An ICES **Workshop on Tradeoffs Scenarios between the Impact on Seafloor Habitats and Provisions of catch/value** (WKTRADE2), chaired by François Bastardie, Denmark, and Jochen Depestele, Belgium, will meet at ICES Headquarters, Copenhagen, Denmark, 4–6 September 2019 to:

a) Describe the practical steps that should be considered to (better) determine the economic costs and benefits associated with bottom fishing (fisheries revenue) at fine spatial scale (preferably at the c-square resolution: 0.05° x 0.05°); (Science Plan codes: 6.6, 6.4, 3.5);

b) Demonstrate the applicability of a set of approaches to estimate fisheries revenue at local, habitat and regional scales and for different metiers (given the present data availability and cross-regional applicability, i.e. to demonstrate what can be used in WGFBIT in 2019 and 2020 to describe trade-offs); (Science Plan codes: 6.6, 6.4, 5.4);

c) Establish ways to assess effort reduction scenarios (as proposed by ICES WGFBIT) with special attention to:

1. Spatial effort displacement (e.g. redistribution effects on benthic seafloor indicators, catch rates and fisheries revenue)
2. Effort allocation among activities (e.g. redistribution among gear types with various selectivity and impact on the seafloor, and various operating costs).
3. Ecosystem effects (accounting for (in)direct effects of effort reduction and displacement on benthic habitats and food webs).

(Science Plan codes: 7.3, 6.6, 6.4)

d) Explore how to (better) incorporate social factors associated with fisheries, given the different management scenarios (e.g. redistribution effects on fishing harbor communities); (Science Plan codes: 7.6, 7.1).

Prior to the workshop, the Chairs will prepare material to address the ToRs. This group will also ensure the completion of the workshop report, and operational TAF (Transparent Assessment Framework) products for WGFBIT consideration.

ICES WKTRADE2 will report by 27 September 2019 for the attention of ACOM and SCICOM.

Supporting information

Priority	High, in response to the stepwise process of delivering guidance on seafloor integrity for the Marine Strategy Framework Directive (MSFD). The workshop outputs will feed into ICES WGFBIT and the ongoing efforts to provide guidance on potential trade-off in the operational implementation of the MSFD.
Scientific justification	Methods for assessing seafloor impact from bottom-contacting fishing gears have been developed within ICES (ICES 2017, 2019). From an EBFM (ecosystem based fisheries management) perspective, these methods can also be used to inform managers about the interlinkages, and therefore trade-offs, between benthic impacts and the landings or revenue of the fisheries. However, an actual cost (and benefit) associated with fishing in specific locations is difficult to estimate, because it differs by metier and by other factors such as a vessel's homeport, vessel characteristics, etc. ICES WKTRADE2 will advise on best practices to better reflect bio-economic cost and benefit trade-offs, and, to outline progression towards potential management options (e.g. scenarios that focus on the reduction of benthic impacts). These suggestions will consider both generic applications (to all EU ecoregions), as well as

more detailed regionally specific applications. ICES WKTRADE2 will use state of the art modelling approaches of key dynamics and parameters.

Beyond methodological developments towards a robust fishery-benthic impact trade-off assessment, we envision the products of this WK to supplement the WGFBIT trade-off outcomes with an assessment grounded on economic and social factors. As part of the WK, effort redistribution scenarios will inform where the redistribution of fishing activity will likely occur under different effort reduction scenarios proposed as test cases by ICES WGFBIT (see below). These outputs will provide information on the scale of fisheries economic and benthic impact tradeoffs. The Greater North Sea, Baltic Sea, or Celtic Sea ecoregions are suggested as first case study areas given the wealth of data and approaches already available in these regions. It is proposed that timing of WKTRADE2 is such that it ensures that assessment outcomes resulting from the tested scenarios are available to WGFBIT (October 2019).

Effort reduction scenarios

The impact assessment framework developed within ICES WGFBIT for MSFD-D6 is an overall assessment of benthic status supplemented by the exploration of alternative management options to improve GES by ecoregion or national jurisdictions. In the current draft advice produced by ICES WGFBIT, selected scenarios are explored in order to reduce the footprint of human activities and establish trade-offs between impact and economic revenue. All these scenarios apply a 10% reduction in effort, but in 5 different ways:

Reduce the effort of each metier in each spatial cell by 10%

Close c-squares to fisheries, starting at the lowest effort c-squares, until 10% of effort has been removed

Identical to 2. but where effort of each metier, rather than total effort, is reduced by 10%

Identical to 2. but where effort in each habitat, rather than total effort, is reduced by 10%

Identical to 2. but where effort in each EEZ, rather than total effort, is reduced by 10%

The first variant represents the simplest translation of a management measure into a pressure change. It is somewhat naive, but serves as a good comparison nonetheless. Variants 2 to 4 represent different priorities and strategies in management implementation. In variant 2. the emphasis is on maximally increasing the unfished area while minimizing the loss of core fishing grounds. Variant 3. is identical but includes an 'equal loss' principle across metiers – the reduction in fishing effort is required for each metier. Variant 4. captures an important element of the MSFD, the goal of reaching good environmental status in each habitat. Variant 5, rather than representing a specific policy priority, is used to study the effect of national, rather than regional, implementation of the example management measure.

These scenarios by construction are likely to lead to a better status in areas where the effort is being reduced, while leading to some revenue loss affecting the fisheries from the cut in fishing opportunities imposed by the scenarios. Because in the present specifications the tested scenarios lead to such predicable outcomes, the WGBIT trade-off analysis would therefore gain at being refined to supplement the draft advice with more socioeconomic

	grounds. In reality, fishing effort may very well be redirected to the surroundings or to some other areas more remotely located. On the biological side, this will likely change the currently overly optimistic net gain on seafloor status expected from a fishing effort reduction if some displaced effort further deplete some other areas and ecosystem components, potentially vulnerable habitats, or previously unfished areas, or redirecting toward essential fish habitats. Ways to avoid such transfer should be considered. On the economic side, reducing the fishing opportunities will likely exacerbate the technical interactions among fisheries. This is because among others, fish movement, seasonal patterns, mutually exclusive gears, and regulations make the fish stocks differently available and accessible in time and space to different types of fishing, also constrained by how mobile the fishing vessels are. The current ICES WGFBIT draft advice gain/loss estimates will benefit from an understanding of how the human activities will redistribute in response to management and from the inclusion of fishery economic evaluation down to the actual fisheries and specific cost structures impacted by the scenarios. We know from our long experience of fisheries dynamics and fisheries behaviour, bio-economic modelling and model development (as listed in ICES WGECON or EU STECF Bio-economic modelling) that specific approaches are needed to capture the feed-back mechanisms in the system (such as, fisheries dynamics, technical interactions and fishery responses to changes in resource situations and management). Some proposed relevant models: DISPLACE, Honeycomb, STRATHE2E, etc.
Resource requirements	ICES Data Centre and secretariat support.
Participants	Workshop with researchers and RSCs investigators. In particular ICES working group experts from: ICES WGFBIT, ICES WGMARS, and ICES WGECON. Industry representatives will also be invited to provide input. If requests to attend exceed the meeting space available, ICES reserves the right to refuse participants. Choices will be based on the experts' relevant qualifications for the Workshop. Participants join the workshop at national expense.
Secretariat facilities	Data Centre, Secretariat support and meeting room
Financial	None
Linkages to advisory committees	Direct link to ACOM and SCICOM.
Linkages to other committees or groups	Links to WGSFD, WGFBIT, WGECON, WGSOCIAL
Linkages to other organizations	Links to OSPAR, HELCOM, Barcelona Convention, Bucharest Convention