ECOREGION   **General advice**

SUBJECT   **OSPAR special request on maximizing the use of available sources of data for monitoring of biodiversity**

Advice summary

ICES advises that two of the major annual coordinated surveys, the International Bottom Trawl Survey and the Beam Trawl Survey, used to provide information to support fish stock assessments, could also be used to provide information for several Marine Strategy Framework Directive (MSFD) indicators. In these two surveys, a small amount of additional sampling effort could deliver a much broader set of data.

ICES advises that an ecosystem monitoring programme should be developed. Such a programme should be designed not only to observe status, but also to understand the processes underlying these observations, and the links between ecosystem components and with the physical environment.

A further six existing surveys have the potential to collect appropriate data for nine of the eleven descriptors.

Request

The purpose of this request is to seek ICES advice on the potential sources of data and information that may be available to support the monitoring and assessment of biodiversity in relation to commitments under MSFD so as to maximise efficiencies in the use of available resources, for example:

- *where efficiencies could be made to identify where there are monitoring programmes or data sources that can deliver multiple indicators, which may relate to different Descriptors, (e.g. The Data Collection Framework could be used to implement D3 and D1 indicators), or*
- *where with a small additional effort existing monitoring could be amplified to deliver a broader set of data.*

Advice is sought as to 1) the quality of these potential data sources and how they could be used, including but not limited to the relevance of outcomes identified in chapter 8 of the ICES MSFD D3+ report to Descriptors 1, 4 and 6.

(OSPAR request 4/2013)

ICES advice

Scientific surveys

Two major ICES coordinated annual surveys could, with relatively minor additional effort, be used to better inform the assessment of the state of multiple OSPAR indicators, relevant to several MSFD descriptors. For the International Bottom Trawl Survey, the main areas where data are available already are the Fish and Cephalopod indicators FC-1 to FC-8[1], with the exception of indicator 4 (on bycatch). Additional data products would be available contingent on a number of procedural developments, including the development of swept area estimation procedures and appropriate maturity estimation keys. Data support could be provided for Foodweb indicators (FW-4 and FW-7). FW-8 could be supported in terms of stomach sampling. For Bird indicators, the surveys could provide seabird data for indicator B-6, but it is suggested that this is more appropriate for other survey types (e.g. acoustic and icthyoplankton).

For the Beam Trawl Survey, the conclusions in terms of the FC indicators are broadly similar, although swept area estimates are much more straightforward with this gear, and could be improved with use of covariates. No data for FC-6 is obtainable due to survey timing, but improvements could be made with new maturity keys and at-sea histological sampling. Biomass and abundance estimates of taxa that can be caught by the survey could support FW-4, FW-7, and FW-8. Again, the surveys could provide seabird data for indicator B-6, but it is suggested that this is more appropriate for other survey types (e.g. acoustic and icthyoplankton).

The combined response table to the OSPAR request for the two surveys is presented in Table1.5.5.2.1 (data availability) and Table 1.5.5.2.2 (possible improvements).

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[1] FC, FW, M, B, BH, PH, and NIS refer to the ICG–COBAM indicator numbering.

Table 1.5.5.2.1 Possible contributions of the ICES International Bottom Trawl Surveys (IBTS) and Beam Trawl Surveys (BTS) to reporting under the MSFD, with regard to biodiversity-related indicators. The selected indicators are based on nomenclature in the EU Decision (COM 477/2010) and matching OSPAR indicator ID (2nd column). IBTS applies only to the North Sea and Northeast Atlantic; BTS is conducted in all areas except the Northeast Atlantic.

EU Indicator ID	OSPAR Indicator ID	Name	Survey	Data availability				
				North Sea	Northeast Atlantic	Western shelf	France/Biscay	Inshore
1.2.1	FC-1 Core	Population abundance/biomass of a suite of selected species.	IBTS	Abundance estimates (per hour and per km^2) of various fish species. Accuracy is species-dependent.	Abundance estimates (per hour and per km^2) of various fish species. Accuracy is species-dependent.			
			BTS	Abundance (per km^2) estimates for various fish species can be supplied. Accuracy is species-dependent.		Abundance (per km^2) estimates for various fish species can be supplied. Accuracy is species-dependent.	Abundance (per km^2) estimates for various fish species can be supplied. Accuracy is species-dependent.	The area covered is spatially restricted but will give additional information not available from other survey sources. Abundance (per km^2) estimates for various fish species can be supplied. Accuracy is species-dependent.
4.2.1	FC-2; FW-3 Core	OSPAR EcoQO for proportion of large fish (LFI).	IBTS	Main source of data for this indicator.	Main source of data for this indicator.			
			BTS	Main source of data for this indicator. Cut-off point and reference limit needs to be defined by the survey.		Main source of data for this indicator. Cut-off point and reference limit needs to be defined by the survey.	Main source of data for this indicator. Cut-off point and reference limit needs to be defined by the survey.	Main source of data for this indicator. Cut-off point and reference limit needs to be defined by the survey.
3.3.2	FC-3 Core	Mean maximum length of demersal fish and elasmobranchs.	IBTS	Main source of data for this indicator.	Main source of data for this indicator.			
			BTS	Main source of data for this indicator		Main source of data for this indicator	Main source of data for this indicator	Main source of data for this indicator
N.A. (related to 4.3.1)	FC-5 Candidate	Conservation status of elasmobranch and demersal bony-fish species (IUCN).	IBTS	Abundance estimates (per hour and per km^2) of various fish species. Accuracy is species-dependent.	Abundance estimates (per hour and per km^2) of various fish species. Accuracy is species-dependent.			
			BTS	Abundance (per km^2) estimates for various fish species can be supplied. Accuracy is species-dependent.		Abundance (per km^2) estimates for various fish species can be supplied. Accuracy is species-dependent.	Abundance (per km^2) estimates for various fish species can be supplied. Accuracy is species-dependent.	The area covered is spatially restricted but will give additional information not available from other survey sources. Abundance (per km^2) estimates for various fish species can be supplied. Accuracy is species-dependent.
1.3.1; 3.3.1	FC-6 Candidate	Proportion of mature fish in the populations of all species sampled adequately in international and national fish surveys.	IBTS	Main source of data for IBTS target species, but depending on species-specific maturation process and hence sampling time (quarter).	Main source of data for IBTS target species, but depending on species-specific maturation process and hence sampling time (quarter).			

EU Indicator ID	OSPAR Indicator ID	Name	Survey	Data availability				
				North Sea	Northeast Atlantic	Western shelf	France/Biscay	Inshore
1.1.1	FC-7 Candidate	Distributional range of a suite of selected species.	IBTS	Main source of data for this indicator.	Main source of data for this indicator.			
			BTS	Main source of data for this indicator.		Main source of data for this indicator.	Main source of data for this indicator.	Main source of data for this indicator.
1.1.2	FC-8 Candidate	Distributional pattern within the range of a suite of selected species.	IBTS	Main source of data for this indicator.	Main source of data for this indicator.			
			BTS	Main source of data for this indicator.		Main source of data for this indicator.	Main source of data for this indicator.	Main source of data for this indicator.
possibly related to 1.7.1 or 4.3.1	FW-4 Core	Changes in average trophic level of marine predators.	IBTS	Calculation of relative abundance is possible.	Calculation of relative abundance is possible.			
			BTS	Calculation of relative abundance is possible.		Calculation of relative abundance is possible.	Calculation of relative abundance is possible.	Calculation of relative abundance is possible.
1.7.1; 4.3.1	FW-7 Candidate	Fish biomass and abundance of dietary functional groups.	IBTS	Biomass and abundance estimates (per hour or per km^2) of various fish species.	Biomass and abundance estimates (per hour or per km^2) of various fish species			
			BTS	Biomass and abundance estimates per km^2 of various fish species.		Biomass and abundance estimates per km^2 of various fish species.	Biomass and abundance estimates per km^2 of various fish species.	Biomass and abundance estimates per km^2 of various fish species.
could be related to 4.2.1; 4.3.1	FW-8 Candidate	Changes in average faunal biomass per trophic level (biomass trophic spectrum).	IBTS	Data on biomass per haul for all fish species.	Data on biomass per haul for all fish species.			
			BTS	Data on biomass per haul for fish species and benthic organisms available for some surveys and some years.		Data on biomass per haul for fish species and benthic organisms available for some surveys and some years.		Data on biomass per haul for fish species available. Epibenthic biomass available for some surveys.

Table 1.5.5.2.2   Possible improvements to the ICES International Bottom Trawl Surveys (IBTS) and Beam Trawl Surveys (BTS) in reporting under the MSFD, with regard to biodiversity-related indicators. The selected indicators are based on nomenclature in the EU Decision (COM 477/2010) and matching OSPAR indicator ID (2nd column). IBTS applies only to the North Sea and Northeast Atlantic; BTS is conducted in all areas except the Northeast Atlantic. The possible improvement of data availability in each of the survey areas, if extra effort is allocated to these surveys, is indicated.

EU Indicator ID	OSPAR Indicator ID	Name	Survey	Possible improvement with extra effort				
				North Sea	Northeast Atlantic	Western shelf	France/ Biscay	Inshore
1.2.1	FC-1 Core	Population abundance/ biomass of a suite of selected species.	IBTS	For some species that are presently not always reported to species level (e.g. squids, gobies), species could be collected for taxonomic ID on shore.	For some species that are presently not always reported to species level (e.g. squids, gobies), species could be collected for taxonomic ID on shore.			
			BTS	Precision could be improved through further development of sampling and statistical techniques.		Precision could be improved through further development of sampling and statistical techniques.	Precision could be improved through further development of sampling and statistical techniques.	Precision could be improved through further development of sampling and statistical techniques.
1.3.1; 3.3.1	FC-6 Candidate	Proportion of mature fish in the populations of all species sampled adequately in international and national fish surveys.	IBTS	For additional species theoretically possible, but requires extra resources for acquisition of maturity data. Guidelines needed for maturity keys / spawning times.				
			BTS	Precision could be improved by further development of analysis of maturity.		Precision could be improved by further development of analysis of maturity.	Precision could be improved by further development of analysis of maturity.	
Poss. related to 1.7.1 or 4.3.1	FW-4 Core	Changes in average trophic level of marine predators.	IBTS	Samples for fish predators can be provided on a regular basis (using stomach analyses or tissue samples for stable isotope analysis); sample processing requires extra analytical effort.				
			BTS	Samples for fish predators can be provided (for stomach analyses or tissue samples for stable isotope analysis); sample processing requires extra analytical effort.		Samples for fish predators can be provided (for stomach analyses or tissue samples for stable isotope analysis); sample processing requires extra analytical effort.	Samples for fish predators can be provided (for stomach analyses or tissue samples for stable isotope analysis); sample processing requires extra analytical effort.	Samples for fish predators can be provided (for stomach analyses or tissue samples for stable isotope analysis); sample processing requires extra analytical effort.
1.7.1; 4.3.1	FW-7 Candidate	Fish biomass and abundance of dietary functional groups.	IBTS	Individual fish weights of non-target species could be provided with extra effort.				
			BTS	Individual fish weights of non-target species could be provided with extra effort.		Individual fish weights of non-target species could be provided with extra effort.	Individual fish weights of non-target species could be provided with extra effort.	Individual fish weights of non-target species could be provided with extra effort.

EU Indicator ID	OSPAR Indicator ID	Name	Survey	Possible improvement with extra effort				
				North Sea	Northeast Atlantic	Western shelf	France/ Biscay	Inshore
could be related to 4.2.1; 4.3.1	FW-8 Candidate	Changes in average faunal biomass per trophic level (biomass trophic spectrum).	IBTS					
			BTS	Full benthic sort and sampling possible with extra resources.		Full benthic sort and sampling possible with extra resources.	Full benthic sort and sampling possible with extra resources.	Full benthic sort and sampling possible with extra resources.
1.1.2	B-6 Core	Distributional pattern of breeding and non-breeding marine birds.	IBTS	Some vessels may be able to take bird observers aboard.				
			BTS	Some vessels may be able to take bird observers aboard.				

A further four surveys can provide information suitable for use in evaluating ecosystem indicators; one of these is outside the area of EU waters:

- Norwegian Barents Sea survey – trawl, acoustic, and ecosystem survey.
- French Biscay Pelagic ecosystem survey – acoustic.
- German mackerel egg survey – icthyoplankton.
- Scottish *Nephrops* TV survey.

ICES analysed the strengths and weaknesses of these surveys and two key themes emerged:

- setting and prioritizing objectives;
- survey design and the need to be able to elucidate process by explicitly linking dynamics in different ecosystem components.

Some of the strengths were mutually exclusive, either operationally or conceptually, and therefore an 'ideal ecosystem survey' on a single vessel, is unlikely to exist. The prioritization of surveys might be based on three factors:

- the characteristics of the ecosystem, particularly with respect to the spatial and temporal scales of variability.
- the available resources in ship time, but also expertise and financial considerations. International pooling of resources will aid to increase efficiency and improve regional ecosystem assessments across national boundaries.
- the management and legal requirements and prioritizations for reporting. This is not a scientific criterion, but an ability to address the former will almost certainly have an impact on the availability of resources.

Acoustic surveys may represent the best option for collecting data to evaluate the Pelagic Habitat (PH) indicators, and also some Benthic Habitat (BH) indicators by acoustic means including multi-beam technology. TV surveys can support BH-1, BH-3, BH-4, and FW-9. Icthyoplankton surveys provide potential to help evaluate both pelagic habitat and foodweb indicators. These surveys are also better platforms for the collection of data on birds and mammals at sea compared with slower trawl surveys.

Integrated monitoring

There are considerable benefits to designing and developing a cost-effective integrated monitoring programme that can address the existing information needs and those of MSFD in comparison with current discipline-specific monitoring programmes. The former may provide advice based on an understanding of ecosystem processes, which can help in identifying how to act rather than merely identifying current status in separate parts of the ecosystem.

As none of the individual surveys can provide all the information that would be required to service the full suite of OSPAR common indicators, it makes the concept of clustering indicators rather difficult to put into practice. Perhaps the most effective cruise, if it were possible to organise, would be a bottom trawl survey where, in addition to the standard fish sampling:

- Stomach and biological samples of a wide range of taxa were collected;
- Seabed habitat acoustic survey data were collected between fishing stations;
- Seabirds and marine mammals at sea were surveyed between fishing stations;
- A continuous plankton recorder was deployed while the vessel was underway between stations;
- Hydrographic data were collected continuously by on-board autonomous samplers;
- CTD data and water and plankton samples were collected at each sampling station;
- The night-time period was utilized to sample benthic invertebrates.

Such a survey would collect data that could potentially service 65% of the OSPAR common indicators (M-2, M-4, B-1, B-6, FC-1, FC-2, FC-3, FC4, BH-1, BH-2, BH-5, PH-1, PH-2, PH-3, FW-2, FW-3, FW-4, FW-5, FW-6, FW-7, FW-8, FW-9, and NIS-2).

Background

This advice has focussed on research vessel surveys as potential sources of data. Other potential data sources include:

- Commercial landings data and logbooks.
- Commercial discard data (that will cease when discard bans come into force).
- Shore-based sampling, particularly for benthos, contaminants, hydrographic parameters and biological oceanography.
- Remote sensing i.e. satellites for e.g. sea surface temperature, ocean colour, sea surface elevation, waves, etc.
- Sea-going sampling systems such as continuous plankton recorders on platforms of opportunity, underwater cameras, etc.
- Aerial surveys (marine mammals, sea turtles, seabirds, sharks).

Several ICES expert groups have been developing analyses of the opportunities for wider usage of fisheries research surveys (ICES, 2010a, 2010b, 2012a, 2012b, 2013a, 2013b, 2013c, 2013d).

The request also refers to the Data Collection Framework (DCF) indicators used to evaluate the ecosystem impacts of fishing. Four of these in particular are relevant to MSFD indicators:

- Conservation status of fish species (FC-5).
- Proportion of large fish (FC-2, FW-3).
- Mean maximum length of fishes (FC-3).
- Size-at-maturation of exploited fish species (FC-6).

ICES has recently advised the European Commission on this topic (ICES, 2013e).

Table 1.5.5.2.3 summarizes some suggestions on how surveys may be adapted to fulfil the needs of OSPAR.
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Table 1.5.5.2.3   Summary of the OSPAR "common indicators" that could potentially be serviced using data derived from the additional (A) ecological sampling that might be feasible during different types of fisheries surveys. E = Existing data collection. Candidate indicators FC-5 to FC-8 are not shown as no technical specifications for these have been supplied to ICES. It may be that some surveys could help in data collection against these indicators.

Column legend:

MAMMALS: M-1 (range pattern grey & harbour seals); M-2 (range pattern cetaceans); M-3 (abundance grey & harbour seals); M-4 (abundance cetaceans); M-5 (seal pup production); M-6 (bycatch)

BIRDS: B-1 (trends in species); B-2 (breeding success kitiwake); B-3 (breeding success/failure marine birds); B-4 (mammals on seabird colonies); B-5 (bycatch); B-6 (distribution)

FISH & CEPH: FC-1 (abundance/biomass); FC-2 (LFI); FC-3 (mean max length); FC-4 (bycatch Chondrichthes)

BENTHIC HAB.: BH-1 (typical species); BH-2 (multimetric indices); BH-3 (damage); BH-4 (area habitat loss); BH-5 (size-freq sensitive species)

PEL. HAB.: PH-1 (changes functional types); PH-2 (biomass/abundance); PH-3 (changes biodiv index)

FOOD WEBS: FW-1 (repr success in relation to food avail); FW-2 (production of phytoplankton); FW-3 (Large Fish Indicator); FW-4 (change in average trophic level of predators); FW-5 (change funct groups plankton); FW-6 (zooplankton); FW-7 (fish biomass and dietary functional groups); FW-8 (Biomass Trophic Spectrum); FW-9 (Ecological Network Analysis)

ALIENS: NIS-1 (pathways management measures); NIS-2 (Rate of new introductions of NIS)

ICES COORDINATED SURVEYS	M-1	M-2	M-3	M-4	M-5	M-6	B-1	B-2	B-3	B-4	B-5	B-6	FC-1	FC-2	FC-3	FC-4	BH-1	BH-2	BH-3	BH-4	BH-5	PH-1	PH-2	PH-3	FW-1	FW-2	FW-3	FW-4	FW-5	FW-6	FW-7	FW-8	FW-9	NIS-1	NIS-2
	MAMMALS						BIRDS						FISH & CEPH				BENTHIC HAB.					PEL. HAB.			FOOD WEBS									ALIENS	
Fish surveys using nets (BTS, IBTS, etc)	A											A	E	E	E		A	A	A	A	A	A	A	A	A		E	A	A	A	E	E	A		A
Acoustic fish surveys	A		A	A								A	E									A	A	A	A				A	A	A	A			A
Video surveys (Nephrops)																	A		A	A														A	
Ichthyoplankton surveys (fish larvae)																						A	A	A					A	A					A

8   ICES Advice 2013, Book 1

Sources

ICES. 2010a. Report of the Working Group on Integrating Surveys for the Ecosystem Approach (WGISUR), 26–28 January 2011, Dublin, Ireland. ICES CM 2010/SSGESST:08. 17 pp.

ICES. 2010b. Report of the Workshop on Cataloguing Data Requirements from Surveys for the EAFM (WKCATDAT), 26–28 January 2011, Dublin, Ireland. ICES CM 2010/SSGESST:09. 38 pp.

ICES. 2012a. Report of the Working Group on Integrating Surveys for the Ecosystem Approach (WGISUR), 24–26 January 2012, Ijmuiden, the Netherlands. ICES CM 2012/SSGESST:20. 24 pp.

ICES. 2012b. Report of the Workshop on Evaluation of Current Ecosystem Surveys (WKECES), 20–22 November 2012, Bergen, Norway. ICES CM 2012/SSGESST:23. 59 pp.

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ICES. 2013d. Report of the Working Group on Biodiversity Science (WGBIODIV). ICES CM 2013/SSGEF:02. 62 pp.

ICES. 2013e. Report of the ICES Advisory Committee. ICES Advice, 2013. Book 1, Section 1.5.2.1.

ICES. 2013f. Report of the ICES Working Group on the Introduction and Transfers of Marine Organisms (WGITMO). ICES CM 2013/ACOM:30. 150 pp.

ICES. 2013g. Report of the Working Group on Marine Habitat Mapping (WGMHM). In draft.

Supplementary background documentation is available at:
https://groupnet.ices.dk/wgeco2013/default.aspx?RootFolder=%2fwgeco2013%2fReport%202013%2fToR%20C&FolderCTID=&View=%7b63F03C99%2d9F39%2d457D%2d8135%2d25A0BEA67AAF%7d