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9–11 June 2009

Tromsø, Norway

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Executive summary

The present report was prepared by the Planning Group on the North-east Atlantic Continental Slope Survey (PGNEACS) in Tromsø, Norway, from 9–11 June 2009. In order to reassess survey needs, the planning group reviewed the main deep-water fish resources in the Northeast Atlantic, summarized their spatial extent and exploitation patterns and identified what are the necessary survey attributes to produce advice on single-stocks of commercial species, non target species and advice on the affect of fishing on the deep-water ecosystem. The group also reviewed how existing survey programs meet the requirements and where there are important gaps in terms of stock and area coverage. This analysis revealed three subgroups of existing deep-water surveys and new survey requirements (proposals) that were grouped by geographical area and are described in the report in subsequent sections:

- The first subgroup deals with Nordic deep-water trawl surveys that are currently undertaken by Norway, Iceland, Faroe and Greenland. These surveys are established time-series that provide abundance indices for deep-water species in particular Greenland halibut to ICES AFWG and NWWG. The surveys are similar in their scientific objectives and design and under PGNEACS would undertake to enhance their coordination in terms of spatial and temporal coverage, data collection, management and analysis. ToRs for future coordination of this subgroup were developed.
- In a second survey subgroup, PGNEACS presents the requirements of a coordinated deep-water trawl survey along the Central European slope and associated banks and seamounts stretching from the Faroese Plateau (Vb) to the Goban Spur (VII). There are currently a number existing survey programs operating in the area (mainly Scotland and Ireland), however their spatial extent does not sufficiently cover the stock distribution and main fisheries of the deep-water species in the area. Hence a new survey proposal is presented which extends the spatial coverage to the main distributions of the deep-water fisheries with a proposed design that allows improved abundance and variance estimation while at the same time retaining elements of existing time-series. This survey proposal depends on external funding and different survey alternatives are presented depending on resource allocation.
- The third subgroup deals with existing and proposed surveys in the southern area (IX and X). It covers the existing survey that is held at ICES Subarea Xa2 as well as its extension to greater depths (down to 1200 m deep) including new seamounts and also new survey requirements for deep-water fishery in the southern area (Iberian slope IXa). In subarea Xa2 the longline survey that is currently taking place covers the islands from the Azorean archipelago and three main seamounts. The lower bathymetric limit of the survey corresponds to 800 m deep. Two experimental longline surveys were already conducted along at the southern Portuguese continental (Subarea IXa) and given the main topographic features of the region the results are considered promising under the objectives of NEACS. Hence a new longline survey is proposed for the Portuguese continental the slope and associated canyons, where the main deep-water fisheries take place. This survey will be coordinated with the Azorean survey that will be spatially extended in order to adequately cover the main distribution of the resources.

In terms of data analysis, PGNEACS reviewed data obtained from comparative tows between existing deep-water trawl surveys to assess compatibility between vessels and found that the catch rates estimates and length frequencies for most species were comparable. Data was also presented for different tow durations and the outcome of the analysis was the basis of proposing a change in deep-water tow duration.

1 Introduction

1.1 ToRs

The Planning Group on the North-east Atlantic Slope Surveys (PGNEACS) met in Tromsø, Norway from the 9–11 June 2009 to:

a) review and report scientific and technical results of the existing NEA deep water and slope surveys that are proposed to be incorporated into the PGNEACS survey with respect to :

i) biological data obtained during comparative hauls,

ii) net parameters and fishing procedures,

b) review funding, resource allocation and logistics for the international PGNEACS 2009.

c) evaluate the possibility and advantage of extending the geographical coverage to include the continental slope from Scotland to Spitsbergen, as well as East Greenland, Iceland and Faeroe Islands, and if appropriate, strengthen coordination between existing surveys in this northern region.

d) review feedback from WGDEEP, WGEF and WGDEC regarding the collection of biological and environmental samples for PGNEACS 2009.

e) on the basis of ToR a) –d) agree upon the coordination and standardization of the individual surveys participating in PGNEACS 2009 and finalize the survey programme for 2009 in terms of survey design, technology, sampling effort and sampling protocols.

f) review progress on making the PGNEACS survey data compatible with DATRAS on this basis,

g) host a deep-water species identification workshop that will standardize identification of deep-water species and review the use of compiled field id guides for deep-water species;

h) evaluate the rational for – and potentials of – international coordination of demersal surveys covering the deeper parts of the Nordic Seas (ICES Divisions XIV, V and II, as well as the northern parts of North Sea and Skagerrak);

i) recommend a procedure for how deep-water surveys in these Nordic areas might be coordinated, including evaluating establishing a new Planning Group for Deep Nordic Seas Surveys (PGDNSS) and specify its relation with existing groups as PGNEACS, PGNAPES and PGRS;

j) if establishing a PGDNSS is recommended, draft ToR for this new group, including compilation of available information of existing surveys, the need for standardization of protocols, species identifications, and other as appropriate.

k) discuss the scope and implementation of the surveys after their being dropped from DCR funding and report on the feasibility for changes.

1.2 Structure of the report

The report is structured into six sections- following the introduction, the second section deals with a general review of survey needs for the deep-water fisheries resources in the Northeast Atlantic. It summarizes the spatial extent and the fisheries characteristics of the main deep-water stocks in the NEA, the deep-water surveys that

are currently being carried out, and the gaps where coordinated surveys need to be developed. This addresses the recommendation of ICES WGDEEP 2009: "that in order to produce appropriate abundance indicators, a survey needs to cover the whole distribution area of the stock(s) in question. Therefore WGDEEP recommends that the spatial distribution of the main stocks for which the survey aims to provide abundance indicators is reviewed. Based on this review the design of the survey should be adjusted to ensure adequate stock coverage while at the same time making a realistic proposal in terms of costs and logistics".

The following three sections focus on existing and proposed deep-water surveys in different ecoregions. Section three covers deep-water surveys and their potential coordination in the Nordic waters (XIV, V, II), addressing ToRs h), i) and j). Section four contains a proposal for an internationally coordinated deep-water survey covering the central European slope and offshore banks from Vb to VII addressing ToRs b) – e) and k). Section five describes a proposed longline survey and coordination with an existing longline survey along the western Iberian Peninsula and the Azores. Section six describes results of survey data analyses and addresses ToR's a) and b), in particular concerning improved coordination through comparative hauls between vessels during existing deep-water surveys and optimization of tow duration. It also addresses ToR g), the production and dissemination of species identification keys.

1.3 Participants

A full list of participants is given in Annex 1.

2 Review of the 2008 PGNEACS proposal

The planning group reviewed the main aims and objectives of a proposed programme of European deep-water fisheries research surveys. In particular the review covered the species and stocks of commercial relevance, the geographical extent of these species and the components of survey design that need to be adopted to provide the scientific basis for management decisions to be made. Key issues addressed are the types of data that should be collected and how the qualities of these data are contingent upon the resources available.

2.1 Review of aims and objectives of the NEA deep-water fisheries surveys

Abundance indices

The primary aim of the deep-water surveys dealt in this planning group is to produce abundance indices for the main deep-water species in the North East Atlantic. These include the species that are assessed by WGDEEP such as black scabbard, blue ling, roundnose grenadier, bluemouth redfish and greater forkbeard, the deep-water sharks Portuguese dogfish and leaf-scale gulper shark assessed by WGEF and other deep-water species such as Greenland halibut assessed by AFWG and NWWG. The data generated from the surveys can then be used to tune stock assessment models or, as is the case of many deep-water stocks that do not undergo formal assessment, they can provide relative trends of abundance over time. Once time-series are established, the surveys will be the main provider of data on stock trends especially for stocks that are classified by the EU as Annex 1 deep-water species (COUNCIL REGULATION No 2347/2002).

Ecosystem indicators

The surveys aim to provide data on population and growth indicators on a species basis, such as length indicators (length frequency distribution, mean length, length quantiles per geographical area and depth strata) to estimate change in the growth patterns and the extent of population structuring (Rochet *et al.*, 2003, 2005). Such indicators are required for European fisheries under the new Data Collection Framework (2008/949/EC). The surveys would also provide the data necessary to generate various indices of biodiversity (Campbell *et al.*, 2009), including DCF indicators on the conservation status of fish species. With these indicators, surveys can provide the input data to assess the affect of fisheries on deep-water fish populations and communities.

Environmental data

The surveys further aim to characterize the deep-water ecosystem and to monitor the affects of fishing on the ecosystem through the collection of environmental data. Thus the surveys aim to provide data on habitat characteristics with particular relevance to vulnerable habitats.

2.1.1 Review of overall survey strategy taking into consideration species distribution and spatial extent of fisheries

In order to objectively assess survey needs, identify gaps in existing surveys and make recommendations on future deep-water surveys, the planning group undertook a review of the main deep-water fish stocks that need to be assessed, their stock extent and the spatial distribution of their fisheries. Following this review, a description of survey attributes were compiled that would provide single-stock advice, ad-

vice on fish communities including non-target species and advice regarding the affect of fishing on the deep-water ecosystem. Survey attributes were classified into three categories in a traffic light approach as desirable, minimum requirements or not acceptable to produce advice. The outcome of this review is shown in Table 2.1a and 2.1b. This table was the first basis to consider survey strategies. As resources are limited, the selection of a suitable survey strategy was driven by considering what the minimum attributes were, that make a survey strategy acceptable for most of its requirements, without sacrificing other requirements. In other words, the best survey strategy was seen as one which was comprised of mainly green and orange attributes, with few red attributes. Also considered were, what essential requirements of a survey were and where compromises could be made.

In summary, the table identified a minimum set of requirements:

- For target species, i.e. the species listed in the single advice section of table 2.1, surveys can target the spatial extent of a theoretical stock distribution, the known distribution of the fishery, and in some cases the known distribution of different life stages. A minimum survey requirement is the spatial coverage of the main fisheries of the listed stocks. A desirable survey would be the spatial coverage of their population.
- Regarding the timing of surveys and their frequency, the main constraint is periods of species aggregation and migration behaviour. For species that demonstrate aggregating behaviours, such as spawning aggregations of blue ling, surveys are more appropriate when they are conducted outside the spawning season. Minimum frequency of surveys is every two years, which is consistent with the frequency of ICES advice. However, if possible, it is desirable to obtain annual data. New surveys should initially be carried out on an annual basis to reduce the time needed to establish time-series.
- For advice on non target species, i.e. species that are not listed for single species advice in Table 2.1, a minimum requirement is to identify measure and record all species caught. This is also necessary to obtain data and provide indicators on changes in fish communities.

In Table 2.1 the main fishing gears used for different stocks and different areas were identified, as well as the most appropriate fishing gear to be used for surveys, taking into consideration the bottom topography and the main fishing practices in the area.

Table 2.1.a. Traffic light table listing NEA deep-water stocks, summarizing their main fisheries, including spatial extent and identifying minimum survey requirements in order to provide advice on single-stocks.

Criteria	Species	area	h	Fishery	Existing time series	Desired	Acceptable	not acceptable
Single species stock status	Aphanopus carbo	Vb, XIIb, VI, VII	500 - 1700 m	Shelf edge, Hatton bank, Wyville Thomson ridge, up to Faroese plateau	FRS deepwater survey, FRS Monkfish survey, VIa (?), MI dw survey VIa, VIIb,, ECOVUP VIb1	full population area coverage Trawl, annual, Q3 or 4	bottom trawl survey fishery area coverage: focusing Rockall, Hatton and south wyville thomspon ridge, and shelf VI and VII, biannual	No regular trawl survey, coverage less than Rockall, Hatton and south wyville thomspon ridge, and shelf VI and VII less than every 2years
	Aphanopus carbo	VIII, IX		No fishery in VIII, Isolated patches west of Portugal	N/A	full population area coverage, Trawl in VIII and Longlining in IX, annual, seasonal time seasonal t?	Longline survey fishery area coverage (area of max catch), biannual, seasonal time?Trawl survey in VIII if fishery is to be developed	No regular longline survey annual, seasonal time?
	Aphanopus carbo	I, II, IIIa, IV, Va, X, XIV		no fisherey in I-IV, some catches around Va, catches around X,	Autumn groundfish survey in Va (ICE), 25-1200 m (?)	full population area coverage in Va (Trawl) and X: (Longlining), annual,	Fishery area coverage in Va (Trawl) andsome seamounts in X: (Longlining), biannual,	Absence of longline survey in X, less than every 2years,
	Argentine silus	Va	250 - 1200 m	Large Icelandic fishery, pelagic and bottom trawls	add details from Gudmundur	Pelagic Trawl& Acoustic, full population coverage, annual,	Pelagic Trawl& Acoustic, full fishery coverage, biannual	Absence of Pelagic Trawl& Acoustic, survey not covering fishery, less than every two years
	Argentina silus	I, II, IIIa, IV, Vb, VI, VII, VIII, IX, X, XII, XIV		Semi-pelagic trawl in Norway. Targeted fishery in Faroe islands, pair trawling	Silver smelt survey (NO), IIa, IVa, IVb, IIIa, FRS deepwater survey (VIa), FRS Monkfish survey, VIa (?), Porcupine bank ES survey	Pelagic Trawl&Acoustic , full population coverage in IIa, Vb and VI, Q1 or Q2	Pelagic Trawl& Acoustic, full fishery coverage in IIa, Vb and VI, biannual	Absence of Pelagic Trawl& Acoustic, survey not covering fishery, less than every two years
	Coryphaenoides rupestris	Vb, XIIb, VI, VII	400 - 1800 m	Bottom trawl. Targeted fishery. Mixed fishery for RNG, BSF and sharks	FRS deepwater survey, FRS Monkfish survey, VIa (?), MI dw survey VIa, VIIb, ECOVUP/ARPA survey (VIb1, X, IIb)	Bottom Trawl, population coverage in all areas, annual	Bottom Trawl, fishery coverage in areas Vb,VI and XIIb, biannual	Bottom Trawl, less than fishery coverage in areas Vb,VI and XIIb, less than every 2 years
		Va, Xb, XIIa, XIIc, XIVb		Mainly XIIa and XIIc, Very small catch.	Autumn groundfish survey in Va (ICE), 25-1200 m (?), Greenland dw survey (?)	Bottom Trawl fishery coverage on reykjanes ridge and around Iceland, annual	Bottom Trawl fishery coverage on reykjanes ridge and around Iceland, biannual	Bottom Trawl, less than fishery coverage, less than every 2 years
		IIIa		Mainly a bycatch fishery, at current TAC levels	*Pandalus borealis* survey (NO) (150-650 m)	Bottom Trawl population coverage, as an extension of P. borealis survey, over whole pop. annual	use of the *Pandalus borealis* survey as it stand in the 2000s	Bottom Trawl, less than fishery coverage, less than every 2 years
	Molva molva	I, II	200 - 900m	Significant longline targeted fishery		Longline survey, population coverage, annual	fishery area coverage (area of max catch) Longlining, biannual, seasonal time?	Absence of longline survey multiannual, seasonal time?
		Va		Bycatch in demersal fishery	Icelandic Groundfish survey	Bottom Trawl fishery coverage, annual	Bottom Trawl fishery coverage biannual	Bottom Trawl, less than fishery coverage, less than every 2 years
		Vb		Mainly targeted longline fishery with some bycatch by trawls	Faeroe surveys < 900m	Longline survey, population coverage, annual	existing Faroese bottom trawl survey, fishery area coverage (area of max catch) biannual	absence of regular Bottom Trawl or longlining survey , less than fishery coverage, less than every 2 years
		IIIa, IV, VI, VII, VIII, IX, X, XII, XIV		Mainly longline fishery. Mixed trawl fishery on Shelf Edge in IV, VI, VII, VIII.	Western IBTS, VII & VIII, Porcupine bank ES survey (?), FRS Monkfish survey, VIa (?)	Longline survey in IIIa, mixed trawl survey shelf and slope in VI,VII,VIII, longline survey in Vib (Rockall) if fishery is to be developed, population coverage, annual	Longlining or Bottom trawl survey, fishery area coverage (area of max catch) biannual,	no regular Bottom Trawl or longlining, less than fishery coverage, less than every 2 years
	Molva dypterygia	Va, XIV	200 - 1500 m	Targeted trawl and longline fishery in Va. No fishery in XIV.	Autumn groundfish survey in Va (ICE), 25-1200 m (?)	Longline and/or bottom trawl survey, population coverage, annual Q3 or 4	Longlining or Bottom trawl survey, fishery area coverage (area of max catch) biannual, seasonal time?	no regular Bottom Trawl or longlining, less than fishery coverage, less than every 2 years
		Vb, VI, VII		Targeted trawl fishery. Possibly longline in Vb.	FRS deepwater survey + FRS Monkfish survey, VIa (?), MI dw survey VIa, VIIb, ECOVUP/ARPA survey (VIb1, X, IIb), Faeroe surveys < 900m (?)	Trawl survey Vb, VI and VII, population coverage, Q3-Q4	Longlining or Bottom trawl survey, fishery area coverage (area of max catch) biannual, Q3-Q4	no regular Bottom Trawl or longlining, less than fishery coverage, less than every 2 years
		I, II, IIIa, IV, VIII, IX, X, XII		Bycatch in longline Ling fishery, species does no occur in VIII, IX & X		Longline survey if a recovery is detected in the fishery, annual	Longline survey if a recovery is detected in the fishery, biannual	no regular Bottom Trawl or longlining, less than fishery coverage, less than every 2 years

Table 2.1.a cont. Traffic light table listing NEA deep-water stocks, summarizing their main fisheries, including spatial extent and identifying minimum survey requirements in order to provide advice on single-stocks.

Criteria	Species	area	h	Fishery	Existing time series	Desired	Acceptable	not acceptable
	Brosme brosme	Va, XIV	250 - 1200 m		spring+autumn groundfish survey (ICE)	Long line survey, fishery coverage, annual	Longline survey, fishery coverage, biannual	Bottom Trawl, less than fishery coverage, less than every 2 years
		I, II		Bycatch in Ling and Cod longline fishery		Long line survey, fishery coverage, annual	Long line survey, fishery coverage (max catch), biannual	Long line survey, fishery coverage (max catch), less than every two years
		XIIa		Bycatch of longline fishery				
		VIb		Bycatch of longline fishery	Faeroe surveys < 900m (?)	Long line survey if fishery is to be developed, annual	Long line survey, fishery coverage (max catch), biannual	Long line survey, fishery coverage (max catch), less than every two years
		IIIa, IVa, Vb, VIa, VII, VIII, IX, XII		Bycatch of trawls and longline mainly IVa, Vb and VIa	FRS deepwater survey (VIa), FRS Monkfish survey, VIa (?)	Long line survey, fishery coverage, annual	Long line survey, fishery coverage (max catch), biannual	Long line survey, fishery coverage (max catch), less than every two years
	Hoplostethus atlanticus	VI	500 - 1550 m	Targeted fishery		Targeted Acoustic and trawl survey VI, fishery coverage incl seamounts, annual	Trawl survey VI for mixed species, dw fishery coverage, less than annual, to cover juv. distib.	Trawl without acoustics on spawning agregations,
		VII		Targeted fishery		Targeted Acoustic and trawl survey VII, fishery coverage incl seamounts, annual	Trawl survey VII for mixed species, dw fishery coverage, less than annual, to cover juv. distib.	Trawl without acoustics on spawning agregations
		I, II, IIIa, IV, V, VIII, IX, X, XII, XIV		Targeted fishery	N/A	Pilot survey (trawl, acoustic and sub.) to assess distribution in VIII, IX, X	No survey until fishery funded exploration suggest standing biomasss may support > 100 t annual landings	Trawl without acoustics on spawning agregations
	Phycis blennoides	I, II, III, IV, V	200 - 1300 m	No TAC in areas I - IV. Almost no catch in V.				
		VI, VII, XII		Bycatch in longline and trawl fisheries in different areas. Adequately sampled by trawl	FRS deepwater survey (VIa), FRS Monkfish survey, VIa (?),Porcupine bank ES survey, MI dw survey VIa, VIIb	Trawl survey on upper slope VI-VII and Hatton/Rockall, covering population annual	Trawl survey on upper slope VI-VII and Hatton/Rockall, covering main fishery, biannual	no regular Bottom Trawl or longlining, less than fishery coverage, less than every 2 years
		VIII, IX		Mainly bycatch. Small TAC		Trawl survey on upper slope VIII, covering population, annual	Increase nb of tow > 300 m in w estern IBTS	
		X		Small targeted longline mixed fishery.	Azorean bottom longline survey	Longline survey, full population area coverage , annual, Q2	Longline survey fishery area coverage (area of max catch), biannual,	No regular longline survey
	Pagellus bogaraveo	VI, VII, VIII		Catch from mixed trawl fishery. Stock currently depleted.	Western IBTS, VII & VIII	bottom Trawl survey (IBTS) to monitor stock recovery		
		IX		Mainly longline fishery	ARSA survey (ES) 30-800 m	Longline survey, full population area coverage , annual, seasonal time?	Longline survey fishery area coverage (area of max catch), biannual,	No regular longline survey
		X		Mainly longline fishery	Azorean bottomlongline survey	fLongline Survey full population area coverage, annual, seasonal time?	Longline survey fishery area coverage (area of max catch), biannual,	No regular longline survey
	Beryx spp	All areas	400 - 600m	Some targeted trawling on MAR. Bycatch in demersal and longline fisheries in other areas.		Longline and/or bottom trawl survey, population coverage, annual	Longlining or Bottom trawl survey in X, biannual, seasonal time?	no regular Bottom Trawl or longlining, less than fishery coverage, less than every 2 years
	Centrophorus squamosus	Global distributio n, all ICES areas except northern seas	300 - 1900 m	Bycatch of deepwater trawl fisheries, and some targeted longline fisheries	FRS deepwater survey, FRS Monkfish survey, VIa (?), Porcupine bank ES survey (?), Azorean bottom longline survey (?), MI dw survey VIa, VIIb	Longline and/or bottom trawl survey, population coverage, annual	Longlining or Bottom trawl survey, fishery area coverage (area of max catch) biannual, seasonal time?	no regular Bottom Trawl or longlining, less than fishery coverage, less than every 2 years
	Centroscymnus coelolepis	Global distributio n, all ICES areas except northern seas	500 - 1800 m	Bycatch of deepwater trawl fisheries, and some targeted longline fisheries	FRS deepwater survey, FRS Monkfish survey, VIa (?), Porcupine bank ES survey (?), Azorean bottom longline survey (?), MI dw survey VIa, VIIb	Longline and/or bottom trawl survey, population coverage, annual	Longlining or Bottom trawl survey, fishery area coverage (area of max catch) biannual, seasonal time?	no regular Bottom Trawl or longlining, less than fishery coverage, less than every 2 years

Table 2.1b. Traffic light table identifying minimum survey requirements in order to provide advice on non target species, population and fish community indicators, biodiversity and vulnerable habitats.

Criteria	Desired	Acceptable	not acceptable
Advice on non target species	total weight, length and numbers registered for all species on bottom trawl/longline survey, additional sampling for sex, maturity, age, annual survey	total weight, length and numbers regisertered for all species on bottom trawl/longline survey, biannual	only total weight, not all species id or measured, frequency less than biannual
DCF Ecosystem indicators: 1.) Conservation status of fish species	total weight, length and numbers registered for all species on bottom trawl survey, fishery coverage, annual survey	total weight, length and numbers registered for all species on bottom trawl survey, fishery coverage (max catch) biannual	total weight, not all species id or measured,frequency less than biannual
DCF Ecosystem indicators: 2.) Proportion of large fish	total weight, length and numbers registered for all species on bottom trawl survey, population coverage, annual survey	total weight, length and numbers registered for all species on bottom trawl survey, fishery coverage (max catch) biannual	total weight, not all species id or measured, frequency less than biannual
DCF Ecosystem indicators: 3.) Mean maximum length of fishes	total weight, length and numbers registered for all species on bottom trawl survey, population coverage, annual survey	total weight, length and numbers registered for all species on bottom trawl survey, fishery coverage (max catch) biannual	total weight, not all species id or measured
DCF Ecosystem indicators: 4.) Size at maturation of exploited fish species	Individual measurements of age, length, sex and maturity for all species in population distribution area	Individual measurements of age, length, sex and maturity for target species, fisheries coverage, biannual	no measurements of sex or maturity, frequency less than biannual
other biodiversity indicators, including indicators for vulnerable habitats	Trawl survey, all species identified and enumerated, including benthic invertebrates, annual, full spatial coverage	Trawl survey, all fish species identified and enumerated, id of indicator species for vulnerable habitats, every two years	no bottom trawl survey, not all fish species identified, no invertebrate identificatio, frequency less than biannual

2.1.2 Abundance indices and other biological data

To get representative abundance indices for the species addressed in the traffic light approach seen in Table 2.1 (Roundnose grenadier, black scabbard, orange roughy, ling, blue ling, greater silver smelt, cod, greater forkbeard, deep-sea sharks: Portuguese dogfish and leaf-scale gulper shark), survey should be undertaken outside the spawning season of blue ling, where the aggregated spatial distribution of this species may prevent the collection of suitable abundance data.

The depth range of the survey should be 400–1800 m to fully cover the depth range of most targeted species (ling and tusk may occur shallower). Provided the survey is carried out in a suitable season for blue ling, it can produce a range of indices for the main deep-water commercial stocks in the area.

Table 2.2. Indices available from survey by species.

Species	Relative biomass	Relative number	Recruitment	Size distrib.	Maturity
Roundnose grenadier					
Black scabbardfish					
Orange roughy					
Blue ling					
Ling					
Greater sliver smelt					
Tusk					
Greater forkbeard					
Portuguese dogfish					
Leaf scale gulper shark					
Other species					

2.1.2.1 Relative biomass and abundance

The survey can produce estimates of biomass and numbers. These abundance indices are relative and not absolute values. They refer to the total population, not to recruitment or any other life stage.

2.1.2.2 Recruitment

For most deep-water species, the survey will not be suitable to provide indices of recruitment, because of the low catchability of small fish and difficulties associated with age readings. However, it may be that the survey will provide indices of abundance of juvenile stages of certain species, e.g. Orange Roughy that are scattered over flat bottom, unlike adults that aggregate over rough ground. It may also be that recruitment of other species will become distinguishable in the survey, as changes in size distribution and abundance over time permits the detection of recruitment pulses for species such as ling, blue ling and black scabbard fish.

2.1.2.3 Size distribution

Size distribution will only be relevant to species where a wide range of size classes can be caught. Estimates of size distributions are accurate for species where there is equal selectivity for all size classes however there can be problems with obtaining a full size distribution for species that have low catchability of small individuals and also for species where there are spatially differential distributions and not all live stages area covered by the survey.

2.1.2.4 Maturity

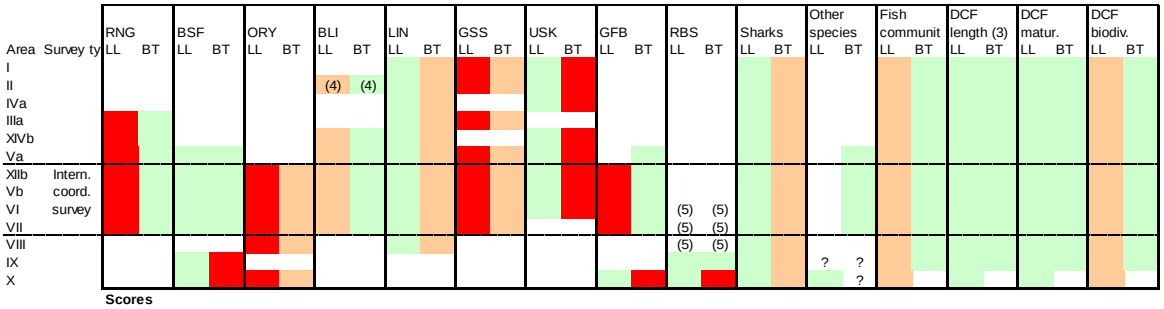
The survey can provide an index of the size at maturity for most species. This excludes orange roughy (small catch of adult fish), and black scabbard in areas where there are no mature fish occurring.

2.1.3 Spatial coverage and selection of most appropriate gear

The choice of survey gear for different areas was further examined by grouping the stocks by area. The most appropriate gear for each stock is presented in a sec-

ond traffic light table using the same categories to produce advice; desirable, minimum requirements or not acceptable (see Table 2.2).

Table 2.2. Traffic light table to identify survey requirements in terms of gear and area for the different species (FAO species codes used).



Area	Scores						Choice
	LL	LL	LL	BT	BT	BT	
I	1	2	5	1	3	4	LL
II	1	3	5	1	3	4	LL
IVa	0	2	5	1	2	4	LL
IIIa	2	2	4	0	3	5	BT
XIVb	1	3	5	1	2	6	BT
Va	2	3	6	1	3	9	BT
XIIb	4	3	6	1	4	9	BT
Vb	4	3	6	1	4	9	BT
VI	4	3	6	1	4	9	BT
VII	4	3	5	0	4	9	BT
VIII	1	2	4	0	3	4	BT
IX	0	2	5	1	1	5	LL
X	1	2	6	3	2	0	LL

(1) e.g. Blue mouth (*Helicolenus dactyloptera*), chimaeras, by-catch species
(2) species composiiton, fish secies diversity
(3) DCF indicators based upon length (minimum length, maximun length, prop. of large fish)
(4) rare species in these areas
(5) Depleted stock covered by current western IBTS

Gear selection was driven by its suitability to target the species listed in Table 2.1, while also adequately sampling all species. Gear was considered most appropriate in targeting the stocks in question if it produced the most green or orange categories and the least red. The table shows that there is a spatial trend for the overall suitability of gear. In the Nordic waters and the North Sea (I, II, IVa) longlining is the most suitable for a number of species that occur in the area, primarily reflecting the most common fishing practices for Ling and Tusk and it is also the most suitable for deep-water sharks. The trade-off with this gear is that it does not adequately sample Greater Silver Smelt. In Norwegian and Icelandic waters (IIIa and Va); bottom trawling addresses the survey needs for most stocks in the area.

This also holds true for the central European slope area and its associated off shore banks (XIIb, Vb, VI, VII and VIII). The reason for this is that most deep-water fisheries in the area are executed by deep-water trawl, covering species such as Roundnose Grenadier, Black Scabbardfish, Blue Ling and Greater Forkbeard. Tusk is caught in a longlining fishery and would not be suitably sampled with trawl. Deepwater sharks are probably best surveyed by longlining; however indices from trawls would also be acceptable, especially when stock levels recover.

In the southern section (XI and X) the most suitable gear to use for the species listed in Table 2.1 and commercially exploited is longlining. The adoption of this gear in the surveys reflects current fishing practices, and also takes into account the unsuitability of the seabed for trawling. To use bottom trawl in this area would require exhaustive bottom topography studies in order to identify potential trawlable areas and subsequently to the evaluation of their adequacy for the main survey objective. In terms of ecosystem and biodiversity indicators it is questionable whether the whole community is adequately sampled using longlines. Longlining traces the main predators but

not the whole spectrum of the community, including invertebrates. It has to be noted though, that there are selectivity issues with all gears and no single gear will adequately sample all species of a community. For this to happen, a multiple gear approach would have to be taken, whereby dredges and or pots would have to be used in addition to trawls and longlines. Longlining is considered the best strategy to samples fish communities in hard substrates and steep slopes, unsuitable for trawling. In particular longlining in vulnerable habitats, e.g. seamounts, limits damage to the seabed. Indicators, such as the DSF indicator on the conservation status of fish, focuses on the affect of fishing on large predator species such as sharks and it is expected that longline surveys can provide data for these.

2.1.4 Assessing existing surveys and identifying needs for new surveys

Existing deep-water survey programmes were described in relation to species and their stock distribution areas in Table 2.1. This information was summarized and presented by species and area in Table 2.3, listing survey programmes that are ongoing time-series, discontinued time-series, surveys subject to funding, and also showing gaps where new surveys need to be developed.

Table 2.3. Summary of existing deep-water surveys in the different ICES areas and the species they are providing data for.

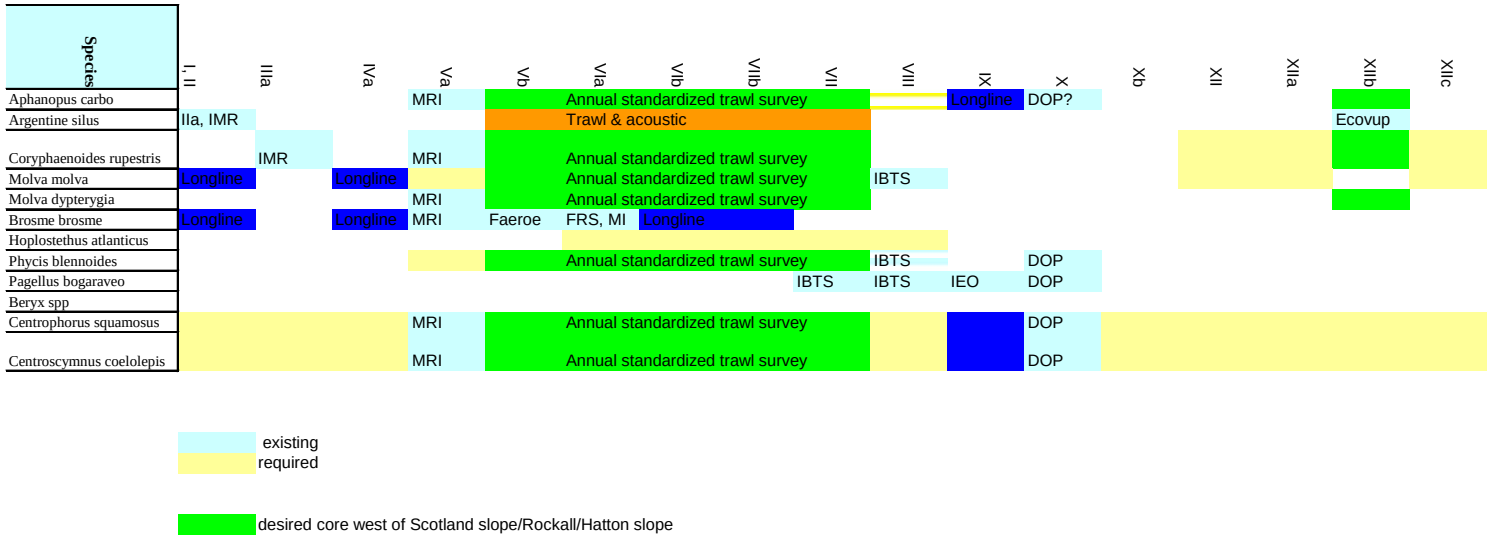
Species	I, II	IIIa	IVa	Va	Vb	VIa	VIb	VIIb	VII	VIII	IX	X	Xb	XII	XIIa	XIIb	XIIc
Aphanopus carbo				MRI ?		FRS, MI	VIb1, Eco	MI								Ecovup	
Argentine silus	IIa, IMR			MRI		FRS, MI	VIb1, Eco	MI, IEO	VIIc,k, IEO							Ecovup	
Coryphaenoides rupestris		IMR		MRI		FRS,MI	MI, Ecovul									Ecovup	
Molva molva					Faeroe	FRS		IEO	IBTS	IBTS							
Molva dypterygia				MRI	Faeroe	FRS, MI	Ecovul	MI								Ecovup	
Brosme brosme				MRI	Faeroe	FRS, MI											
Hoplostethus atlanticus																	
Phycis blennoides						FRS, MI		IEO, MI		IBTS		DOP					
Pagellus bogaraveo						FRS, MI		IEO	IBTS	IBTS	IEO	DOP					
Beryx spp						FRS, MI						**DOP**					
Centrophorus squamosus				MRI		FRS, MI		MI				DOP					
Centroscymnus coelolepis				MRI		FRS, MI		MI				DOP					

ongoing
time series subject to funding
discontinued survey
required

Table 2.3 shows that there are a number of existing survey programmes in the northern area, (I,II,Va), mainly from Norway and Iceland, covering some of the important deep-water stocks in the area. In the central area, Vb to VIII, there are a number of survey time-series that are subject to funding, in particular the Scottish and Irish deep-water surveys covering area VI. Deepwater extensions of the French IBTS in area VII and VIII are also subject to funding.

The table highlights gaps in stock and area coverage for a number of stocks in Vb, VIb and VII. Gaps are also identified for some species, such as black scabbard, in area IX and surveys targeting stocks in area X are also subject to funding. There are no ongoing long term deep-water surveys covering the mid Atlantic Ridge. The outcome of Tables 2.1 to 2.3 are the basis of suggested coordinated survey proposals summarized in Table 2.4, and are described in detail in the following sections of this report.

Table 2.4. Summary of proposed deep-water surveys in the different ICES areas and the species they are providing data for.



2.2 References

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Rochet, M.J., Trenkel, V.M. 2003. Which community indicators can measure the impact of fishing? A review and proposals. Can. J. Fish. Aquat. Sci., 60, 1, 86–99.

Rochet, M.J., Trenkel, V., Bellail, R., Coppin, F., Le Pape, O., Mahe, J.C., Morin, J., Poulard, J.C., Schlaich, I., Souplet, A., Verin, Y., Bertrand, J. 2005. Combining indicator trends to assess ongoing changes in exploited fish communities: diagnostic of communities off the coasts of France. ICES J. Mar. Sci., 62, 8, 1647–1664.

3 Nordic Deepwater surveys

3.1 Coordination of the Nordic surveys (Addressing ToR h)

The surveys listed below by the Faroes, Greenland, Iceland and Norway are all nationally funded deep-water trawl surveys. These surveys consist of established time-series providing abundance indices for Greenland halibut and other species. It was agreed that these time-series should not be jeopardized by attempting to design a single standardized survey in all areas. At the same time, it has mutual benefits to increase the coordination between the surveys in terms of data collection protocols, species identification, data management, cross-ecosystem comparisons and interpretation of results.

The purpose of such cooperation would be to increase the scientific output from all available resources (man-hours and ship time), thereby improving the knowledge of the deep-sea ecosystems and of the species for which management advice are requested.

It was noted that all the surveys are already broadly similar with respect to gear, sampling design, depth range, and species composition (Table 3.1). Together they cover most of the continental slope areas of the Norwegian and Greenland Seas (Figure 3.1). The most notable exception is the slope of Northeast Greenland. This area is usually ice covered all year-round, making surveys only occasionally possible. This may change in future, as ocean temperature may rise, and the feasibility of more regular coverage in these areas should be considered in future cooperation.

It was also noted that it should be evaluated if it would be possible and advantageous to make the survey data available in the ICES DATRAS database, in order to facilitate joint research and analyses.

3.1.1 The Norwegian surveys

There are two Norwegian benthic trawl surveys undertaken by IMR that target deep-water fish. This excludes pelagic deep-water surveys. Additionally there are deep stations on other IMR surveys particularly north from Spitsbergen and in Skagerrak that are not listed here. Both of the listed surveys use Alfredo no 5 trawl with a 60 mm codend lining.

The first survey samples the continental shelf and slope (60°-70°N), off mid Norway primarily, and targets greater argentine, beaked redfish and golden redfish. It is an acoustic survey supported by fixed bottom trawl and pelagic stations. The depth range of the bottom trawl stations is approximately 300–900 m. The survey has been conducted occasionally since the 1980s. It is proposed to undertake the survey on a more regular basis, most likely annually, to cover the area with regard to deep-water fish species. However this will be a subject to a current revision of the IMR survey strategy.

The Norwegian Deep Water survey along the northern shelf break (68°-80°N) has been undertaken annually since 1994, targeting primarily Greenland halibut and beaked redfish with bottom trawl. The sampling is stratified random on depths ranging from approximately 400–1350m. The deepest stations are limited by cold (below zero) water and the boundary between subzero polar water and warmer Atlantic water is located at 900–1200 m depending on latitude. This boundary is shallower in the southern part of the survey area. The survey is expected to continue either annually or biennially.

3.1.2 The Icelandic surveys

From 1996 to 1999 150 stations were sampled by trawl in waters deeper than 500 m on the west, north, east and southeast continental slopes off Iceland (primarily targeting Greenland halibut). In 2000, 74 stations were added to the survey, covering the continental slopes to the south of Iceland and the Reykjanes ridge. The station coverage of autumn survey from the year 2000 is thought to represent a reasonable coverage for Greenland Halibut, redfish, blue ling, ling, tusk and greater silver smelt. Details of the fishing gear and the survey design area given in Table 3.1.

3.1.3 The Faeroese surveys

The Faeroese Spring Groundfish Survey was initiated in 1983 and comprises 100 stations covering the depths on the Faroe Plateau down to 500 m. The Faroese Summer Groundfish Survey, initiated in 1996, comprises 200 stations covering the depths down to 500 m on the Faroe Plateau. In addition, in March and in September, there are 29 stations on the Faroe Bank, 8 of which are deeper than 200 m. The research vessel "Magnus Heinason" has been used for all surveys. Details of the fishing gear are given in Table 3.1.

The Faeroese Greenland halibut survey was designed by fixing the area, depth, and time of the year to be fished. Within these restrictions, the skipper on the research vessel was free to select the actual positions of the tows and their actual duration, as long as the tows lasted between 3 and 6 hours. The catch was sampled in the same way as the Faroese groundfish surveys.

The coverage of the surveys of the deep waters (> 400 m) is rather sparse, and a Greenland halibut survey was therefore initiated in 1995 that covered the 400–600 m depth interval on the Faroe Plateau. The stations are not fixed to specific positions, but are restricted to certain areas on the slope on the Faroe Plateau where it is possible to trawl for 3–5 hours (9–15 nautical miles). The area coverage was less extensive in 1995–1997 than during 1998–2009. The gear is a Star trawl with 135 mm mesh in the codend. The survey is conducted in late May to early June (12 days) with around 40 tows being carried out. In addition to the Greenland halibut survey a similar survey targeting redfish was undertaken from 1995–2007, but has since been terminated.

3.1.4 The Greenlandic surveys

In 1998 Greenland Institute of Natural Resources initiated a bottom trawl survey covering East Greenlandic waters within ICES Area 14B from 61°N to 67°N at depths from 400 to 1500 m. The survey area was stratified in 5 Subareas. As a result of lack of funding there was no survey at East Greenland in 2001.

The survey was planned as a Stratified Random Bottom Trawl Survey with a total of 70 hauls. Because of ice coverage and bad bottom normally only 40–55 stations were taken annually. Each stratum was allocated at least two hauls. The remaining hauls were allocated in order to minimize the variance in the estimation of the biomass of Greenland halibut.

The survey was conducted by the 722 GRT trawler RV "PAAMIUT", using an ALFREDO III trawl with a mesh size on 140 mm and a 30-mm mesh-liner in the codend. The groundgear was of the rock-hopper type. The trawl doors were changed to "Injector" weighing 2700 kg, in 2004. Towing time was usually 30 min, but towing times down to 15 min were accepted. Average towing speed was 3 kn.

Table 3.1. Details of deep-water surveys carried out by the Nordic countries.

Survey	Survey acronyme	IAGS	TN	TS	FD	EG
	Full name		Norwegian Deep Water survey along the Northern Shelf Brake	Norwegian argentine and redfish survey along the southern shelf and slope		Greenland halibut survey in East Greenlandic waters
	Nation	Iceland	Norway	Norway	Faroe Islands	Greenland
	Month	10	8	3/4	Late 4 to beg. 5	8/9 (until 2008 6)
	Periodicity	annualy	annualy	interannualy (?)	annually	annualy (except 2001)
	First year of time series	1996/2000	1994	2009 (earlier ocational)	1995	1998
Design parameters	Area	Icel. Shelf and slope	Norwegian slope 68°-80°N	Norwegian slope 60°-70°N	Faroe Slope	East greenlandic waters from 61°45' to 67°
	Area coverage	1500	20144			37397
	#hauls 0-400m	120	0	14		0
	#hauls 401-600m	60	40	17	Around 40	10
	#hauls 601-800m	100	89	11		12
	#hauls 801-1000m	100	43	0		16
	#hauls 1001-1200m	50	15	0		8
	#hauls >1200m	0	6	0		6
	Depth range		400-1350	300-900	400-550	400-1500
	Total # stations		190-195	40-50	Around 40	40-55 (depending on icecoverage)
	Design	Stratified random/fixed	Stratified random/fixed	Stratified random/fixed	Random	Buffered stratified random
	Towing speed (knots)	3.8	3.8	3.8	3	3
	Towed distance (nm)	3	2-3.5	2-3.5	9-15	2.5
Gear specifications	Gear type	Bottom trawl	Bottom trawl	Bottom trawl	Bottom trawl	Bottom trawl
	Gear name	Gulltoppur	Alfredo no 5	Alfredo no 5	Star trawl	Alfredo III
	Drawings available	Yes	Yes	Yes	Yes	Yes
	Headrope length	35.6	37.5	37.5		
	Groundrope length	22.6	32.3			
	Mesh-size, roof (mm)	170	170	170		
	Mesh-size, belly (mm)	165	155	135	135	140
	Mesh-size, cod-end (mm)	42	60	60	135	30
	Ground gear	Rockhopper	Rockhopper	Rockhopper	Rockhopper	Rockhopper
	Weight og ground gear (Kg)	2470				
	Door type/area	Polyice no 8/8m2	Various/11.5m2	Various/11.5m2	Thyborøn	Injector/?
	Weight of doors (Kg)	2700	3500	3500		2700
	Door spread (m)		170-180	170-180		100-150
	Wing spread (m)					
	Sweeps (m)		140	140		
Biological sampling	Catch weight and nubers	Yes	Yes	Yes	Yes	Yes
	All species identified	Yes	Yes	Yes	Yes	Yes
	Length distribution of all species	Yes	Yes	Yes	Yes	Yes
	Individual weighs for deep-water species	Yes	R. hippoglossoides and Sebastes	S. mentella and A. silus	Yes	R. hippoglossoides
	Sex and maturity for deep-water species	Most species	R. hippoglossoides and Sebastes	S. mentella and A. silus	R. hippoglossoides	R. hippoglossoides
	Stomach contents for deep-sea species	Some species (6)	No	No	Seldom	No
Catch composition	Most abundant species below 400m	Sebastes mentella	Reinhardtius hippoglossoides	Reinhardtius hippoglossoides	Reinhardtius hippoglossoides	Sebastes mentella
	2. most abundant	Reinhardtius hippoglossoides	Sebastes mentella	Greater argentine	Sebastes mentella	Reinhardtius hippoglossoides
	3. most abundant		Macrourus berglax	Sebastes mentella	Amblyraja radiata	Coryphaenoides rupestris
	4. most abundant			Sebastes marinus	Golden redfish	Macrourus berglax
	5. most abundant				Bathyraja spinicauda	Gadus morhua
	#Invertebrate species recorded					~20 (squids, crabs and shrimps)
	#Elasmobranch species recorded					~10
	#Teleost species recorded					~140
Data storage	Format	Oracle database	SPD	SPD	Oracle database	Acces database
	Aggregation level	Individual	Individual	Individual		Individual
	ICES-database format?					

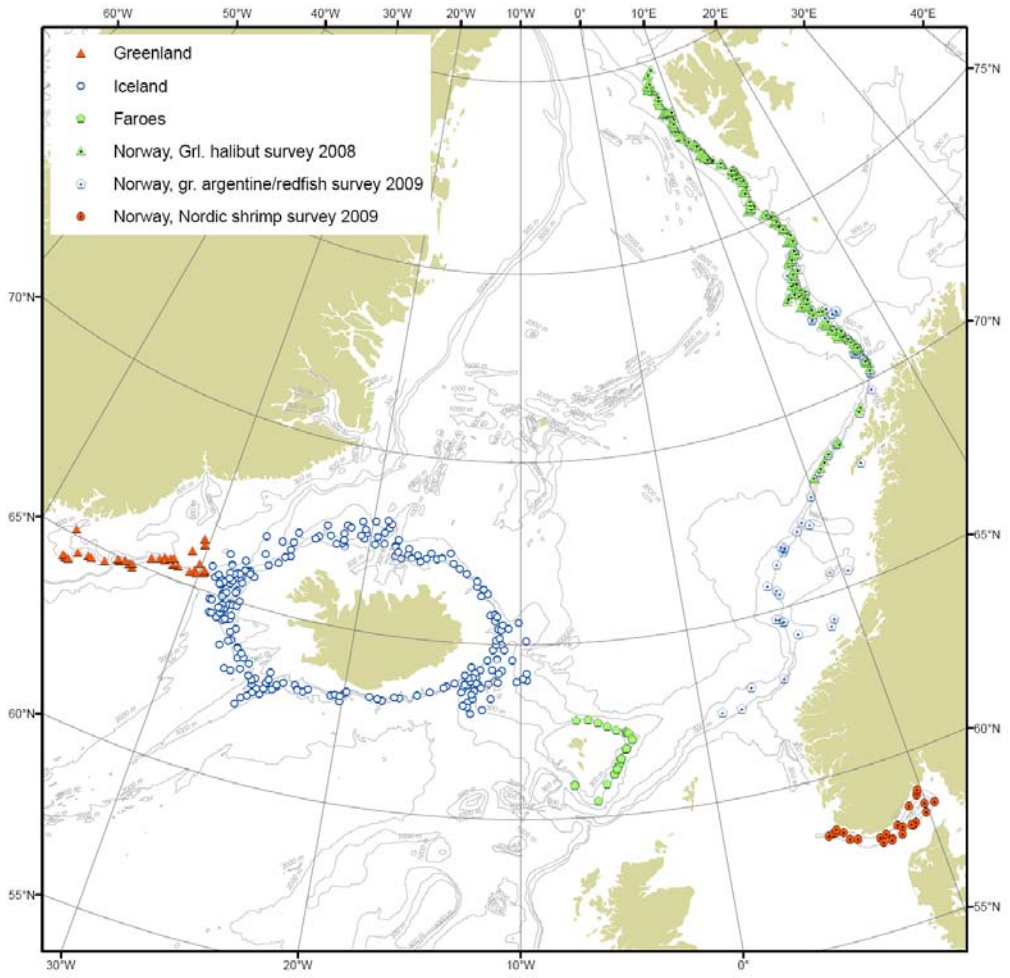

Figure 3.1. Survey distribution of deep-water surveys in the Nordic countries.

3.2 Nordic survey coordination within PGNEACS (Addressing ToR i)

The PG discussed how the Nordic surveys should be coordinated along with the other surveys considered by PGNEACS. Two possibilities were discussed. Either include the Nordic surveys along with those to the south or establish a new and separate Nordic planning group.

The PG realizes that the Nordic surveys differ from the central and southern surveys in several important respects. For one, they cover a different ecosystem, with the dominance of other species. In all the Nordic deep-water surveys Greenland halibut dominate the species composition and the surveys are mainly targeting this species, which is not commonly found in the surveys further south. Secondly, the abundance indices produced are mainly reported to AFWG or NWWG, whereas the southern surveys tend to report to WGDEEP and WGEF. The analytical approach is also different, with the Nordic surveys supporting several data rich assessments, whereas most southern stocks are considered data poor, and must be approached with different methodologies. It was also noted that the financial situation is different, and that coordination of surveys from 40–80°N as well as from east to west in the Norwegian Sea, is an enormous task that may not be feasible.

On the other hand, there are several key aspects that are common to both the Nordic and the more southern surveys. These include technological problems associated with observations or in situ sampling at great depths, species identification of rare

and often vulnerable sharks and skates, data management and analytical approaches. It also has to be added that there is a continuum of some deep-water species such as black scabbard that are caught in the Nordic surveys as well as the central and the southern surveys.

Despite obvious geographical and faunal differences between the Nordic and the central and southern ecoregions, the PG decided that the coordination of the Nordic surveys should be facilitated within a subgroup of PGNEACS and not through the creation of a new PG This will allow close cooperation between those involved with the surveys, and at the same time secure coordination of issues that are common to both subgroups more southerly.

Recommended ToR for 2010 (Addressing ToR j)

Evaluate present sampling protocols for surveys by Faroe, Greenland, Iceland and Norway, and attempt to standardize the protocols as much as possible.

Evaluate the combined total survey coverage in relation to distribution of all major stocks in the area and consider the feasibility of bridging any gaps.

Evaluate the extent and quality of information on non-targeted species and the ability to describe larger parts of the fish communities and the physical environment.

Evaluate the prospect of making all the combined survey data available to all parties by use of e.g. the ICES DATRAS database, in order to facilitate joint research and analyses.

4 Central NE Atlantic Deepwater survey

4.1 General considerations

A survey of the west of Scotland slope has been carried out for 10 years. Although there have been some changes in the survey design and depth sampled over time, this survey may now provide trends in abundance of the total multispecies biomass and total biomass for roundnose grenadier, black scabbard and deep-water sharks, over a restricted part of the stock ranges. The survey may also provide abundance indices for non assessed species such as smoothheads, small macrourids (to species level for the most abundant species), morids, etc.

Expanding this survey from the west of Scotland slope out to the seamounts and banks further west (Anthon Dohrn, Lousy, Faroe, Bill Balley, Rosemary, Rockall and Hatton) would provided abundance indices at the scale of the fisheries distribution and/or management area for roundnose grenadier, blue ling and black scabbardfish. For deep-water sharks' Portuguese dogfish and leafscale gulper shark the area of distribution of their stocks is not known, as some species have global distributions, but the survey would provide abundance indices over the central area of the NE Atlantic.

Such a survey should be standardized in terms of season, trawl, fishing methodology: towing speed, tow duration, trawl monitoring (vertical and horizontal opening).

4.2 Detailed Survey plan

The primary aims of the central NEA deep-water survey is:

1) To provide indices of relative abundance of those species that are representative of the main stock units (as highlighted in Section 2, Table 2.1)

2) to determine the spatial and depth distribution of target and non target deep-water species

3) to provide indices of the biodiversity of the fish assemblages and data to assess the affect of fishing on the ecosystem.

To be fit for purpose the survey should sample the geographic and depth ranges of the main species or stocks of interest, over a period that is sufficient to detect trends within 5 to 10 years. This section of the report deals with the geographic extent of the survey, the depth extent of the survey, the spatial resolution of the survey, the choice of stations and the temporal resolution of the survey.

4.2.1 Geographic range

The central NE Atlantic area ranges from approximately 48º to 62º N and from 1 º to 20 º W. This area (Fig 4.1) includes ICES areas IVa (West Shetland), V (Faroe Islands), VI (West of Scotland slope and seamounts and Rockall/Hatton banks), VII (Porcupine) and XIIb (west Hatton bank). There are scientific reasons for considering this sector of the NEA as separate from the Northern sector and the Southern sector. There is a strong faunal divide northeast of the Wyville-Thomson ridge at approximately 60 N 6 W where the Atlantic waters of the Rockall trough merge with the Arctic waters of the Norwegian Sea. Many of the main deep-water species extend to the limit of this boundary but not further. Equally at the southern boundary there is a general change in species assemblage. Some species such as black scabbardfish do occur further south, but by and large the fish assemblage of the central NEA is characteristically different from that of the north and south. It should be noted that there

are several large areas in the central NEA that have been recently closed for conservation of vulnerable marine ecosystems (VME's) and these areas are not available to be sampled by trawl surveys.

The area can be subdivided into 6 main survey areas (Figure 4.1); 1) Scottish slope, 2) the Irish slope/Porcupine bank slope, 3) the Celtic sea slope /Bay of Biscay slope, 4) Rockall bank, 5) Hatton bank, 6) a northern area including the seamounts, banks and the Wyville-Thomson ridge.

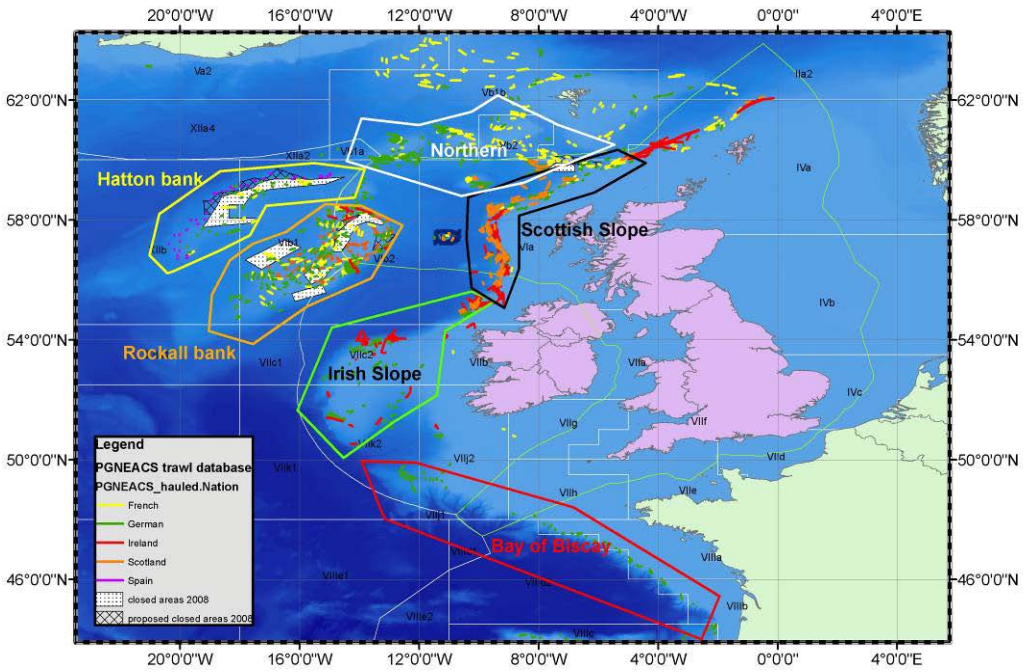

Figure 4.1. Map of the central NE Atlantic showing the 6 areas proposed to be covered by the central deep-water survey. Also plotted are closed areas and current and historical research vessel trawl station positions (colour coded by country).

4.2.2 Depth range

It is generally agreed the deep-water ecosystem and fish assemblage begins to predominate at a depth of 400 m and this is also the formal ICES definition. The international groundfish survey (IBTS) has maximum depth ranges of 400m in most cases, and 600 in selected cases. Therefore, to avoid extensive overlap with shelf species distribution, 400m was selected as the shallowest depth for the trawl survey. With respect to maximum depth, a few species such as roundnose grenadier and orange roughy have been recorded as deep as 2000 m, but data from the Scottish and Irish deep-water surveys suggest a strong downturn in abundance between 1500 – 1800m. On occasion trawls have been made to 1900 and 2000 m by *Scotia* and the *Celtic Explorer*. This is the maximum depth possible due to warp length restrictions. Recently acquired data from deep-water scanmar sensors suggest that at these depths the trawl does not fish correctly and therefore the maximum depth considered will be 1800 m, which is approximately 200 m deeper than the deepest commercial trawl.

4.2.3 Area coverage and survey design

The survey strategy and initial design must consider the following aspects:

- Whether to preserve an existing time-series, and if so how many of the core stations need to be continued in the new design to continue monitoring trends.
- How best to adopt sampling stratification and randomization in the survey, and how to test assumptions about the distribution of species over space and depth, i.e. whether distributions can be treated as random, patchy and or strongly auto correlated.
- Careful consideration of survey time, cost and logistics in relation to scientific objectives.

A fixed grid of stations ensures maximum information on the distribution throughout the area and gives the most precise estimate over time because it allows for control of environmental variability. It does however rest heavily on the assumption that the fish are randomly distributed within the area. If the fish are not distributed at random, the survey might give a less accurate estimate of biomass.

In the past the Scottish and Irish surveys have undertaken a depth stratified fixed station survey for which up to 10 years of time-series data exists. Furthermore there are practical constraints to randomly allocating hauls, for example, rough ground, steep slopes or obstacles on the bottom may not allow a true random distribution of stations. This can be circumvented by selecting from a pool of already trawled position, so not to risk unnecessary gear damage. The steaming time between stations is also increased as randomly selected stations are further apart, than stations along a depth transect. New stations can be gradually introduced into the survey design to assess variance estimates and test statistical assumptions. The key to interpreting the data from the survey is to be able to estimate the variance between hauls so that statistical analyses can be undertaken. It is important that the depth stratification is decided *a priori* on a sound ecological basis and that coverage within the range of each depth stratum is contiguous, or can be assumed to be fully representative of the stratum.

4.2.4 Sampling effort to estimate fish abundance

Areas of high abundance are often associated with high variability, leading to reduced precision if the same sampling effort is devoted to all areas. Therefore the sampling sizes in each stratum will be determined through proportional allocation (Cochran, 1977).

There are strong depth related patterns in abundance however, with different species showing different patterns, for example roundnose grenadier shows the highest abundance at 1500m, whereas blue ling and black scabbard are most dominant at 1000m. As the PGNEACS survey intends to provide indices for these different species it is proposed that depth strata be sampled with equal intensity in the first few years. Latitudinal and longitudinal trends are much less pronounced for these species therefore, sampling intensity will not vary according to these criteria. For some regions fisheries independent survey data are not available and it would be prudent to allocate survey effort according to patterns in fishing effort. For example, the survey should reflect the fact that some areas, e.g. the Bay of Biscay, do not support significant deep-water fisheries, whereas the Scottish slope is intensively trawled. On top of this there is the problem of known hot-spots of abundance for certain species in certain places at certain times of the year, particularly those that aggregate to spawn,

such as blue ling and orange roughy. Since the survey is proposed to take place outside the main spawning period when aggregation is known to occur this concern is less.

4.2.5 Sampling intensity in relation to the geographical area of the depth strata

Sampling intensity should be proportional to the area of the depth stratum. Five depth strata are selected which provide an almost contiguous coverage of the slope. The strata were divided as such to reflect clusters of distinct fish assemblages. There is a wider depth range stratum (the one referred as 900 -1400 m). This stratum is wider because the analysis of data from the MSSML (formerly FRS) survey suggest the community changes very little between 1100 and 1400m and that precision of fish abundance estimates does not improve with further division of strata at this depth. The area within each depth strata is broadly similar (Table 4.1) except for the 700–900m stratum which may need approximately 10% more trawls than the other strata. Within some subdivisions not all depth strata are available for trawling and thus the survey design will reflect this.

Table 4.1 Area and proportionality of each depth strata within the whole survey area.

DEPTH STRATUM	500–700	700–900	900–1400	1400–1600	1600–1800
% of total area between 500–1800 m	14	13	43	16	14

4.2.6 Spatial resolution

The MSSML (formerly FRS) DW survey indicates that on the slope a set of stations for every degree of latitude and longitude is sufficient to distinguish latitudinal trends (as opposed to 1 set of stations for every 0.5 degree - ICES stats square). However given the area to be covered by the PGNEACS survey this may still be too finely resolved. The decision was taken therefore to gain representative coverage of the area within each subdivision. This works out on approximately between 1 and 3 degree intervals apart depending on the area of the subdivision. The number of trawl stations per area varies according to the size of the area and the range of depth available to be sampled (Table 4.2).

Table 4.2. Survey sampling strategy by area.

Region	N sample areas	Depth range	Min N hauls per area	Total number
Scottish slope	4	500–1800	5	20
Wyville-Thomson ridge	2	500–1500	4	8
Rosemary bank	1	500–1500	4	4
Rockall bank	4	500–1800	5	20
Faroe, Lousy, Bill Bailey	3	500–1000	3	12
Hatton bank	4	1000–1500	4	16
Irish slope and Porcupine	4	500–1800	5	20
Goban Spur and Biscay	3	500–1800	5	15
Total				**115**

4.2.7 Temporal resolution

In cases where an existing time-series for an area is available, it may be possible to decide upon the temporal resolution that is optimal for the survey, otherwise an annual survey should be implemented for a minimum of 5 years to establish the time-series and assess any emerging trends. It is proposed that this component of the PGNEACS survey be carried out simultaneously at the same time of year (September). This will control for seasonal effects on fish distribution and abundance that could confound interpretation of an index of relative abundance. Once a time-series is established, i.e. after 5 years, it is proposed to continue the survey every two years, consistent with the frequency of the biannual advice and management framework of deep-water fisheries.

4.2.8 Trawl duration

It proposed that 1 hour tow durations be adopted by PGNEACS. The justification for why 1 hour is optimal is detailed in Section 6.2.

4.2.9 Number of trawls per area and depth stratum

It is recommended that in at least one locality per area more than 1 haul per depth stratum is carried out so that between haul variability can be estimated. This need not be every year, but rather introduced gradually as the survey develops.

4.2.10 Selection of trawl sites

Within the overall survey area there are different bottom substrates, some of which area unsuitable for trawling. A database has been compiled of trawl positions from current and historical trawl surveys in the central NEA area, in order to estimate the locations where trawling is possible. In the 1970's trawl surveys were undertaken by French and German research vessels and in the 1990's and 2000's Scottish, Irish and Spanish research vessels undertook trawl surveys. The database contains a total of 1709 reliable records of trawl positions (Figure 4.1.)

4.2.10.1 Rockall bank

There are large areas of Rockall closed or under consideration for closure to bottom trawling which obviously curtails the full range of trawl options. Rockall is clearly an area where vulnerable marine ecosystems (VMEs) are prevalent and care must be taken to avoid trawling in areas that contain corals, gorgonians and sponges. Nevertheless there are approximately 300 known trawl sites between 500 and 1500 m depth. Several of these derive from recent Marine Scotland monkfish surveys and can therefore be considered as reliable and low risk. The remainder have not been fished for decades and pose considerable risk to the gear and may also contain VMEs. Only a few trawls are deeper than 1500 m – these are located only on the east side of the bank. Initially four areas are proposed on Rockall Bank (Figure 4.2) within which a series of trawls will be carried out – the southwest, the central west, northwest and central east. In the first year considerable effort will need to be expended making soundings over potential trawl stations and utilizing TV drop-frame to check for VMEs. In the longer term the survey would aim to expand the pool of tows to other areas on the bank, to assess the degree to which the proposed areas reflect the fish populations on the bank as a whole.

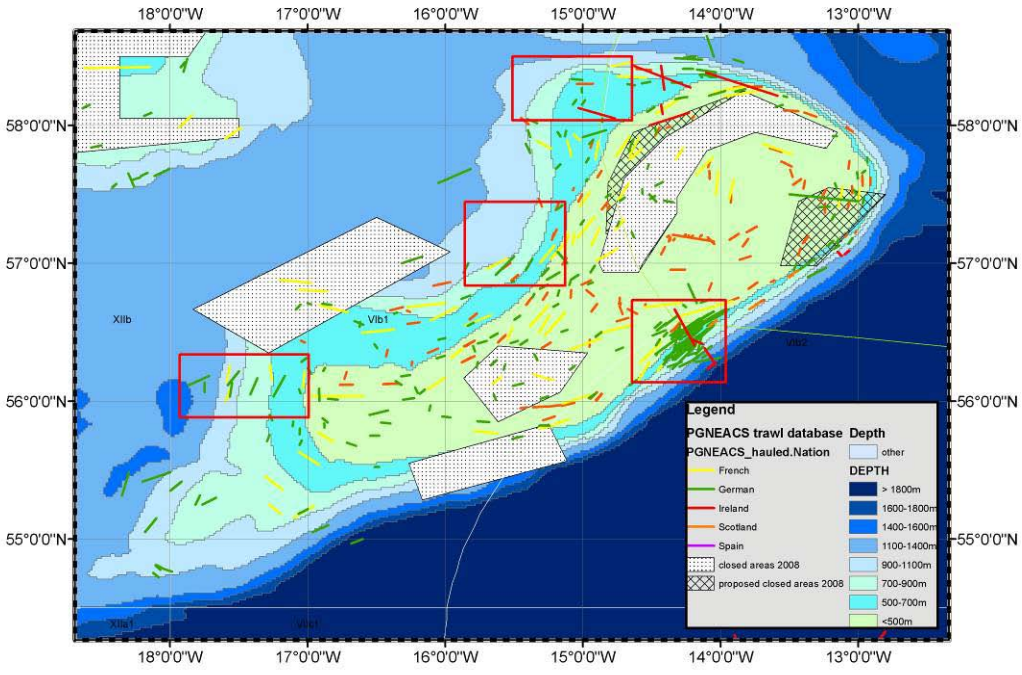

Figure 4.2. Possible trawl sampling areas (red boxes) on Rockall bank. Also plotted are closed areas and the current and historical research vessel trawl station positions (colour coded by country) that were used to guide possible survey areas.

4.2.10.2 Hatton bank

There are also large areas of Hatton bank that are closed or under consideration for closure to bottom trawling which obviously curtail the full range of trawl options (Figure 4.3). Care must be taken to avoid trawling in areas that contain corals, gorgonians and sponges. The current closures prevent trawling on grounds less than 1000 m. The main trawl fisheries operate along the western flank (known as the Hatton drift) of the bank between 1000–1500 m. There are relatively few tows available for this remote area; however recent accurate information is available for the west side of the bank from Spanish surveys. Four areas are proposed as candidate survey sites; three along the western flank for which trawl stations are known and one on the eastern rise of the bank for which only historical data are available. The eastern area may not prove possible to trawl, but should be explored in the first year. Likewise with Rockall bank, exploratory trawls outside the proposed squares will be made as the survey establishes, to test assumptions of sampling representation.

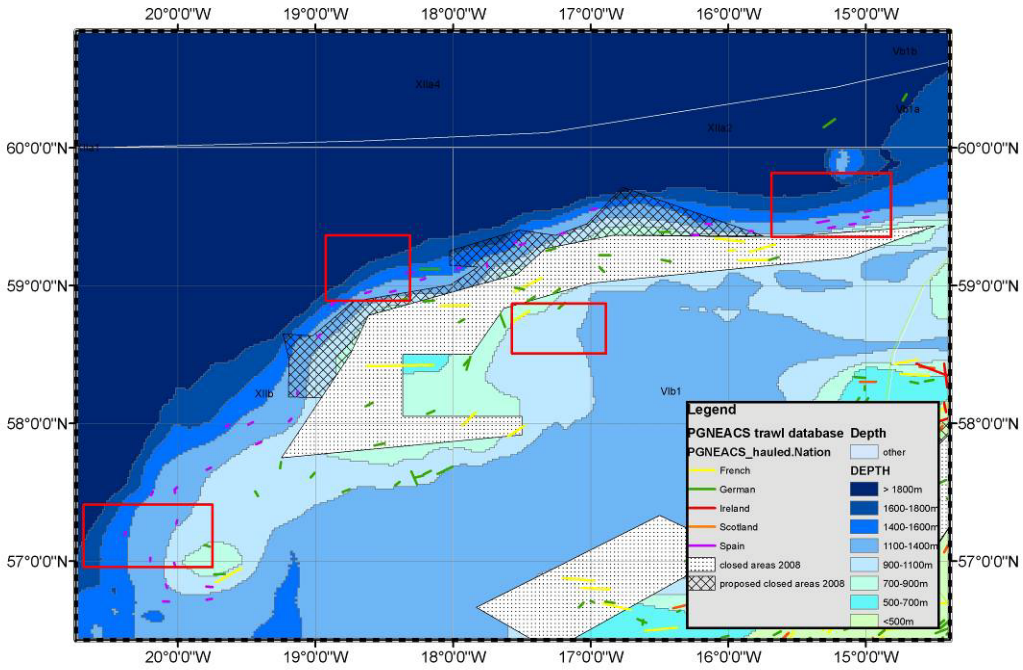

Figure 4.3. Possible trawl sampling areas (red boxes) on Hatton bank. Also plotted are closed areas and the current and historical research vessel trawl station positions (colour coded by country) that were used to guide possible survey areas.

4.2.10.3 Northern seamounts, banks and Wyville-Thomson ridge

This area includes Lousy bank, Bill Bailey's bank, Rosemary bank, Faroe bank and the Wyville Thomson ridge (Figure 4.4). This is a very challenging area for a trawl survey as the seamounts and ridges are characterized by very hard terrain that is difficult to trawl. Furthermore the seamounts and banks are known to contain VME's and care must be taken to source tows which can be demonstrated not to contain VMEs. There is one major area closed to bottom trawling (the Darwin mounds) and

another area that is being considered for closure (The Wyville Thomson ridge). However, the proposed survey area is all to the west of these areas.

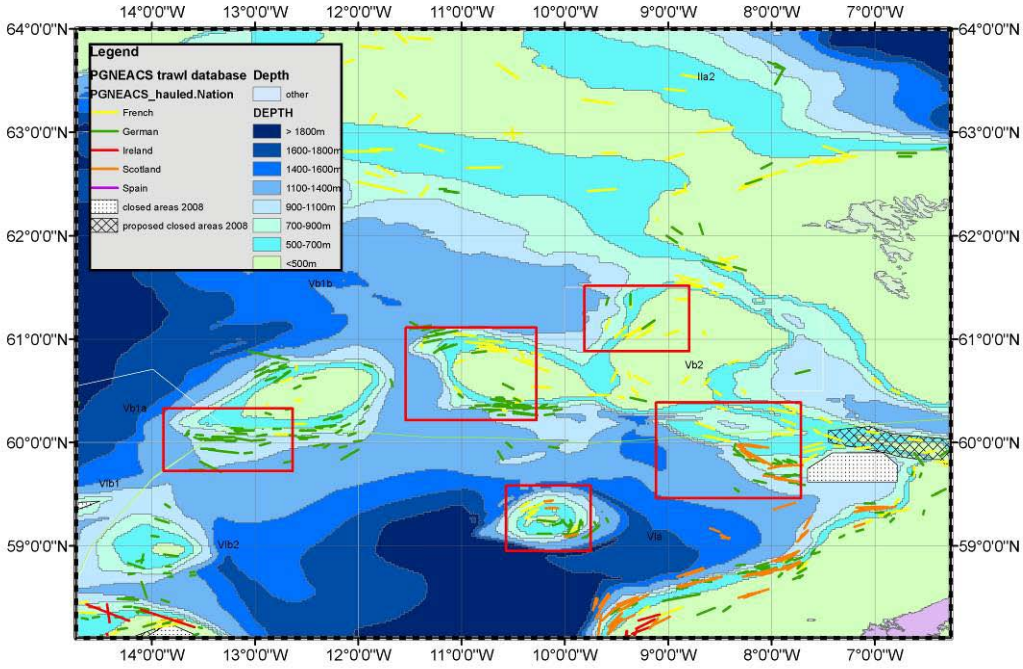

Figure 4.4. Possible trawl sampling areas (red boxes) in the northern banks region. Also plotted are closed areas and the current and historical research vessel trawl station positions (colour coded by country) that were used to guide possible survey areas.

4.2.10.4 The Scottish slope

The Scottish slope sector extends from approx 60º N to 56 º N (Figure 4.5). There are multiple trawl stations available at all depths and this is the traditional area of the Marine Scotland deep-water survey. Five areas are proposed for surveying in this area that run approximately N-S along the slope. Only one of these areas (in the far North) has not been successfully surveyed in the past. Some exploration is necessary, but overall no problems are foreseen for this part of the survey. Key to this area is consideration of the fact that 10 years of data already exists and the survey should aim to continue this important dataseries.

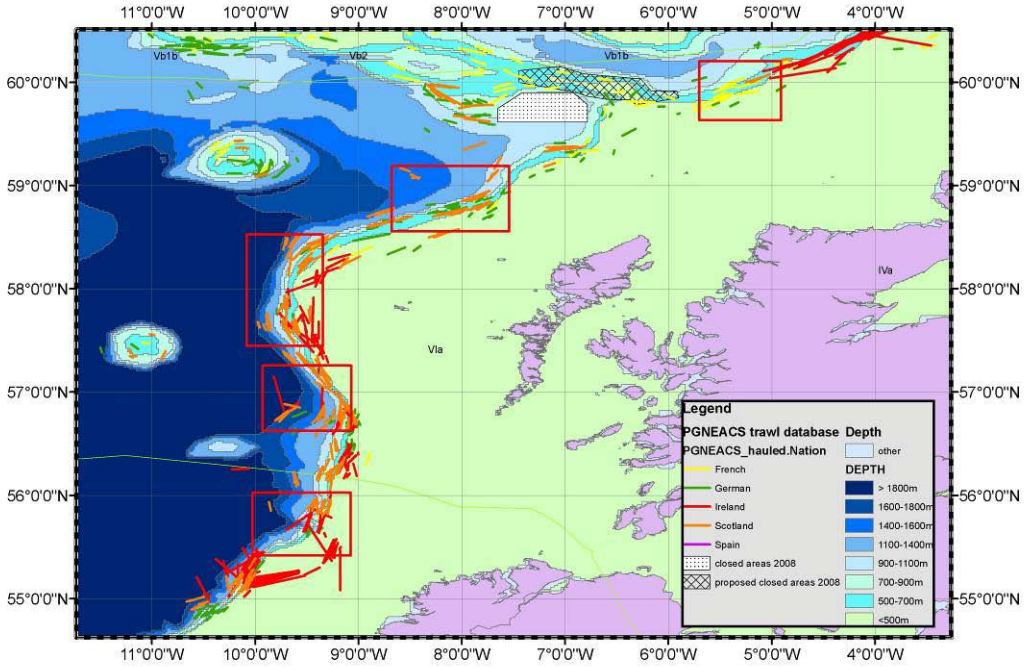

Figure 4.5. Proposed trawl sampling areas (red boxes) on Scottish slope. Also plotted are closed areas and the current and historical research vessel trawl station positions (colour coded by country) that were used to guide possible survey areas.

4.2.10.5 The Irish Slope and Porcupine bank

There are multiple trawl stations available at all depths and this is the traditional area of the Marine Institute's deep-water survey. Four areas are possible candidates for surveying in this area (Figure 4.6). Only one of these areas (in the far south) has not been successfully surveyed in the past. Some exploration is necessary, but overall no problems are foreseen for this part of the survey. As with the Scottish slope some of these stations have been trawled in the past and consideration should be given to building on this existing time-series.

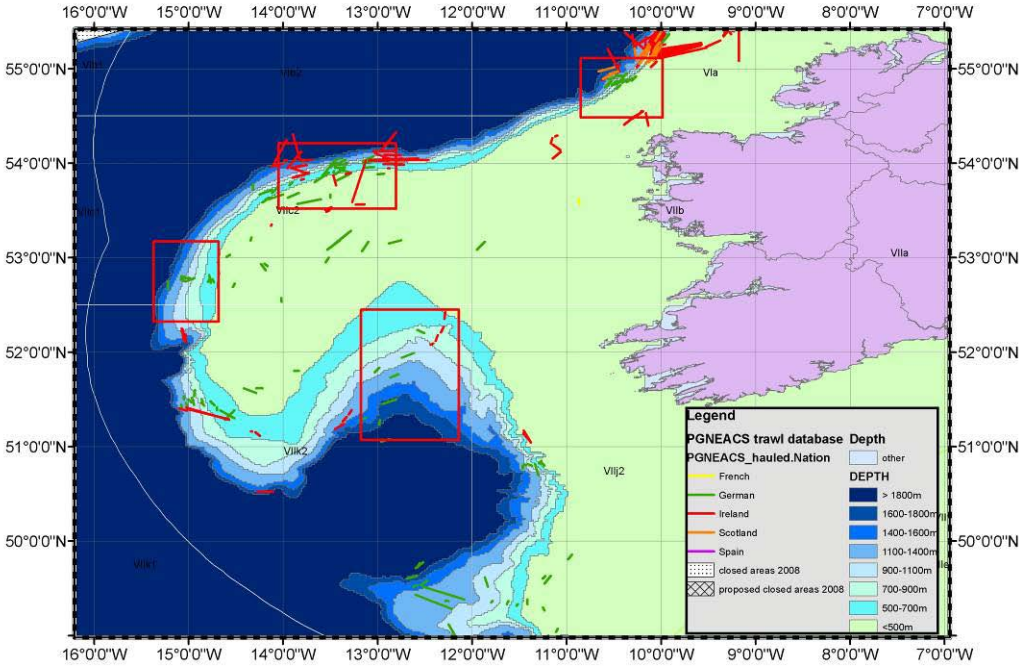

Figure 4.6. Possible trawl sampling areas (red boxes) on Irish slope and Porcupine bank. Also plotted are closed areas and the current and historical research vessel trawl station positions (colour coded by country) that were used to guide possible survey areas.

4.2.10.6 The Goban Spur and Bay of Biscay

This area represents the southern limits of the central deep-water survey (Figure 4.7). There are only historical trawl data for this area and only three sites are considered as being amenable to trawl surveys as a result of the extreme relief and steep gradients in this area. The French IBTS survey undertakes trawls in this region to depths of 600 m which will serve to supplement information on the upper slope in this region. There are no significant fisheries deeper than 600 m in this area and it is therefore not considered necessary to survey in the same detail as the other areas.

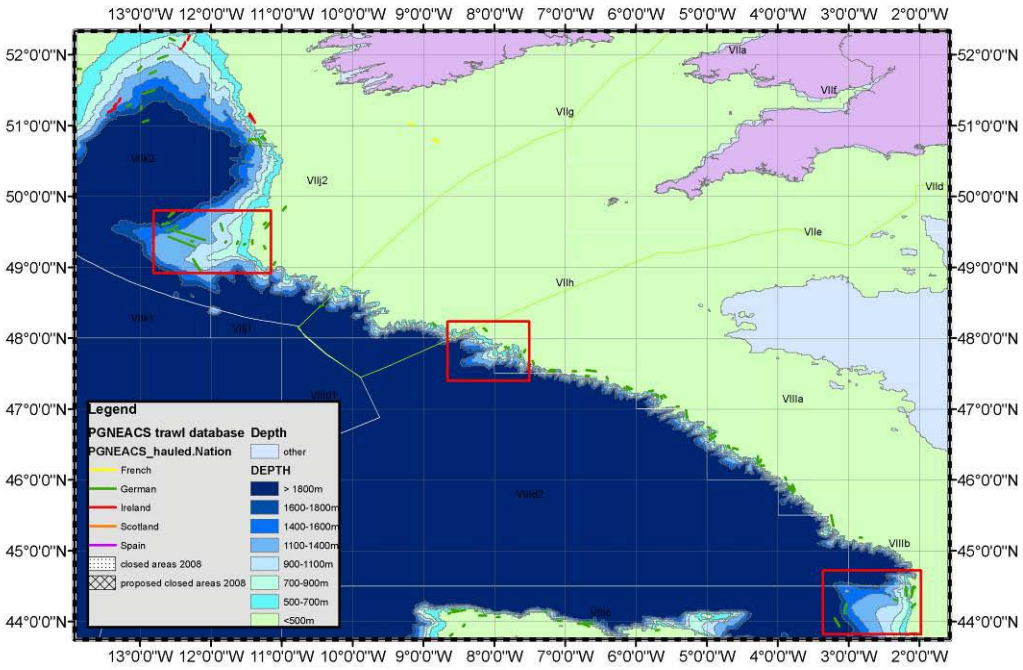

Figure 4.7. Possible trawl sampling areas (red boxes) on Celtic Sea and Bay of Biscay. Also plotted are closed areas and the current and historical research vessel trawl station positions (colour coded by country) that were used to guide possible survey areas.

4.3 Logistics of the ideal survey

The survey requires in the region of 115 one hour trawls (Table 4.2). Most of the sites are considerable distances offshore and there are often large distances between survey areas. Between 4 and 5 hauls are usually possible in a day which means approximately 30 days of trawling are necessary. To this needs to be added approximately 10 days of passage time. Allowing for 1 day per week downtime as a result of weather conditions, trawl damage, mechanical problems etc necessitates an additional 4 days. In total therefore approximately a minimum of 44 ship days are needed to complete this survey. This would mean either 3 two-week surveys or 2 three-week surveys.

4.4 Alternative survey options

The proposed survey has been designed to achieve all the scientific objectives set out at the beginning of this section. It goes without saying that such a survey will be very costly in ship resources, fishing gear and equipment and scientific personnel. We therefore suggest several alternative survey plans that would be significantly less costly in all respects, but that as a consequence could not be expected to achieve all the scientific objectives. Nevertheless they may provide a more acceptable balance of cost–benefits and therefore have been presented.

Option B - An internationally coordinated survey that maintains the geographical coverage proposed in the main survey plan, but samples each area far less extensively – i.e. only 2 sampling areas per region. This would approximately half the number of hauls. It would not however reduce steaming distances or costs associated with the risks of trawling new grounds. An approximate saving of around 30% ship-

time would be achieved. The scientific consequences would be that the precision of the estimate for each region may be reduced.

Option C - An internationally coordinated survey of more limited geographical coverage. This would not include Rockall bank, Hatton bank or the Northern area. It would focus only on the continental slope (Scottish slope and Porcupine Slope). This would generate precise indices of abundance, but one could not assume that such indices are reflective of the entire extent of the stocks or fisheries in question, i.e. they may be inaccurate. This would approximately half the cost of the survey in terms of ship time and other associated costs such as probable gear damage in initial years.

4.5 12 hour sampling justification

Although there is no light penetration at the depth where the deep-water surveys are operating, an influence of the diurnal rhythm on the movement of fish cannot be ruled out. There is some evidence of diurnal migration along the slope for some deep-water species and it is known that one of their important food sources, the mesopelagic layer, is undergoing strong diurnal migrations. Limiting trawling to daylight hours reduces additional variances associated with potential diurnal changes in behaviour. From a logistical point of view, fishing during night-time is often also restricted due to work time directives operating on a number of European research vessels. To use ship time efficiently, steaming is carried out at night where possible and night-time can further be utilized to identify new towable areas or collect environmental data.

4.6 Technical specification for surveys

Last year's PGNEACS report describes the technical specification for

- Trawl gear and net monitoring system
- Biological sampling protocols including details on different measurements types
- Additional biological sampling for selected species
- Collection of environmental data.

Details can be found in:

http://www.ices.dk/reports/LRC/2008/PGNEACS/PGNEACS08.pdf

PGNEACS notes that the expert groups WGDEEP, WGDEC and WGEF reviewed the PGNEACS sample collection details from 2009. PGNEACS welcomes close communication with the expert groups and will endeavor to adjust sampling protocols according to recommendation to ensure the surveys are fit for purpose.

4.7 Review of funding, resource allocation and task sharing for the international PGNEACS proposal

Although some countries might be able to carry out some aspects of the survey proposal for some years, there are no national commitments for any long-term funding programme that can guarantee adequate coverage and long-term delivery. An internationally coordinated survey that covers the essential areas and produces long-term abundance/ecosystem indicators can only be guaranteed through international funding. Therefore the central survey proposal is heavily dependent on the funding of the European data collection framework.

If the survey is funded under the European data collection framework, it is suggested that the mechanism for resource allocation and tasks sharing among member states is modelled on the system used to operate the internationally coordinated blue whiting survey. Funding for the survey is allocated according to national quota allocation of deep-water stocks in the area. Member states with research vessels that have the technical specifications and capabilities of carrying out the deep-water trawl surveys apply for shiptime funding under the DCF to carry out components of the survey with funding contributed from countries with deep-water quotas in the area.

An example of vessels with technical capabilities of carrying out deep-water survey is given in Table 4.3.

Table 4.3. Technical specifications of some research vessels with capabilities of deep-water fishing.

Name Nationality	Celtic Explorer Ireland	Scotia Scotland	Thalassa France	GO Sars Norway	Arni Friariksson Iceland	Paamiut Greenland	Magnus Heinasson Faroes
Length (m)	65.5	68.6	73.65	70	69.9	57	44.5
Breadth (m)	15	15	14.9	13.03	14	11	9.5
Draft (m)	5.8	5.65	6.1	7.03	6.8	5.4	5
Tonnage	2425	2610	3022	1447	473	721	455
Power (Hp)		3600		2250		2000	1800
Cruising Speed (kn)	10		11	11	13		10
Accomodation		29					18
Crew	15		25	17	18	14	
Scientists	16		25	15	15	12	
Max fishing depth (m)	2200		2000			1500	1000
Nets	Jackson BT184	Jackson BT184	Jackson BT184 **?**	Alfredo No. 5	Gultoppur	Alfredo No. 3	Star trawl
Groundgear	D-gear	Rockhopper D-gear in 2009		Rockhopper	Rockhopper	Rockhopper	Rockhopper
Headrope (m)	41.5	41.5		37.5	35.6		
Footrope (m)	53.4	53.4		32.3	22.6		
Cod-end liner (mm)	20	20		60	42	30	135

4.8 Reference

Cochran, W.G. 1977. Sampling techniques John Wiley &Sons 3rd Edition.

5 Southern Deepwater surveys

5.1 General considerations

In southern areas the bottom topography is highly variable, from continental shelf to abyssal plain, and includes some remarkable topographic features such as seamounts, banks and submarine canyons. Ecosystems in this area are very rich, support a rich fauna and for many species this region constitutes the southern or northern limit of distribution for many marine species. Species richness to the south of 40º N is twice as diverse as to the north, but their biomass shows the reverse. Bottom sediments vary according to the topography and the local currents. Where the topography is rugged, crustal rocks may be exposed, especially along the Mid-Atlantic Ridge where the seabed was formed relatively recently. However, on the abyssal plains the seabed is generally covered with thick accumulations of sediment.

The rocky and rugged nature of the bottom substrate in this area poses technological problems for sampling near or at the seabed and the risk of gear damage or loss is very high. This is one of main reasons why fisheries taking place in this areas use static gears.

5.1.1 Main topographic and hydrographic features

The Azorean Archipelago is situated ICES region X, which represents the deep waters of the North-East Atlantic across the abyssal plain and the Mid-Atlantic Ridge. The bottom topography ranges from continental slopes, through the sharply fluctuating seabed associated with seamounts, banks of fragmented continental rocks and the Mid-Atlantic Ridge, to extensive areas of almost featureless abyssal plain. There are also a number of different vulnerable deep-sea habitats such as hydrothermal vents, carbonate mounds, cold-water coral reefs, coral gardens and sponge communities. At the surface it is mainly influence by the Gulf Stream water mass flowing from the west, approximately at 40°N which then splits into the North Atlantic current and the Azores current. The actual system is more complex because it may change during the year affected by the complex bottom topography of the Azores (Juliano 1994, Santos *et al.*, 1995, Bashmachnikov *et al.*, 2004, 2007). Despite this dominance of the oceanic system from the west, marine littoral flora and fauna from Azorean ecosystem have more affinities with the Eastern Atlantic (Santos *et al.*, 1995). About 460 fish species have been identified in the Azores, (Santos *et al.*, 1997) but endemic fish species are almost absent. Thus, the Azores region has been described as a "cross-road" where fauna and flora from different origins meet and serve as a "stepping-stones"area for dispersion of organisms.

The marine Azores environment is area characterized by narrow island coastal areas (the strata from 0 to 1000 m represents about one per cent of the total EEZ area); seamount (including knolls, hills or guyots) areas (strata from 0 to 1000m) represent about two per cent of the total EEZ (Isidro 1996, Menezes 2006, Pinho 2003, Morato *et al.*, 2008). Areas down to 1000m, considered as less productive for fisheries, represents about 97 per cent of the total EEZ. This deep-water ecosystem is complex because of the particular features and interactions of the different dynamic areas. The dynamics of some areas, such as seamounts, are in general poorly known (Pitcher *et al.*, 2007).

The Iberian Atlantic coast extends from the Gulf of Cadiz to the Galicia Bank off the northwest edge of the Iberian Peninsula (Figure 5.1). The continental shelf along the

coast varies from 15 to nearly 400 km in width and the region is influenced by Atlantic eastern boundary currents, as well as, by upwelling in spring and summer - April to August (Fiuza *et al.*, 1982).

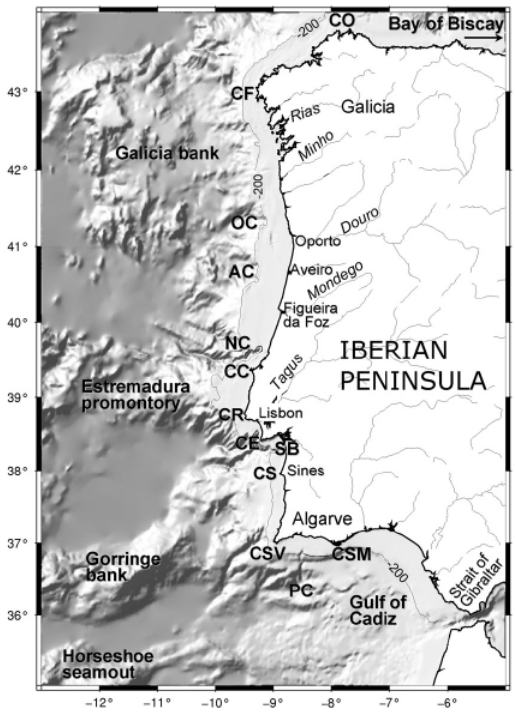

Figure 5.1. Geography of the Western Iberian Ecosystem, showing the main features referred to in the text. The 200 m bathymetric contour, that roughly delimits the continental shelf, is represented. From north to south: CO, Cape Ortegal; CF, Cape Finisterre; OC, Oporto Canyon; AC, Aveiro Canyon; NC, Nazaré Canyon; CC, Cape Carvoeiro; CR, Cape Roca; CE, Cape Espichel; SB, Setúbal Bay; CS, Cape Sines; CSV, Cape São Vicente; PC, Portimão Canyon; CSM, Cape Santa Maria (Relvas *et al.*, 2007).

A unique feature of the Iberian hydrography is the presence at intermediate depths (centered at 1000 m) of a relatively warm and salty water mass, resulting from the mixing between the Atlantic Intermediate Water and the Mediterranean Water flowing through the Strait of Gibraltar (Ambar and Howe, 1979). The main effect of the Mediterranean Outflow is to generate a dramatic salinity-driven, in excess of 2.4 salinity units, density plume that is bottom advected (Relvas *et al.*, 2007).

5.2 Description of historical and current surveys

5.2.1 Portuguese surveys

From 1994 to 2002 IPIMAR conducted, at least, a yearly deepwater trawl survey along the Portuguese continental slope. Several constraints rendered 1996 and 1999 surveys impossible to perform and, in the remaining years, only in 1995 and 1997 all the coast was surveyed. The objective of the surveys were to estimate the abundance of deep-sea resources off the Portuguese mainland coast, identify the species of the total catch, collect length and weight information on species caught and collect biological data for several of the target species. Target species were the bluemouth (*Helicolenus dactylopterus*), greater fork-beard (*Phycis blennoides*), gulper shark (*Centrophorus granulosus*), leafscale gulper shark (*Centrophorus squamosus*), Blue and

red shrimp (*Aristeus antennatus*) and deep-water rose shrimp (*Parapenaeus longirostris*). From 1994–2000 a stratified random sampling strategy was used whereby strata were defined according to depth and geographic area and at least two hauls were performed in each stratum as defined by the geographical areas shown in Figure 5.1.

From 2003 onwards, this type of survey was discontinued, since the deep-water resources with more commercial importance for Portugal, namely black scabbardfish and deep-water sharks (as a bycatch of the black scabbard fishery), were not adequately sampled in these surveys.

The results from IPIMAR deep-water surveys were characterized by a poor representation of commercial species such as black scabbardfish and squalids and for which abundance indices are required under PGNEACS.

IPIMAR also carried out some experimental surveys using different fishing gears, both on the shelf and on the slope. Among them were two different longline surveys in September 2003 using i) floating (FL) and ii) bottom longliner (BL). In 2002 and 2003 IPIMAR developed a scientific program that aimed to improve the knowledge in a restricted area of the Portuguese continental slope, comprised between 26 and 48 nm south of Cabo Santa Maria (CSM; Figure 5.2). The main objectives of this program were: i) topographic and bottom type characterization of the slope at depths down to 1500m and identification of potential fishing grounds and ii) design and trials of different fishing gear prototypes (bottom trawl; floating longliner; bottom longliner and traps) to operate on those areas. The morphology of the surveyed area was classified as highly diverse. Considering the relative dimension, the bottom topography and the adequacy for the operation of a specific fishing gear, several grounds were identified and classified as potential fishing grounds. It is worth mentioning that despite the area surveyed has been selected because of its gradual slope (and not abrupt as for the greater part of the coast), characteristic apparently adequate for trawling, the proportion of trawlable grounds, shadowed in light blue in the Figure 5.2, was small.

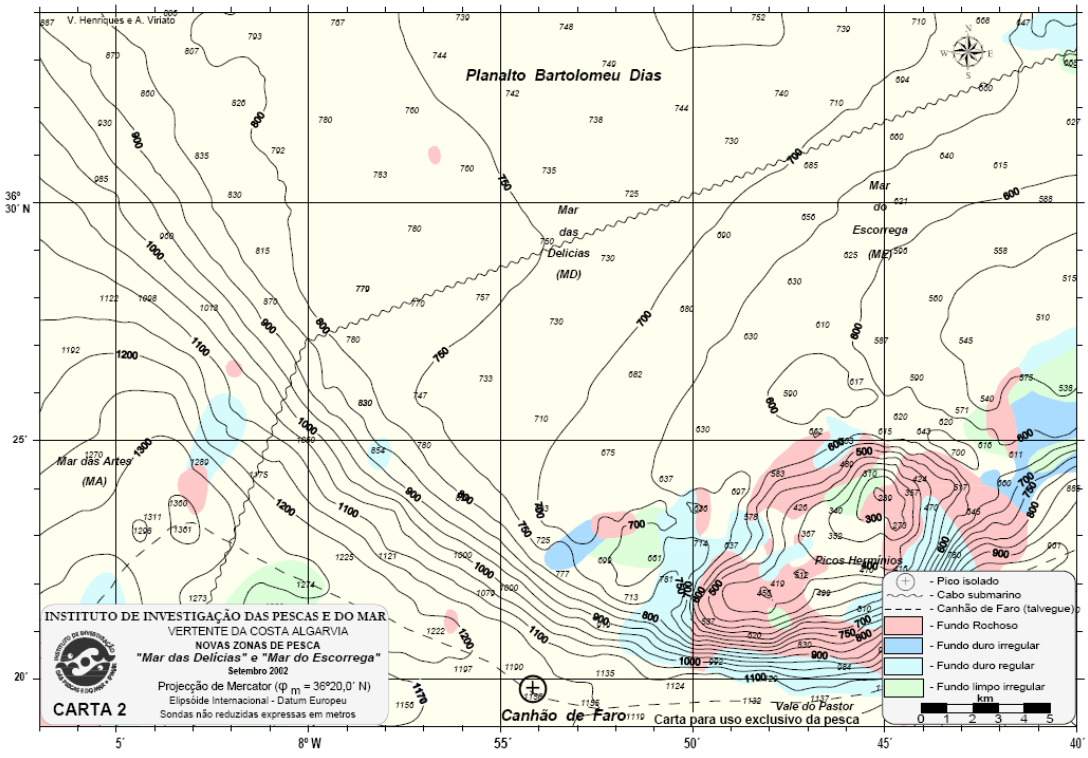

Figure 5.2. Bottom characterization of a restricted area of the southern Portuguese continental slope (Henriques and Viriato, 2002).

5.2.2 Azores

Abundance data, independent of the fishery, are collected annually (1995–2008) from the Azorean spring bottom longline survey. Surveys are conducted on the RV 'Arquipélago' around all the nine Azorean islands and some major seamounts of the EEZ, following a random stratified design by area and depth. Surveys use standardized bottom longline gear, similar to that used by the commercial fishery: J-hooks nº 9, baited with salted sardine chops, spaced 1 m apart in an alternated 'stone-buoy' design (Pinho, 2003, Menezes, 2006). The survey covers the depth strata from the littoral to 1200m. However, for abundance estimation only the depth until 600m was covered until 2004. This depth was extended to 800m thereafter.

5.3 Southern deep-water survey coordination under PGNEACS

Deep-water species, commonly exploited by Portuguese fleets, show a very steep vertical distribution, being associated with areas of very irregular seabed morphology.

At this stage and due to the bottom topography of the region and to the insufficient number of trawlable areas identified at depth range adopted by PGNEAC, it is considered that trawl is inappropriate sampling methodology for PGNEAC main objective "*estimation of fishery-independent abundance indices*" in southern areas. Additional constrains might be also invoked. Among these it is worth to emphasizing that in ICES Subarea X EU has approved a ban on bottom trawling around deep waters around the Azores, Madeira and the Canary Islands and restrictions on access to the waters concerned by vessels from other Member States so that habitats in these areas are protected under the CFP(Reg CE 1568/2005). This restriction has not hindered that the fishery-independent abundance indices estimated using the DOP longline research survey have been used at ICES WGDEEP (ICES, 2006).

5.4 –Survey plan

5.4.1 Mainland Portugal

Fishing hauls will be randomly set within each cell of the regular grid established for the Portuguese continental slope. The proposed regular grid is presented in Figure 5.3. The total number of fishing hauls will depend on the available budget and the required level of precision for species abundance estimates. The gear will be settled each day during the morning and retrieve late in the afternoon. Each fishing haul will have an approximate duration of 10 hours. The intended sampling effort will be of two fishing sets per day. Achieving this target will, however, depend on operational and weather conditions.

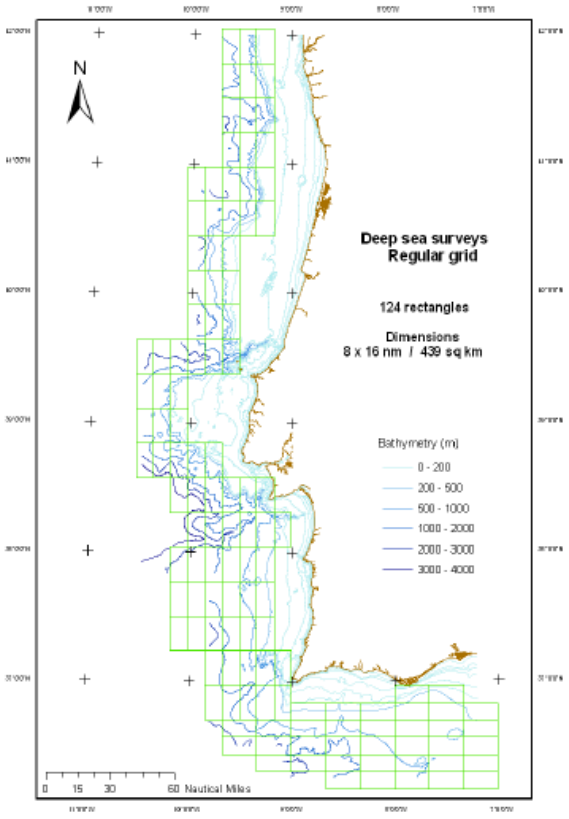

Figure 5.3. Proposed sample areas for the NEACS longline survey in IXa.

5.4.2 Azores

The survey follows a random stratified design by area and depth with effort proportional to the area size. Sets were randomly located around a given island or seamount and deployed on a straight line from the shallowest point available (usually 30–40 m around the islands) down to 600 or 1200 m depth. On average about 30 sets (transepts) are done annually, covering about 504 stations, due to time and costs constrainers. The survey was designed for abundance estimation until 600 m. This depth range was extended to 800m in 2004. Currently only, one set per statistical area is extended to 1200m for ecological studies. The objective is to extend the total coverage of the survey from 800 to 1200m and also cover more seamounts (seamounts are not covered in the current survey Figure 5.4). However, it is very difficult to do these extensions on depth and area using the logistic of the actual survey (RV and technol-

ogy limitations, selection of key seamounts and proportion of total area to sample) and so it should be better defined under the international coordination.

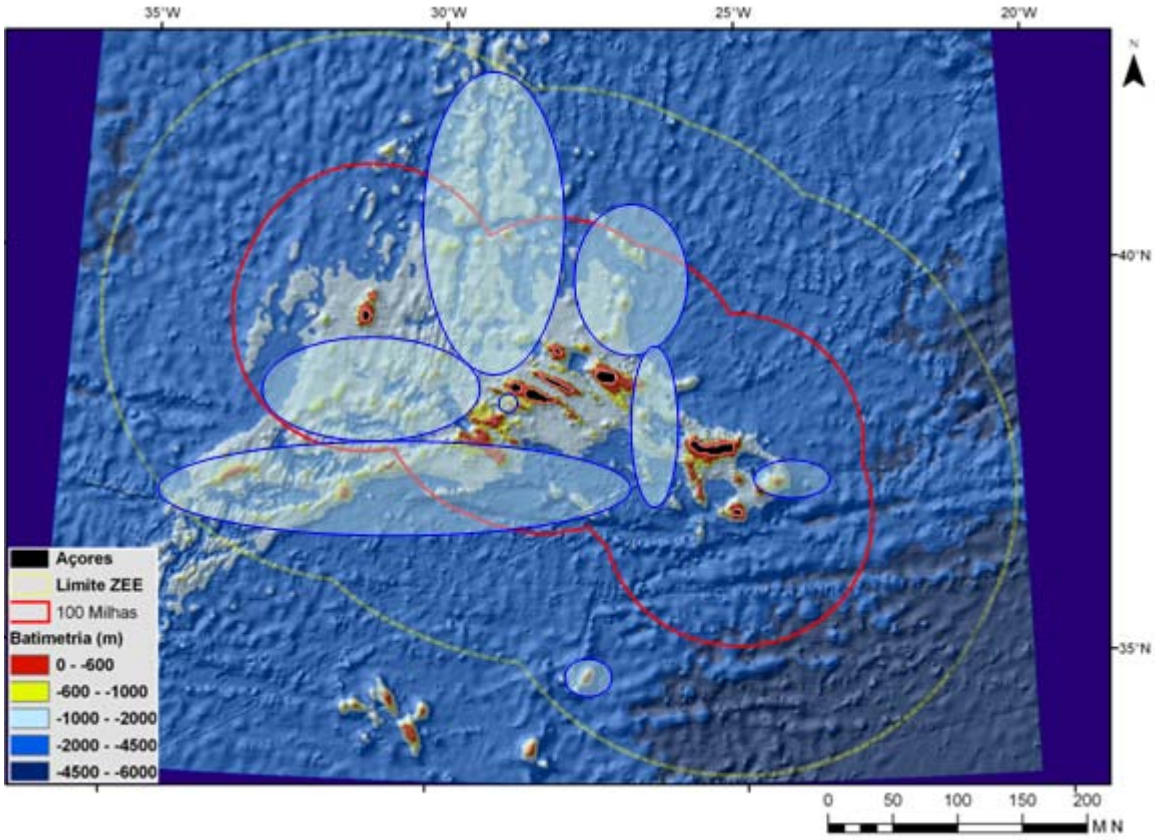

Figure 5.4. An illustration of the Azores area. Red areas are covered by the actual survey. Blue circles are potential seamount areas not covered by the current survey.

5.5 Technical specification

5.5.1 Mainland

For longline survey the gear will be adapted from the traditional longline used by the commercial boats in Portugal. The main characteristics of this gear are: bottom longline with mainline detached from the seabed by floats. It will be composed by 2000 gangeons spaced about 4.15 m apart, each 1.50 m long fitted with hooks number 5. Connected to each hook there is a piece of brass wire 120 to 150 mm long to prevent loss of catches from fish biting.

5.5.2 Azores

Survey gear was very similar to that used by the commercial fishery. The gear consists of several mainline units, of approximately 30 hooks each, called quarter-skate. Four quarter-skates arranged on a wood cage constitute a skate. The quarter-skate are connected each other alternatively by a stone or a buoy during the deployed. The buoy is used to connect the mainline to the main-rope. This gear is locally known as a "stone/buoy" longline and is effective at fishing for benthic and bentho-pelagic species. Line setting started one hour before sunrise and line retrieval started about 1.5 hours after setting. The sampling gear was set from the shallow to deep strata and generally was retrieved in the same order. The soak time, computed as the difference

between setting and retrieval times, varied from about two and six hours. The bait was chopped salted sardine (*Sardina pilchardus*).

Time, position (GPS) and depth (echosounder) were recorded for every quarter-skate during gear deployment. During the retrieval fish species caught was recorded and hook condition sampled by quarter-skate.

Coordination between the two surveys:

5.6 Southern survey coordination within PGNEACS

The PG discussed how the southern surveys should be coordinated along with the other surveys considered by PGNEACS. The PG realizes that the main difference is related to the fishing gear used to conduct sampling. However PG is also aware that the abundance indices estimated are reported to the same ICES working as those from central survey. Despite the differences on fishing gear the analytical approach is similar to the one from central surveys because both are considered data poor and must be approached with similar methodologies.

There are other aspects that are common between the central and the more northern surveys (central and Nordic), as e.g. technological problems associated with observations at great depths, species identification of rear and often vulnerable sharks and skates, data management and analytical approaches.

The PG therefore recommends that the coordination of the southern surveys be made within a subgroup of PGNEACS and not by the whole group as such. This will allow tight cooperation between those closely involved with the surveys, and at the same time secure coordination of issues that are common with the southern surveys.

5.7 Recommended ToR for 2010

Evaluate sampling protocols for Azorean and mainland Portuguese survey and attempt to standardize the protocols as much as possible.

Evaluate the combined total survey coverage in relation to distribution of all major stocks in the area and consider the feasibility of bridging any gaps.

Evaluate the extent and quality of information on non-targeted species and the ability to describe larger parts of the fish communities and the physical environment.

Evaluate the prospect of making all the combined survey data available to all parties by use of e.g. the ICES DATRAS database, in order to facilitate joint research and analyses.

5.8 Review of funding, resource allocation and task sharing for the international PGNEACS proposal

Whereas in subarea X Azorean Regional Fisheries Secretariat might be able to carry out some aspects of the survey proposal for some years, there are no commitments for any long-term funding programme that can guarantee adequate coverage and longterm delivery. An internationally coordinated survey that covers the essential areas and produces long-term abundance/ecosystem indicators can only be guaranteed through EC funding. Therefore the southern survey proposal is heavily dependent on the funding of the DCF.

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6 Analysis of results of existing deep-water surveys

6.1 Comparative tows

Ireland and Scotland carried out a number of comparative tows on their Deepwater surveys since 2006. It had been planned to carry out one tow at four depths in two survey areas but each year only seven tows were carried out. In 2006 the depths sampled were 500, 750, 1000 and 1500m. In 2007 and 2008 the 750m tows were substituted by tows at 1800m. In 2006 and 2007 three depths were sampled in Area 2, west of the Hebrides, and four stations were fished in Area 4, west of Donegal. In 2008 four depths were fished in Area 2 and three in Area 4.

The nets used by both vessels were the Jackson BT184 with a codend of 20mm mesh. The groundgear used by both countries differed with Scotland using 21" hoppers (Rockhopper gear), whereas Ireland used 16" hoppers (D gear). Effective fishing time, from when the net hit the bottom, was set at two hours. Tows were made along the contour line.

The catch was sorted and identified to species level, and weights were taken. At this stage subsampling of abundant species took place. The majority of fish caught were measured to total length, to the nearest centimetre below, to produce a length frequency distribution for each species. Some species could not be measured to total length due to fragility of tails or fins. A list of these species, and their measurement criteria, can be found in the PGNEACS report of 2008.

The data collected by both vessels was quite similar. In 2008 the surveys recorded 116 species, with the *Celtic Explorer* recording 97 species, totalling 18032 fish, whereas the *Scotia* recorded 95 species, totalling 14075 fish. For the *Celtic Explorer* this was a 10% increase in species numbers but a 4% decrease in catch compared to 2007, whereas for the Scotia it was a decrease of 11% in species composition and a decrease of 22% in fish numbers. In 2007 117 species were collected. The *Celtic Explorer* recorded 83 species, totalling 18800 fish, whereas the *Scotia* recorded 107 species, totalling 20700 fish. The 2006 data are omitted due to difficulties calibrating the effort.

Catches of commercial species tended to be small on both vessels. *Coryphaenoides rupestris*, roundnose grenadier, provided the largest catches in all years, followed by *Merluccius merluccius*, hake, and *Aphanopus carbo*, black scabbard. *Argentina silus*, greater argentine, occasionally produced large catches.

Length frequency distributions were produced for all the major species per tow, per depth, per area and per year. The graphs from both vessels were very similar. For most species the size ranges caught by both vessels were comparable. The analysis of the catches showed good agreement on the size structure of the fish.

The KS test (Kolmogorov-Smirnov) is a goodness-of-fit test, and was carried out on the data from both surveys in 2007 and 2008. This test tries to determine if two length frequency datasets differ significantly. It tests the proportion of fish at each size class in the distribution. It makes no assumption about the distribution of data.

The main commercial species looked at using this test were *Argentina silus*, Argentine, *Aphanopus carbo*, black scabbard, *Phycis blennoides*, greater forkbeard, *Coryphaenoides rupestris*, roundnose grenadier, *Brosme brosme*, tusk, *Molva molva*, ling, *Molva dypterygia*, blue ling, *Merluccius merluccius*, hake, and *Hoplostethus atlanticus*, orange roughy. The two main commercial shark species *Centroscymnus coelolepis*, Portuguese shark, and *Centrophorus squamosus*, leafscale gulper shark, were also analysed. *Alepocephalus*

bairdii, Baird's smoothhead, was added, as it is one of the most numerous species below 1000m, although it has no commercial value. The KS test requires a minimum sample size of 25 in both samples. Due to this a number of species, which were only caught in small numbers, could not be analysed for all hauls.

Only four commercial species, plus *A. bairdii*, were caught in large enough numbers to carry out the KS test. Even though the length frequency histograms of *C. rupestris* and *A. bairdii* were similar on both vessels at all depths, and between years, they always rejected the null hypothesis, indicating that the frequency distributions were dissimilar (Figure 6.1). On the other hand *A. carbo* and *P. blennoides* always accepted the null hypothesis, the frequency distributions were similar, when they were caught in sufficient numbers. *A. silus,* being a pelagic species was caught in occasional tows. Once again its distributions were dissimilar (Figure 6.1).

Many of the other grenadier species showed differing results. *Coelorinchus labiatus*, spearsnout grenadier, consistently rejected the hypothesis. *Coryphaenoides guentheri,* Günther's grenadier and *Nezumia aequalis,* showed equal distribution between accepting and rejecting the hypothesis. *Trachyrhynchus murrayi*, Murray's grenadier however showed a strong year effect, frequencies were dissimilar in 2007, but similar in 2008.

Combining the data for all depths and areas for both years we find an increase in the number of species that are accepting the hypothesis. In all twenty eight species produced results for both years. In 2007 nine species showed similar frequency distributions whereas 19 species were dissimilar. In 2008 this had changed to sixteen species being similar with twelve being dissimilar. This could indicate that the coordination between the two vessels is improving. Otherwise it may be a factor of the sampling programme. In 2007 the vessels carried out the comparative tows a week apart, whereas in 2008 they were two days apart in area 2, and fished in area 4 on the same day.

The surveys track each other quite well. The same species were being caught in the same areas and depths. Size ranges were very similar. Neither vessel consistently outperformed the other. The difference between the total number of species caught by both vessels and the number caught by each vessel can be attributed to small numbers of "once-off" species. Some of these may be mesopelagic and will be caught as the net is going up and down through the water column.

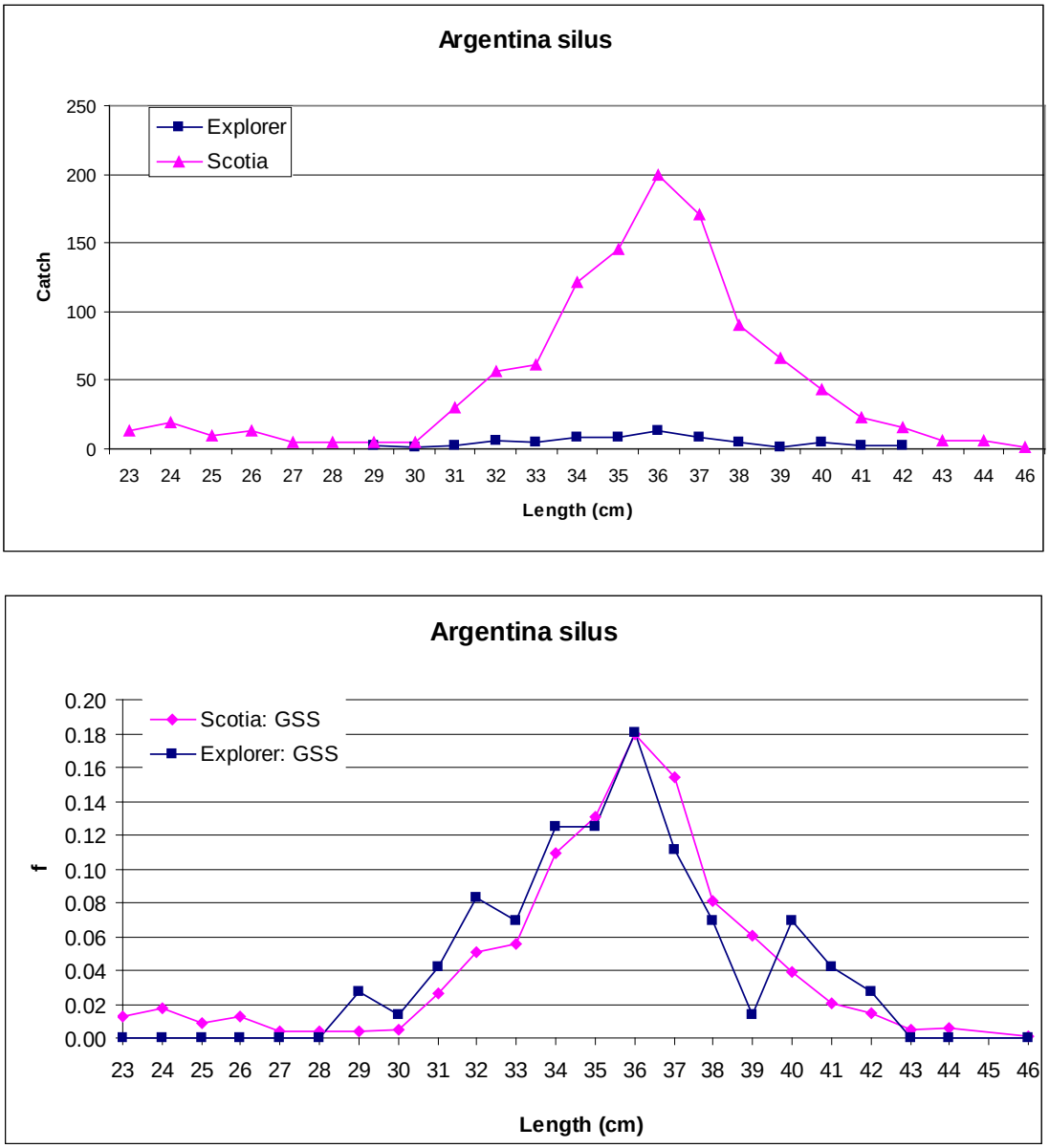

Figure 6.1. Length frequency distribution for *Argentina silus* between the *Explorer* and the *Scotia* (top graph); the lower graph is produced by the KS test. In this case the test accepts the distribution proportions are comparable.

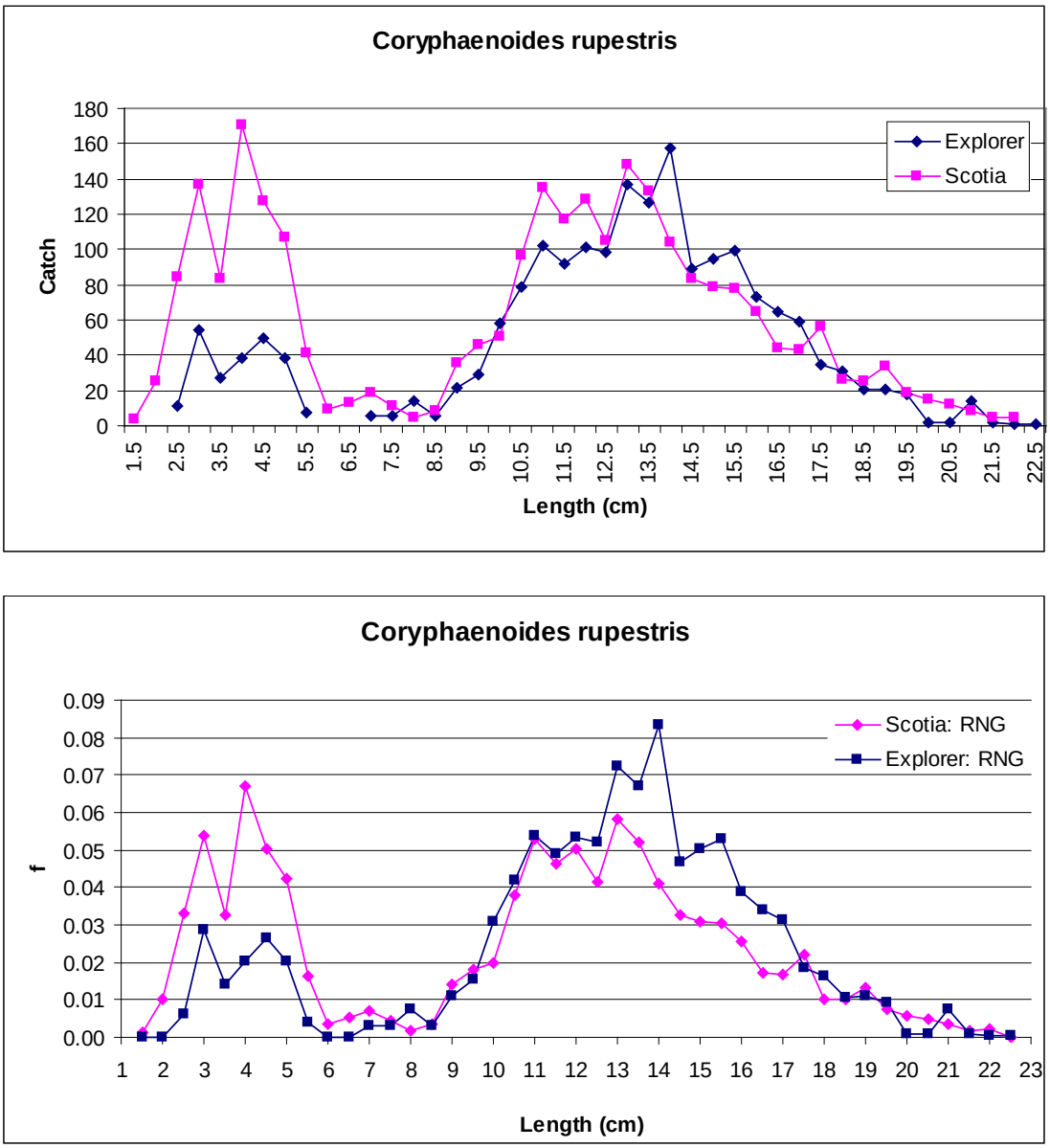

Figure 6.2. The top graph shows the length frequency distribution for *Coryphaenoides rupestris* between the *Explorer* and the *Scotia*. The lower graph is produced by the KS test. In this case the test rejects the distribution proportions are comparable.

6.2 Trawl duration

The optimal trawl duration adopted by a survey will depend on the objective of the survey and the variation in the abundance of target species and the diversity of the fish assemblage being sampled. For estimation of abundance of common species short hauls may be adequate, whereas for rarer species longer hauls may be needed. If the survey also aims to monitor species diversity longer trawl durations have a higher probability of sampling rarer species. There is however a trade-off between the duration of the haul and the number of independent hauls that can be made. With increasing numbers of hauls comes increasing statistical power and precision. PGNEACS primarily aims to provide abundance indices of commercial deep-water species, but also aims to provide indices of biodiversity and monitor changes in other non-commercial species. To meet both objectives an optimal compromise must be reached.

6.2.1 Two hours vs. one hour haul duration.

In the past the deep-water survey carried out by Marine Scotland – Science, the Marine Laboratory (MSSML; formerly FRS) mainly used a trawl duration of 2 hours. Throughout the time-series however a number of 1 hour trawls were made. This provided an opportunity to evaluate 1 hour vs. 2 hours trawls. The 1 hour duration catch data, combined with corresponding catch data from 2 hour tows from the same area and depths were compared to evaluate the effect of duration on overall catch abundance as well as picking up any change in the total number of bentho-pelagic species observed. In all 12 valid one hour tows were identified at locations and at depths where there was also significant comparable data for 2 hour tows. 31 valid two hour hauls were identified from the dataset as being comparable. The depths where there were sufficient data to perform a comparative analysis were 500, 600, 1000 and 1500m respectively. Figure 6.3 below displays the observed mean abundance of bentho-pelagic species by depth recorded for both one and two hour tows with the corresponding error bars displaying the 95% confidence limits.

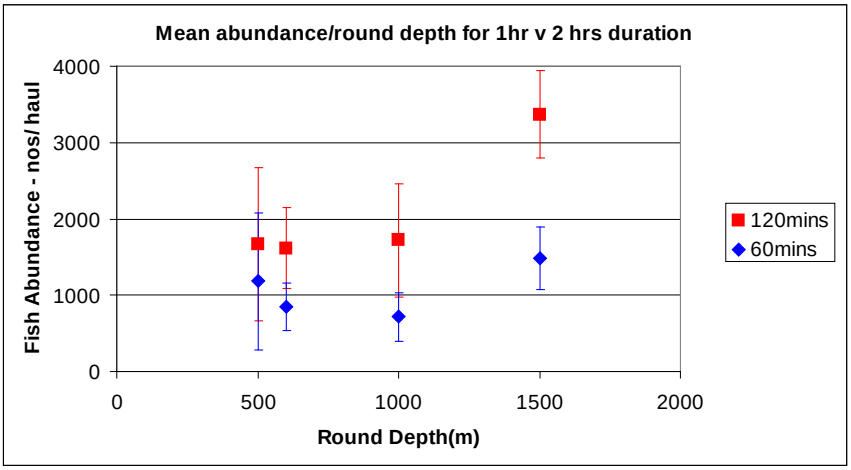

Figure 6.3. Mean fish abundance in numbers per haul at depth for one and two hour tow durations.

Whilst the data in Figure 6.3 clearly shows that a significant disparity exists between haul abundance at 60 minutes compared to that at 120 minutes, it is not clear whether this disparity is uniform or whether as the data hints at, the relationship between abundance and duration varies with depth, i.e. the disparity broadens with depth. A linear model was run on the log transformed data to test for any significant interaction between duration and depth and none was found. It is therefore safe to conclude that the effect of duration on abundance will be the same whatever the depth trawled. The mean abundance values for the 500m, 1000m and 1500m data at both durations as well as the mean abundance for the 60 minute data expressed as a proportion of the 120 minute value can be seen in Table 6.1. Assuming from the model that the relationship between abundance and duration is a linear one then the mean proportionality for 60 minutes against 120 minutes is 0.51, as can be seen from the table below. This is a satisfactory conclusion as it suggests that overall hauls at one hour duration catch approximately 50% of the of the fish compared to those recorded for two hours.

Table 6.1. Observed mean abundance figure for key sample depths.

Rounded Depth(m)	Mean Abundance 60 minutes	Mean Abundance 120 minutes	Proportionality 60mins/120mins
500	1126.1	1697.2	0.66
1000	717.9	1742.4	0.41
1500	1559.7	3387.6	0.46
Combined			0.51

Using the same data the mean number of bentho-pelagic species observed at each depth for both tow durations was also plotted and can be seen below in Figure 6.4, again with the corresponding error bars displaying the 95% confidence limits. This was done in order to evaluate whether in fact a reduction in duration would result in a consequent reduction in the number of species encountered.

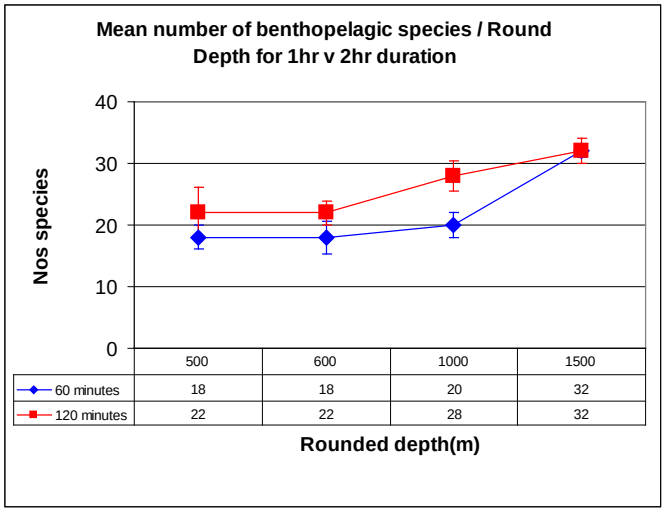

Figure 6.4. Mean number of bentho-pelagic species at depth for one and two hour tow durations.

Three of the depth categories sampled recorded smaller numbers of species for the one hour tows. However at the shallower depths there was significant overlap in the data as evidenced by the error bars and at 1500m the values were identical. Whilst acknowledging there may be a slight reduction in species number at a haul level with a move to a shorter duration this is likely to be negated at survey level by an increase in the number of hauls completed as a result of the time saved. As with the abundance data a linear model was run to test for any significant interaction between depth and duration on the number of species recorded. Again no interaction was found suggesting that the effect of duration on the species count will be the same at all depths.

It is therefore proposed that PGNEACS adopts trawl duration of 1 hour and from September 2009 the MSSML survey will move to this. This will allow for one additional station to be completed during each daylight period and could potentially increase the number of sample tows in a survey by up to 25%. It also makes the task of sourcing new tows very much easier because the probability of locating a 1 hour stretch of trawlable ground is much higher than a 2 hour stretch. MSSML feels confident that reducing tow duration will confer very significant gains in terms of expand-

ing the number of hauls at a time when the geographical and bathymetric range of the survey is likely to increase substantially.

6.3 Dissemination of identification keys

Since 2004 MSSML, FRS Aberdeen, has been developing several field identification keys for some of the more abundant species groupings encountered on the deep-water survey. The species groupings currently included are listed below.

Grenadiers *(Macrouridae)*

Deepwater Eels

Rabbitfishes *(Chimaeridae and Rhinochimaeridae)*

Deepwater Sharks

No development work has taken place on any new keys in the last year. One of the most pressing areas is the development of an accurate key for *Apristurus spp.* This work is continuing and hopefully an updated key will soon be ready for trialling.

The development and evolution of keys is seen as an ongoing process and will be regularly reviewed and updated to include new species as well as to include improved images/text for existing species. The intention is to expand and broaden ID keys to incorporate additional species from these groupings that may be present in the expanded survey area. (44° - 60°N)

Finlay Burns from MSML has been nominated as the coordinator for this process, and all submissions of new images/suggestions should be directed to him.

PGNEACS recommends the following action points to coordinate and improve identification efforts of deep-water species on the different survey programmes:

- Annual identification workshops should be hosted at future PGNEACS meetings, where facilities allow. These workshops should be organized by the host nation and focus on species collections from the host's deep-water area. The workshops should also be used to feed and optimize identification keys and manage the image library.
- A common image library should be created for the use of PGNEACS participants and regularly updated. Key identification images selected by PGNEACS should be provided to fishbase to aid the deep-water species id in a wider forum.

6.4 Data management – Progress on DATRAS

It is the intention of PGNEACS that all survey data will be centrally stored and made available to all relevant Expert Groups as required. The most appropriate database seems therefore to be DATRAS, the ICES survey database that hosts the International Bottom Trawls Survey (IBTS) data. ICES have agreed to host the PGNEACS survey data on condition that it is made available in the DATRAS format. Certain countries, namely Ireland and the UK (Scotland) collect deep-water survey data using in-house databases that are also used to collect IBTS data. Therefore these data should only require relatively minor adjustments and standardization (e.g. species and survey codes) to be made suitable for DATRAS storage. It is hoped that for IBTS submitting countries that participate in PGNEACS that all survey data in 2010 be compatible with DATRAS, and where possible surveys in 2009 should also collect data in this standard format. Historical data may also be converted to DATRAS format, but this could be time-consuming.

Countries that do not contribute to IBTS, such as Greenland, may require modifications to data and storage methods, to be made suitable for these databases. It is proposed as one of next year's ToRs that the Nordic countries evaluate the prospect of making all the combined survey data available to all parties by use of e.g. the ICES DATRAS database, in order to facilitate joint research and analyses.

6.5 Proposed future analysis and use of survey data

Detailed recommendations on data analysis from surveys to optimize survey designs and survey coordination are presented in Sections 3 to 5.

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Annex 2: Agenda of meeting

PGNEACS

Meeting of the ICES Planning Group for the North-east Atlantic Continental Slope Survey

Marine Research Institute, Tromsø, Norway

9–11 June 2009

Tuesday, 9 June am and pm- possibly extending into Wednesday

Start 9.00h

General:

- Welcome and housekeeping issues
- Adoption of the agenda – additional items to be considered

Survey Plan Review

1) Review the 2008 PGNEACS proposal in the light of Commission's feedback

- Review of aims and objectives of the survey
  - Abundance indices
  - Ecosystem indicators
  - Environmental data
- (Includes addressing ToRs d) review feedback from WGDEEP, WGEF and WGDEC regarding the collection of biological and environmental samples for PGNEACS 2009.)
- Review of spatial survey coverage taking into consideration species distribution and spatial extent of fisheries.

(Includes ToRs c) evaluate the possibility and advantage of extending the geographical coverage to include the continental slope from Scotland to Spitsbergen, as well as East Greenland, Iceland and Faroe Islands) and recommendation from WGDEEP 2009 on deep-water surveys (see overleaf)

2) Based on the above agree on a survey design in terms of spatial and temporal coverage, gear, sampling effort and sampling protocols.

(Includes ToRs e): on the basis of ToR a) –d) agree upon the coordination and standardization of the individual surveys participating in PGNEACS 2009 and finalize the survey programme for 2009 in terms of survey design, technology, sampling effort and sampling protocols

3) Northern Coordination

- h) Evaluate the rational for – and potentials of – international coordination of demersal surveys covering the deeper parts of the Nordic Seas (ICES Divisions XIV, V and II, as well as the northern parts of North Sea and Skagerrak);

- i) Recommend a procedure for how deep-water surveys in these Nordic areas might be coordinated, including evaluating establishing a new Planning Group for Deep Nordic Seas Surveys (PGDNSS) and specify its relation with existing groups as PGNEACS, PGNAPES and PGRS;
- j) If establishing a PGDNSS is recommended, draft ToR for this new group, including compilation of available information of existing surveys, the need for standardization of protocols, species identifications, and other as appropriate.

Wednesday, 10 June pm

4) Logistics of survey proposal

- b) review funding, resource allocation and logistics for the international PGNEACS 2009.
- k) Discuss the scope and implementation of the surveys after their being dropped from DCR funding and report on the feasibility for changes.

Thursday, 11 June am

5) Review of existing survey results

- a) review and report scientific and technical results of the existing NEA deep-water and slope surveys that are proposed to be incorporated into the PGNEACS survey with respect to :i) biological data obtained during comparative hauls, ii) net parameters and fishing procedures,
- g) review the use of compiled field id guides for deep-water species;
- f) review progress on making the PGNEACS survey data compatible with DATRAS
- Discussion on future analysis and use of survey data

Thursday, 11 June pm

Report writing and review of text.

PGNEACS will report by 1 August 2009 for the attention of SCICOM, TGISUR and ACOM.

Annex 3: PGNEACS Terms of Reference for the next meeting

The Planning group for North-east Atlantic Slope Surveys [PGNEACS] (Chair: L. Dransfeld, Ireland) will meet at ICES HQ, Copenhagen, Denmark from 8–10 June 2010 to:

a) Prepare, by correspondence and prior to the meetings of WGDEC and WGDEEP (March 2010) a first draft of a Best Practice Manual for scientific surveys in areas closed to fishing. This draft to be sent to WGDEC and WGDEEP for their comments.

b) Review comments on the draft for the Best Practice Manual in particular from WGDEC and WGDEEP and finalise the manual. The manual should be available for NEAFC in October 2010.

c) Review the development and evaluation of deep-water species identification guides for the NEA deep-water surveys and review progress on the development of a common image library.

d) With regards to the coordination of Nordic deep-water surveys:

   d.1) Evaluate present sampling protocols for surveys by Faroe, Greenland, Iceland and Norway, and attempt to standardize the protocols as much as possible.

   d.2) Evaluate the combined total survey coverage in relation to distribution of all major stocks in the area and consider the feasibility of bridging any gaps.

   d.3) Evaluate the extent and quality of information on non-targeted species and the ability to describe larger parts of the fish communities and the physical environment.

   d.4) Evaluate the prospect of making all the combined survey data available to all parties by use of e.g. the ICES DATRAS database, in order to facilitate joint research and analyses.

e) With regards to the central deep-water survey

   e.1) Review the use of survey abundance and ecosystem indicators from deep-water surveys during the bench marking process of WGDEEP.

   e.2) Evaluate intersessional work on variance estimates of existing NEA deep-water surveys and based on results optimize proposed survey design in terms of station allocation.

   e.3) Coordinate the timing, area and effort allocation and methodologies for the central European deep-water survey in 2011, if the programme is funded under the new data collection frame work.

f) With regards to the southern deepwater survey

   f.1) Evaluate sampling protocols for Azorean survey and attempt to standardize the protocols as much as possible.

   f.2) Evaluate the combined total survey coverage in relation to distribution of all major stocks in the area and consider the feasibility of bridging any gaps.

   f.3) Evaluate the extent and quality of information on non-targeted species and the ability to describe larger parts of the fish communities and the physical environment.

f.4) Evaluate the prospect of making all the combined survey data available to all parties by use of e.g. the ICES DATRAS database, in order to facilitate joint research and analyses.

PGNEACS will report by 20 July 2010 to the attention of SCICOM.

Supporting Information

Priority:	High. The work of the Group is essential if ICES is to collate even the most basic data and to progress the application of assessment techniques.
Scientific justification and relation to action plan:	This planning group would fulfil the need of internationally coordinating the existing dedicated deep-water surveys that are currently being carried out along the European continental shelf and nordic seas. This internationally coordinated deep-water survey would be a potential source of abundance indices for roundnose grenadier, black scabbardfish, deep-water sharks, bluemouth redfish and greater forkbeard and also be a platform for carrying out studies of seamounts identified by WGDEC and any related studies of the efficacy of closed areas.
Resource requirements:	None specific, beyond the need for members to prepare for and participate in the meeting.
Participants:	10 to 15 participants, including scientists that are involved in the scientific and technical running of the NEA deep-water surveys that will be coordinated by this group. In addition it includes scientists that are involved in the assessment of NEA deep-water species and scientific experts in the fields of deep-water fish biology and taxonomy as well as the ecology of deep-water habitats.
Secretariat facilities:	None.
Financial:	No financial implications.
Linkages to advisory committees:	Yes to ACOM
Linkages to other committees or groups:	Close links with WGDEEP and WGEF and also for the Nordic deep-water surveys NWWG and AFWG to provide abundance indices on deep-water species including deep-water sharks; links with WGDEC for the collection and analysis of environmental data and deep-water habitat characterization. Links with IBTS in order to benefit from expertise in the international coordination of trawl surveys.
Linkages to other organizations:	Possibly NEAFC

Annex 4: Recommendations

RECOMMENDATION	FOR FOLLOW UP BY:
2. PGNEACS recommends that the coordination of the Nordic surveys be made within a subgroup of PGNEACS and not by the whole group as such. This will allow tight cooperation between those closely involved with the surveys, and at the same time secure coordination of issues that are common with the southern surveys.	Nordic members of PGNEACS
3. PGNEACS recommends the exploration of existing survey data with regard to variance (depth resolution and spatial resolution) to test hypothesis of extrapolating down the slope and along latitudinal gradients. This analysis should include reanalysing existing data as hypothetical random design.	Members of PGNEACS
4.PGNEACS recommends that for IBTS submitting countries that participate in PGNEACS all survey data in 2010 be compatible with DATRAS, and where possible surveys in 2009 should also collect data in this standard format.	Members of PGNEACS
5. In order to coordinate and improve identification efforts of deep-water species on the different survey programmes: PGNEACS recommends that annual identification workshops should be hosted at future PGNEACS meetings, where facilities allow. These workshops should be organized by the host nation and focus on species collections from the host's deep-water area. The workshops should also be used to give feed and optimize identification keys and manage the image library. PGNEACS also recommends that a common image library should be created for the use of PGNEACS participants and regularly updated. Key identification images selected by PGNEACS should be provided to fishbase to aid the deep-water species id in a wider forum.	Members of PGNEACS