effects on seabed habitats. In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, sr.2022.18, https://doi.org/10.17895/ices.advice.21674084

ICES. 2022a. EU request for a Technical Service to produce a compilation of assessment methods and indicators that can be used to assess seabed habitats under D6/D1 for the MSFD. In Report of the ICES Advisory Committee, 2022. ICES Advice 2022, sr. 2022.11. https://doi.org/10.17895/ices.advice.21070975

Surface and subsurface disturbance by mobile bottom-contacting fishing gear

The Swept Area Ratio (SAR) is an approximate value to quantify the pressure of the mobile bottom-contacting fishing gear on the seafloor. It is evaluated for the > 12 m vessel category using vessel monitoring system (VMS) and logbook data. Swept area is calculated as hours fished × average fishing speed × gear width. The SAR is calculated for all 0.05 × 0.05 degree grid cells and is the sum of the swept area divided by the area of each grid cell. The resultant values indicate the theoretical number of times the entire grid cell area would have been swept if effort had been evenly distributed within

each cell. The SAR is calculated separately for surface and subsurface contact based on gear type. Different gear types interact with the seabed in different ways and thus exert different levels of physical disturbance, in terms of the substrate areas affected and the penetration depth. Surface abrasion is defined as the damage to seabed surface features; subsurface abrasion as the penetration and/or disturbance of the substrate beneath the seabed surface.

Endocrine disruptors?

Information is provided on some chemicals which can interfere with the endocrine system in fish (e.g. polycyclic aromatic hydrocarbons, polychlorinated biphenyls). But the ecosystem overview doesn't provide evidence of environmentally induced endocrine disruption.

Has the monitoring done by recreational angling been considered?

There is no quantitative analysis / presentation of recreational fisheries data other than from the following two published sources:

1. Hyder, K., Radford, Z., Hardman, F., Gibson, I., Brown, A., and Townhill, B. 2020. Participation, catches and economic impact of sea anglers resident in the UK in 2016 and 2017. Final Report of the Sea Angling 2016 and 2017 project. CEFAS report.
2. Radford, Z., Hyder, K., Zarauz, L., Mugerza, E., Ferter, K., Prellezo, R., Strehlow, H. V., et al. 2018. The impact of marine recreational fishing on key fish stocks in European waters. PLOS ONE 13(9). https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0201666

These contain and consider information also on angling.

Does the 52% of the ecosystem fished refer to 52% of c squares (0.05 degree units) having fishing occurring in them over the 2018-2021 period or does it refer to an estimate of the actual fishing footprint, or something else?

Yes 52% of the ecosystem fished refer to 52% of c squares (0.05 x 0.05 degree units) having fishing occurring in them (by mobile bottom contacting gears by vessels ≤12mm). In response to an annual ICES data call, ICES member countries submit aggregated fishing activity (VMS and Logbooks) to ICES at a c squares (0.05 x 0.05 degree units) scale. ICES uses the submitted data to determine the presence or absence of for example, mobile bottom contacting fishing, fishing within a c-square. For c-squares where mobile bottom contacting fishing occurs, a swept area ratio (SAR) is calculated using vessel speed and metier and vessel length-specific gear width. The SAR expresses the proportion of the seabed in each c-square which interacts with mobile bottom gears. Average SAR values calculated for each c-square using VMS data from 2009-2021 are used in the assessment.

Further reading:

Eigaard OR, Bastardie F, Breen M, et al. 2016. Estimating seabed pressure from demersal trawls, seines, and dredges based on gear design and dimensions. ICES Journal of Marine Science: Journal du Conseil, 73: i27i43. https://doi.org/10.1093/icesjms/fsv099

Rees, T. 2003. "C-squares", a new spatial indexing system and its applicability to the description of oceanographic datasets. Oceanography 16(1): 11–19.

ICES. 2019. Spatial distribution of fishing effort and physical disturbance of benthic habitats by mobile bottom trawl fishing gear using VMS; Technical Guidelines. In Report of the ICES Advisory Committee, 2019. ICES Advice 2019, Section 16.3.3.3, https://doi.org/10.17895/ices.advice.4683

Effects of seabed cables related to ORE?

Offshore renewables is considered in the ecosystem overview in the context of the need to respond to climate change, as a source of contaminants and as affecting fisheries The ecosystem overview doesn't provide any information on the effects of seabed cables related to offshore renewables.