

ECOREGION **WIDELY DISTRIBUTED AND MIGRATORY STOCKS**
SUBJECT **EC request on scientific surveys for deep water fisheries**

Advice Summary

ICES advises that the following fisheries independent surveys should be extended or established to meet current and near-future requirements for stock assessment and ecosystem monitoring.

- A coordinated deep-water trawl survey to cover ICES Subareas VI and VII and Divisions Vb and XIIb that incorporates the existing deep-water trawl survey from Scotland and the now discontinued survey from Ireland;
- A coordinated international longline survey covering ICES Subarea VIII and Division IXa.

Request

ICES is requested to evaluate the need of fisheries independent data and propose solution for the near future, namely:

- 1) *compile as many details as possible on the data needed and their periodicity;*
- 2) *evaluate the need for additional work compared to the current situation; and*
- 3) *identify the added value for stock assessment coming from the extension and/or harmonisation of the current surveys.*

ICES Advice

For most deep-water stocks fished by EU fleets, there are no adequate surveys that currently provide data to be used in stock assessments at a spatial scale corresponding to the distribution area of these stocks. The data required are summarised in Annex 1.

Additional data from surveys should also be collected to meet the ecosystem monitoring requirements under the EU Data Collection Framework (DCF), Marine Strategy Framework Directive (MSFD), and OSPAR.

Surveys have been proposed by the ICES Working Group for North-east Atlantic Continental Slope Survey (WGNEACS) for the central northeast Atlantic (ICES Subareas VI and VII and Divisions Vb and XIIb) and the Iberian Shelf/Bay of Biscay (Subareas VIII and IX) (ICES, 2010). If fully implemented, these surveys would meet current and near-future (and long term) requirements for stock assessment and ecosystem monitoring.

However, some additional data cannot be collected during the WGNEACS coordinated surveys and will require separate surveys, namely the spatial extension of the Azores longline survey (Subarea X) to cover offshore seamounts. This survey is expected to provide improved abundance indices for red sea bream, bluemouth, and deepwater sharks. The additional resources required to meet this objective are currently being considered.

Recommendations

The proposed surveys could be coordinated by ICES through WGNEACS. ICES recognizes the need of additional funds in order to insure the implementation of this proposal.

The proposal for spatial extension of the Azores longline survey should be further developed, and implemented once funding is available.

Basis of advice

Background

Under the current Memorandum of Understanding between ICES and the EU, ICES is required to provide fisheries management advice for deep-water fish stocks in relation to the MSY framework. ICES, as well as the EU funded project "[Deepfishman](#)", have made considerable progress in assessing deep-water stocks; however, the lack of appropriate fisheries independent data series has resulted in many deep-water stock assessments being heavily dependent on abundance indices derived from commercial landings data. Problems related to the use of commercial lpu series are well known, but are particularly acute for deep-water fisheries because of (a) the large spatial extent of stocks relative to fishing areas; (b) the effects of depth on catch rates; and (c) the potential for sequential depletion of local aggregations. Moreover, the implementation of very low or zero TACs for a number of stocks has led to the truncation of some commercial lpu series and reductions in the quality of others, highlighting the need for fisheries independent data to monitor stock status.

In addition to the requirement for abundance indices, the Data Collection Framework ecosystem indicators, the Marine Strategy Framework Directive, and OSPAR's Quality Status reporting require monitoring of ecosystem status.

In 2007, ICES received requests from both the EU Regional Coordination Meeting for the North Atlantic and from NEAFC to consider co-ordination and development of deep-water surveys for the Northeast Atlantic (NEA). In response, ICES in 2008 established an international deep-water survey planning group, the Planning Group on the Northeast Atlantic Continental Slope Surveys (PGNEACS) (ICES, 2008). PGNEACS reviewed existing NEA deep-water and slope surveys, and developed a proposal for international coordination.

Data requirements

For the purpose of single species stock assessments, Annex 1 summarizes the data needed, survey periodicity, and how the requisite data should be collected. Colour coding is provided to indicate (a) the existing surveys which adequately address the data requirements (green shading); (b) those surveys having limited suitability because they do not adequately cover the core stock unit (orange shading); and (c) those stocks for which no surveys exist or where the current surveys do not provide any stock size data (red shading). The Annex table also indicates what additional survey efforts are required to address the existing data deficiencies, and how these efforts would improve the current stock assessments.

It is apparent from the Annex table that, for most deep-water stocks fished by EU fleets, no adequate surveys exist that provide sufficient data for stock assessment purposes.

The survey requirements to adequately address stock assessment and ecosystem monitoring needs are detailed below and compared to the current situation.

Proposed deep-water trawl survey in Vb, VI, VII and XIIIb

Following recommendations from the Working Group on the Biology and Assessment of Deep Sea Fisheries Resources (WGDEEP) and the Working Group on Deep-water Ecology (WGDEC) in 2007, WGNEACS (2009 and 2010a) proposed a coordinated deep-water survey to cover ICES Subareas VI and VII and Divisions Vb and XIIb. This proposed survey would incorporate the existing deep-water trawl survey from Scotland and the now discontinued survey from Ireland. ICES has evaluated the proposed survey design and indicated that the proposed survey would meet current and near future data requirements for stock assessment, as well as address some ecosystem monitoring needs in this region. A proposed trawl survey previously recommended by PGNEACS for the Bay of Biscay was re-evaluated, and considered not adequate because the Bay of Biscay is largely unsuitable for deep-water trawling. Consequently, this area needs to be covered as part of the existing southern longline survey.

The area covered by the proposed coordinated deep-water survey encompasses the spatial distribution of the main commercial deep-water stocks in this region. The survey design is optimised to maintain the available time-series (Scottish and discontinued Irish deep-water trawl surveys) and provide representative abundance indices, by using a depth and area stratified sampling design. Additional biological sampling requirements specified in the Annex table should be fully satisfied by the proposed survey methodology. All species will be identified, recorded, and measured; this should provide appropriate data for the development and monitoring of ecosystem indicators.

Based on the WGNEACS recommendation, the surveys should be conducted annually during the first 5 years to rapidly establish a time-series, after which the survey should be conducted biennially (every two years) to coincide with the two-year management cycle for deep-water species.

Additional survey effort allocation and methodologies for the deep-water trawl survey in Subareas VI and VII and Divisions Vb and XIIb are described in ICES (2009; 2010a) and are summarised here.

The proposed survey should cover four geographical regions, only one of which is now surveyed (Scottish slope), and these regions should be further subdivided into sampling areas that can be trawled (as documented in ICES, 2009). The proposed sampling strategy is summarised by geographical region and depth range in Table 9.3.2.1.1; together with an indicative number of hauls per region based on knowledge of the spatial distribution needed to detect abundance trends and the feasible number of hauls considering the extension of the survey areas.

Table 9.3.2.1.1. Survey sampling strategy by area for the proposed deepwater trawl survey (from ICES, 2009).

REGION	NO. SAMPLE AREAS	DEPTH RANGE	NUMBER OF HAULS PER REGION
Scottish Slope	4	500–1800	20
Northern	6	500–1500	24
Rockall and Hatton Banks	8	500–1800	36
Irish slope and Porcupine	4	500–1800	20
Total			100

The total area coverage of the proposed survey is presented in Figure 9.3.2.1.1.

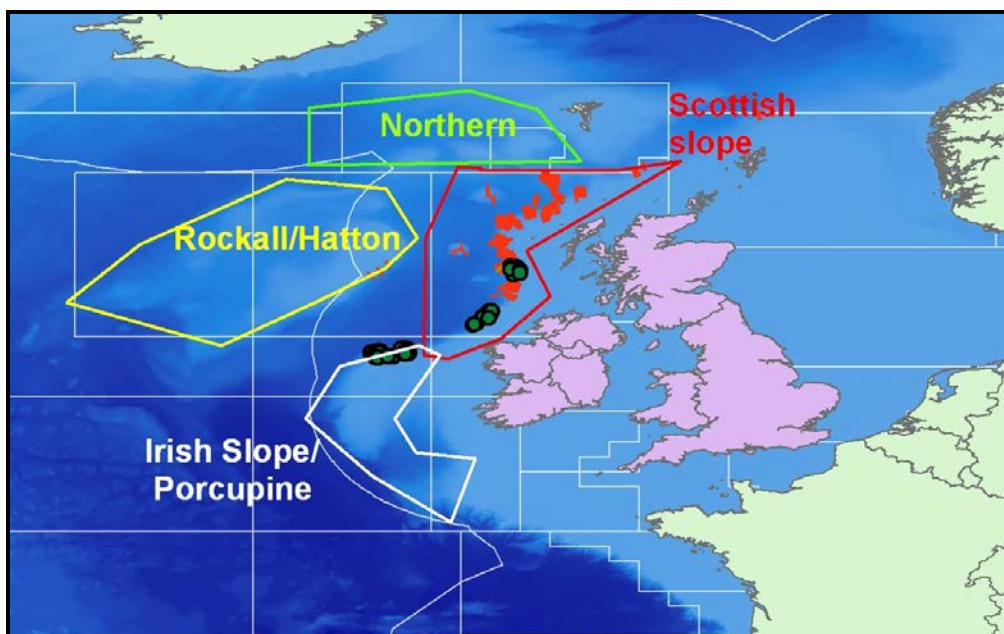


Figure 9.3.2.1.1. Area coverage of the proposed deep-water trawl survey (ICES, 2010a). Red symbols = trawl hauls of the existing Scottish Deepwater survey (1998+), green symbols = trawl hauls from discontinued Irish Trawl survey (2006–2009) and polygons represent proposed sample regions.

The surveys require large research vessels such as *RV Scotia*, *RV Celtic Explorer*, *RV Thalassa*, and *RV GO Sars* because commercial vessels generally do not carry enough warp to fish to the bathyl limits of the species range. Vessels can expect to complete 4–5 one-hour hauls per day, implying a vessel cruise duration of 20–25 fishing days plus steaming time. At least two ships are needed to cover the entire survey area.

Proposed international longline survey in the southern area (ICES Subarea VIII and Division IXa)

For deep-water surveys in Subarea VIII and Division IXa, trawl surveys are not appropriate due to rough bottom topography. A previous trawl survey of this area, discontinued in 2003, was not considered adequate to properly sample the main commercial deep-water species. Therefore, an internationally coordinated longline survey was proposed by

WGNEACS 2009 and 2010. ICES evaluated the proposed survey design and believe that the proposed survey will meet current and near-future data requirements for stock assessment, and also address several ecosystem monitoring needs in this region. ICES further indicated that the survey should be expanded to cover the Bay of Biscay.

The main objective of the survey is to produce abundance estimates for black scabbardfish and deep-water sharks. The TAC for the latter group is currently zero, and hence its recovery and stock status can only be monitored using survey data.

In ICES Division IXa, fishing hauls will be randomly accomplished within each cell of a regular grid. Sampling effort will be two longline sets per day, with each set having about 10 hours of soak time. Relative depth and area stratified abundance indices will be computed, together with other population indicators (length distribution, sex ratio, maturity, age distribution). In Subarea VIII, a similar sampling grid will be developed, but a lower sampling intensity will be used owing to the much reduced catches of deep-water species in this Subarea.

As a preliminary estimate, 40 fishing days using 15–25 m long chartered commercial longliners will be required to adequately cover Division IXa and Subarea VIII.

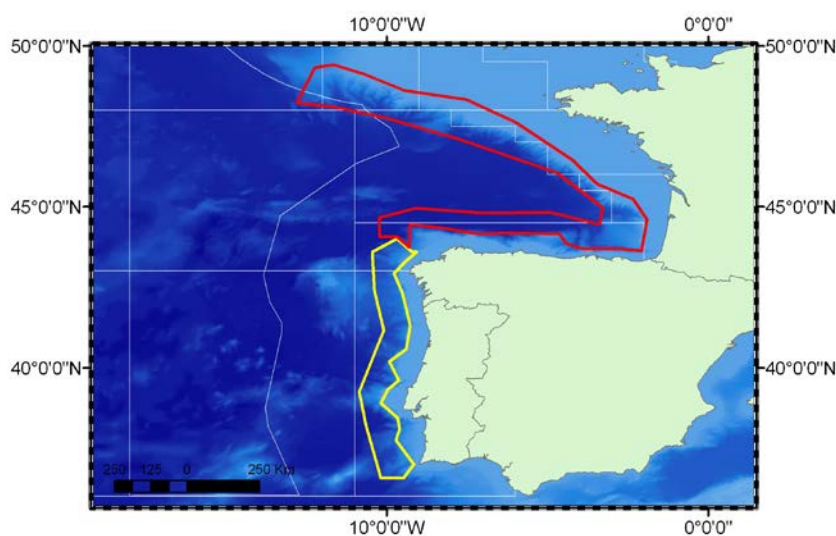


Figure 9.3.2.1.2 Area coverage of the proposed deep-water longline survey (ICES, 2011). Polygons represent proposed sample regions.

How this would improve the current situation (identification of the added value for stock assessment coming from the extension and/or harmonisation of the surveys)?

Annex 1 identifies the data needed to improve the stock assessments of the main commercial deep-water species. ICES considers that the survey proposed by WGNEACS will satisfy all of these requirements.

For the main commercial deep-water species, such as black scabbard, roundnose grenadier, and blue ling, it is anticipated that the proposed surveys will provide spatially and depth stratified abundance indices and length/age distribution information. In some cases (e.g. blue ling), it is hoped that the data will also facilitate development of recruitment indices. For stocks that are currently severely depleted and have TACs set at zero (such as the deep-water sharks and orange roughy), it is anticipated that the surveys will be the principal means to monitor the recovery and status of these stocks.

For the provision of deep-water ecosystem advice, three major uses of the deep-water survey data were identified:

- a) to map the spatial and bathyal distribution of deepwater species;
- b) to generate indices of biodiversity and any other ecosystem indicators as required by DCF, MSFD, and OSPAR;
- c) to address specific research and monitoring needs such as stock identification, habitat mapping, and contaminant monitoring.

There is an increasing need to research and monitor the status of deepwater ecosystems within the EEZ of the EC as part of the Marine Strategy Framework Directive (MSFD). This requires the development of indicators of ecological quality or ‘good environmental status’ (GES). Qualitative descriptor No. 1 of the MSFD for GES is maintaining

biological diversity. Indicators of deep-water fish biodiversity can only be reliably generated using fishery-independent survey time-series data. For example, taxonomic-based indicators have successfully been applied in assessing spatial and temporal variability in deep-water fish communities (Campbell *et al.*, 2011). Size-based indicators are also being developed; information on individual weights and lengths of the species that make up deep-water fish communities allow the potential effects of fishing to be assessed quantitatively.

For deep-water benthic fauna, while bycatch records are informative, most fish sampling gears are not designed to survey benthic animals. Benthic sledges and beam trawls sample benthos more effectively, but clearly are not desirable as they can cause significant adverse impacts on vulnerable marine ecosystems (VMEs). In areas where this is the case, alternative non-destructive sampling methods need to be developed and implemented, such as remotely operated vehicle (ROV) surveys or drop-frame/towed camera surveys. Future deep-water surveys therefore need to have a multidisciplinary design. Deep-water surveys also provide the platform to collect acoustic and physical data on the seabed. Such data can be valuable in detecting the presence of different types of deep-water features such as coral reefs or seapen/mud habitats. Deep-water surveys are also important for collecting samples for studies on stock discrimination, food webs, and other projects outside of the Data Collection Framework.

Other data requirements

Some additional data requirements, such as the expansion of the longline survey in the Azores (ICES Subdivision Xa₂), have been identified. It is not anticipated that this survey will be included in WGNEACS coordination.

Since 1995, a longline survey has annually been conducted in ICES Division Xa₂ during spring. The survey area covers about 70% of the area of distribution of the main demersal species of red (blackspot) seabream, blue-mouth redfish and alfonosinos. The survey provides abundance and length distribution data. Indices from the survey have been available to the Working Group on the Biology and Assessment of Deep Sea Fisheries Resources (WGDEEP) and the Benchmark Workshop on Deep-water Species (WKDEEP). WKDEEP concluded that inter-annual variability in the cpue index for red (blackspot) sea bream may be a result of factors relating to the spatial distribution of the stock that are not adequately accounted for in the survey design (ICES, 2010b). Therefore, spatial extension of the survey to cover offshore seamounts will facilitate coverage of the entire area of the stocks, and should improve the utility of the survey indices in stock assessments.

Additional resource requirements to meet this objective are currently being considered by the Department of Oceanography and Fisheries of Azores University (DOP/UAz).

References

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- ICES. 2010b. Report of the Benchmark Workshop on Deep-water Species. 17–24 February 2010 WKDEEP. Copenhagen, Denmark. ICES CM 2010/ACOM:38. 247 pp.
- ICES. 2011. Report of the *Ad hoc* Group on Deep-sea Survey (AGDSS). 3 March 2011, Copenhagen, Denmark. ICES CM 2011/ACOM:54.

Annex 1.

Review of data requirements for single stock assessment for the main commercial deep-water species exploited by EU fleets. Letter coding in data requirement column are B=biomass, N=number, L=length, A= age, M=maturity, S=sex (data requirement in brackets means “potentially required”). Color coding of table indicates existing surveys addressing data needs (green shading), surveys with limited suitability due to partial stock coverage (orange shading), no surveys present to provide required data (red shading).

Species	Stock area	Known depth range of the species	Data requirements	Periodicity	How produced?	Additional survey requirements	expected input into assessments
<i>Aphanopus carbo</i>	Vb, XIIb, VI, VII	500 - 1700m	B, N, L, A, M, S	Annually for 5 years, then biennially	Deepwater trawl survey in Vb,VI,VII, XIIb	Expansion of current spatial survey coverage to stock area	Spatially and depth stratified abundance index and length/age distribution
<i>Aphanopus carbo</i>	VIII, IX	500 - 1700m	B, N, L, A, M, S	Annually for 5 years, then biennially	Deepwater longline survey in VIII, IX	New deepwater long line survey	Spatially and depth stratified abundance index and length/age distribution
<i>Aphanopus carbo</i>	I, II, IIIa, IV, Va, X, XIV	500 - 1700m	B, N, L, A, M, S	Annually for 5 years, then biennially	Deepwater longline survey in X as no significant catches in other areas	Expansion of current longline survey to offshore areas	Spatially and depth stratified abundance index and length/age distribution
<i>Coryphaenoides rupestris</i>	Vb, XIIb, VI, VII	400 - 1800m	B, N, L, (A), (M), (S)	Annually for 5 years, then biennially	Deepwater trawl survey in Vb,VI,VII, XIIb	Expansion of current spatial survey coverage to stock area	Spatially and depth stratified abundance index and length/age distribution
<i>Molva dypterygia</i>	Vb, VI, VII	300 - 1500m	B, N, L, A, M,S	Annually for 5 years, then biennially	Deepwater trawl survey in Vb,VI,VII	Expansion of current spatial survey coverage to stock area	Spatially and depth stratified abundance index, length/age distribution, and recruit index
<i>Brosme brosme</i>	Vlb	100-1000m	B, N, L, A, M, S	Annually for 5 years, then biennially	Rockall haddock and Rockall monkfish surveys.		Spatially and depth stratified abundance index and length/age distribution
<i>Hoplostethus atlanticus</i>	VI	500 - 1550m	B, N, L, (M), (S)	Annually for 5 years, then biennially	Deepwater trawl survey in VI	Expansion of current spatial survey coverage to stock area	Monitoring of the long term recovery of the stock with indicators, and possible recruit index
<i>Hoplostethus atlanticus</i>	VII	500 - 1550m	B, N, L, (M), (S)	Annually for 5 years, then biennially	Deepwater trawl survey in VII	New deepwater trawl survey	Monitoring of the long term recovery of the stock with indicators, possible recruit index
<i>Phycis blennoides</i>	VI, VII, XII	200 - 1100m	B, N, L, S	Annually for 5 years, then biennially	IBTS and deepwater trawl survey in VI, VII	Expansion of current spatial survey coverage to stock area	Spatially and depth stratified abundance index, length distribution, and recruit index
<i>Phycis blennoides</i>	VIII, IX	200 - 1100m	B, N, L, S	Annually for 5 years, then biennially	IBTS and deepwater longline survey in VIII and IX	Expansion of current spatial survey coverage to stock area	Spatially and depth stratified abundance index, length distribution, and recruit index
<i>Pagellus bogaraveo</i>	VI, VII, VIII	30-800m	B, N, L, A, M, S	Annually for 5 years, then biennially	IBTS		Monitoring of the long term recovery of the stock with indicators
<i>Pagellus bogaraveo</i>	IX	200 -800m	B, N, L, A	Annually for 5 years, then biennially	Alternative proposal under development	Alternative proposal under development	-
<i>Pagellus bogaraveo</i>	X	200 -800m	B, N, L, A, M, S	Annually for 5 years, then biennially	Deepwater long line survey	Expansion of current longline survey to offshore areas (seamounts)	Spatially and depth stratified abundance index and length distribution
<i>Centrophorus squamosus</i>	Global distribution, all ICES areas except I and II	300 - 1800m	B, N, L, M, S	Annually for 5 years, then biennially	Deepwater trawl survey in V,VI,VII, XIIb and deepwater long line survey in VIII, IX and X	Expansion of current spatial survey coverage to stock area and new longline survey in VIII, and IX	Monitoring of the long term recovery of the stock with indicators
<i>Centroscymnus coelolepis</i>	Global distribution, all ICES areas except I and II	500 - 1800m	B, N, L, M, S	Annually for 5 years, then biennially	Deepwater trawl survey in V,VI,VII, XIIb and deepwater long line survey in VIII, IX and X	Expansion of current spatial survey coverage to stock area and new longline survey in VIII, and IX	Monitoring of the long term recovery of the stock with indicators
Other deepwater sharks as given Annex I of deepwater licensing regulation 2347 /2002	Global distribution, all ICES areas except I and II	200 - 1800m	B, N, L, M, S	Annually for 5 years, then biennially	Deepwater trawl survey in V,VI,VII, XIIb and deepwater long line survey in VIII, IX and X	Expansion of current spatial survey coverage to stock area and new longline survey in VIII, and IX	Monitoring of the long term recovery of the stock with indicators
<i>Argentina silus</i>	I, II, IIIa, IV, Vb, VI, VII, VIII, IX, X, XII, XIV	0-1000m	B,N,L,A,M,S	Annually for 5 years, then biennially	Deepwater trawl survey in Vb,VI,VII, and IBTS	Expansion of current spatial survey coverage to stock area Vb, VI and VII	Spatially and depth stratified abundance index and length and age distribution, recruit index