WORKSHOP ON THE DISTRIBUTION AND BYCATCH MANAGEMENT OPTIONS OF LISTED DEEP-SEA SHARK SPECIES (WKSHARK6)

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Contents

i Executive summary

WKSHARK6 was established to address a joint Special Request from OSPAR and NEAFC. This was the first such joint request from these organisations. The group focussed on four main areas:

- Produce maps showing the main distributions of deep-water sharks in the Northeast Atlantic
- Provide an overview of surveys that provide data on deep-water sharks in the Northeast Atlantic
- Summarise which fishing fleets caught these sharks
- Summarise the ICES advice for these stocks

Countries were asked to provide data from 20 years of surveys through an ICES data call. Some went further and provided historical data going back up to 60 years. These data have been included for the relevant species. Records of distribution have been produced for 22 species of deep water shark, ray and chimaera. Individual species-maps focus on the key areas of Iceland/Greenland, the Norwegian Sea and the Celtic/Iberian ecoregion, depending on the distribution of each species. As well as being published in this report, the group has made all the shapefiles used to create the distribution maps available as supporting documentation online. The data provided show the main hotspots for these species, illustrating the main sea basin areas where they occur and do not occur. Their dependency on rather narrow depth contours is also apparent. While they are widely distributed they are confined to relatively narrow depth intervals on the continental slopes and offshore plateaux. The survey data available is patchy and mainly confined to areas near the continent and areas easily sampled by bottom trawl. As such the distribution maps do not give the whole picture of the distribution of these species, and some important areas of distribution have not been surveyed or the surveys were not available. However, this is the first time that so many European survey-series have been analysed for these vulnerable species. This report highlights the advice applicable to these species, the degree of susceptibility they have to bycatch, and most especially underlines the importance of the NEAFC Regulatory Area for these species.

ii Expert group information

Expert group name	Workshop on the distribution and bycatch management options of listed deep-sea shark species (WKSHARK6)
Expert group cycle	Annual
Year cycle started	2020
Reporting year in cycle	1/1
Chair	Maurice Clarke, Ireland
Meeting venue and dates	21–24 January 2020, Galway, Ireland, 12 participants

WKSHARK6 – Terms of Reference

2019/2/FRSG32 Workshop on the distribution and bycatch management options of listed deep-sea shark species (WKSHARK6), chaired by Maurice Clarke (Ireland) will meet in Galway, Ireland from 20–24 January 2020 to:

a) Review the first drafts of the species distribution maps and, where possible, identify key areas for the species;
b) Review and, where necessary, update the table on overview of surveys;
c) Create a table with the following: complete list of species; overview of fleets taking the species as bycatch both past (from mid-1980s) until present; and area covered by the fleet (see also WKSHARK1)
d) Summarise ICES advice for species/stocks where applicable; Start to formulate potential options that can contribute to improving the status of the species and mitigate bycatch (using information from questionnaire in WGEF Report 2019 and the "EU request for ICES to provide advice on a revision of the contribution of TACs to fisheries management and stock conservation" (TACMAN)).

This workshop is part of a 2-year process to answer the NEAFC/OSPAR request on Deep-Sea Sharks, rays and chimaeras.

WKSHARK6 will report by 2 March 2020 for the attention of FRSG and ACOM.

1 Introduction

This working group was convened to answer an advice request from OSPAR and NEAFC combined. The request has arisen from the new OSPAR/NEAFC collective arrangement. This concerns cooperation and coordination regarding selected areas in areas beyond national jurisdiction in the North-East Atlantic (NEAFC Basic Texts / Collective Arrangement, OSPAR Agreement 2014-09) adopted by the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) and the North-East Atlantic Fisheries Commission (NEAFC). It is a formal agreement between legally competent authorities managing human activities in the Areas Beyond National Jurisdiction (ABNJ) in the North-East Atlantic. The essential aim of the collective arrangement is to become a collective and multilateral forum composed of all competent entities addressing the management of human activities in this region.

From the OSPAR perspective, the aim of institutional cooperation is to help deliver an ecosystem approach to the management of all relevant human activities in the marine environment. The objectives of NEAFC in adopting measures to protect the marine ecosystem from the potential adverse impacts of fisheries are of great interest to OSPAR in the context of protective, restorative and precautionary measures aiming at protecting and conserving species, habitats and ecosystems of the North-East Atlantic marine environment. For NEAFC, cooperation can also highlight measures within the broader ecosystem that OSPAR can take within its competence to support NEAFC's objective to ensure the long-term conservation and optimum utilisation of fishery resources, providing sustainable economic, environmental and social benefits.

2 Summary of advice and mitigation of by-catch

2.1 Summary of advice

For most of the deep-water shark stocks the inexistence of reliable information on trajectories of individual species' abundance prevent the quantitative evaluation of the exploitation rates their stocks can sustain. Nevertheless, given the biology and spatial dynamic of these species only very low levels can be considered and the recovery time of the heavily exploited stocks is admitted to be quite extended.

Advice has been provided by ICES for these species, upon request of the European Commission, since 2005. Portuguese dogfish (*Centroscymnus coelolepis*), leafscale gulper shark (*Centrophorus squamosus*), and kitefin shark (*Dalatias licha*). However, given the scarcity of fishery independent data and of reliable fishery data, particularly due to the lack of species-specific catch data, the scientific advice on deep-water shark stocks has been provided under precautionary approach. In 2019, ICES has not been requested to provide advice on the two Black-mouthed dogfish (*Galeus melastomus*) stocks but survey trends-based assessment implemented under ICES framework for category 3 stocks (ICES, 2012) indicated: an increase of stock size indicator since 2001 for sho.27.67 stock (West of Scotland, southern Celtic Seas, and English Channel) and stability for 27.89a stock (Bay of Biscay and Atlantic Iberian waters).

All the stocks for which ICES provides advice are classified as Category 2 in the NEAFC categorization of deep-sea species/stocks which implies that NEAFC requires measures stipulating that directed fisheries are not authorised and that bycatches should be minimised. The latest advice provided in 2019 (ICES, 2019c) is summarised below.

Kitefin shark (*Dalatias licha*) in subareas 1–10, 12, and 14 (the Northeast Atlantic and adjacent waters)

The stock structure of this species in the NE Atlantic is unknown. The species occurs widely at low abundance throughout the ICES area, being mainly distributed at the Azorean Islands (ICES Subarea 27.10). Historically there was an Azorean directed fishery targeting this species. The assessment of the stock using the Azorean data performed in 2002 considered that the stock was depleted and that it has undergone a marked decline in abundance from the mid-1970s to the late 1980s (Heessen, 2003). In 2010, a TAC 0 was adopted for the stock.

ICES, following precautionary approach, has advised zero catches in each of the years 2020–2023, this advice did not change from previous 2015 advice. This stock is assessed under ICES framework for category 6 (ICES, 2012). According to this and since no information on abundance or exploitation is available, ICES considers that a precautionary reduction of catches should be implemented unless there is ancillary information clearly indicating that the current level of exploitation is appropriate for the stock. Discarding is known to take place, but ICES cannot quantify the corresponding catch. Discard survival, which may occur, has also not been estimated

Leafscale gulper shark (*Centrophorus squamosus*) in subareas 1–10, 12, and 14 (the Northeast Atlantic and adjacent waters)

The stock structure of this species in the NE Atlantic is unknown. The species is widely distributed, and the stock likely extends into the CECAF area (data for this part of the stock are not available). Members of the genus *Centrophorus* are among the least productive of all deep-water sharks and can thus only sustain a very low level of fishing mortality.

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Portuguese dogfish (*Centroscymnus coelolepis*) in subareas 1–10, 12, and 14 (the Northeast Atlantic and adjacent waters)

The stock structure of this species in the NE Atlantic is unknown. The species is widely distributed, and the stock likely extends into the CECAF area (data for this part of the stock are not available). Members of the genus *Centrophorus* are among the least productive of all deep-water sharks and can thus only sustain a very low level of fishing mortality.

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2.2 Mitigation of by-catch

All the deep-water sharks are subject to 0-TAC advice under the deep-water TAC and quota regulation (EU2019/124) or are prohibited from being fished by NEAFC. That effectively is a license to discard these species and being caught at such depths the likelihood of survival is very low. The existing legislation is not designed to mitigate by-catch. There is also an allowed by-catch in target fisheries for other species e.g. black scabbardfish fishery, and again this is a license to discard the sharks, with low probability of survival.

WKSHARK6 notes that deep-water sharks may be taken in five broad gear types:

True deep-water fisheries in waters greater than 400 m depth, and/or targeting deep species

1. Bottom trawls
2. Longlines
3. Gillnets and tangle nets

Non-deep-water fisheries with some interactions with deepsea species

4. Pelagic trawls when deployed at or near the bottom
5. Outer–shelf bottom fisheries for various species such as

True deep-water fisheries

Most of these deep-water sharks are only present in waters deeper than 500 m (Figure 1). Hence, mitigation of bycatch is a concern only in dedicated deep-water fisheries or those operating in deep waters (e.g. some pelagic trawling).

Various regulations restrict the use of the first 3 gear types above. Bottom trawling by EU vessels and in EU waters is banned in waters deeper than 800 m (Regulation 2016/2336), while gillnet and tangle net fisheries (by EU vessels and in EU waters) are banned in waters deeper than 600 m (Regulation 41/2007). A gillnet ban in waters deeper than 200 m is also in operation in the NEAFC regulatory Area (all international waters of the ICES Area). NEAFC also ordered the removal of all such nets from NEAFC waters by 1 February 2006.

Given these bans, the following gear types represent the main risk of by-catch:

- Longlines in all areas
- Bottom trawls in waters shallower than 800 m
- Bottom trawls in all depths in the NEAFC Regulatory Area (NEAFC-West only because deep-water sharks are not widely distributed in NEAFC– Banana Hole and -Doughnut Hole)
- Pelagic trawls operating in waters deeper than 600 m, especially when contacting the bottom.

Bycatch mitigation measures are difficult to implement for chondrichthyans since many species occur in a similar size range as the target species in mixed fisheries (exemptions include the Greenland shark *Somniosus microcephalus*). Possible yet to be evaluated mitigation measures may be deterrent measures "triggering" electromagnetic senses of elasmobranchs (hook material, net material etc.), as well as acoustics and light-based technologies. Gear-based technical measures can be applied to improve the selectivity for sharks. For example, use of hooks at different depths, alternative hooks and/or deployment of magnets on hooks, alternative mesh sizes and shapes, new materials, grids and escape windows to reduce bycatch. Novel grid panels designed to facilitate flatfishes (e.g. 'Freshwind' https://vimeo.com/channels/801304) may have potential

to reduce some skates bycatches with similar body morphology. These measures should always be subjected to proper scientific evaluation, before they could be considered.

For deep-water sharks, spatial management could be considered to minimise bycatch. It might be necessary to trial new methodologies or to improve knowledge on where to best deploy fishing gears. The avoidance of some fishing grounds or epochs of the year where the spatial overlap between the target species of the fisheries and deep-water shark species could be also considered. However, there is not adequate information on any deep-water shark to frame such measures at present.

Non-deep-water fisheries

Small bodied and/or, upper slope, cold water tolerant species such as *Galeus melastomus, Etmopterus spinax* and *Chimaera monstrosa* may be taken in crustacean fisheries in many areas including the Skagerrak (Subarea 3, Iceland (Subarea 5), Greenland (Subarea 14), the Porcupine Bank (Subarea 7) and Biscay (Subarea 8). The key consideration in these areas, however, is whether the species' populations can sustain the level of discarded by-catch. This should be evaluated in the context of a population assessment providing estimates of fishing mortality in relation to sustainable exploitation rates.

Pelagic trawls

Commercial fisheries for Clupeids, Scombrids and species such as *Micromesistius poutassou*, normally take place at depths less than 500 m. Fisheries for *Sebastes* species make take place at greater depths. However most elasmobranch species are found close to the bottom, so interactions and bycatch would be limited, unless the nets are placed close to the bottom. However, some pelagic trawlers do deploy their nets on the bottom, to some extent, and a by-catch of deep-water sharks can be expected. Further research is required to evaluate the full extent of interaction between pelagic trawls and bottom dwelling sharks. Until this work is completed, a precautionary approach could be adopted to assume that some interaction does occur. Although by-caught numbers may be expected to be low, midwater pelagic fisheries may interact with species which can swim off the bottom in the water column.

3 Overview of surveys

3.1 Data call and results

A data call was sent by the ICES Secretariat to all ICES member countries (Annex 3). This specified the specific species for which data was requested, the time period of the surveys, location of the surveys, and which specific surveys were to be examined for records of the named species. Records were returned from most countries, although there was some variation in the data returned. Some countries added data from earlier surveys while others included surveys that were not known to the original data call compilers. Some observer data from commercial trips was also included by some countries. All data provided have been included in the data analysis.

Data were received from ten ICES Member Countries, covering a geographic area from ICES area 27.1 (Northeast Arctic) to 27.14 (Azores). The earliest survey submitted was from 1936, with the most recent in 2019. Most data supplied was from two time-periods – the 1990s, when deep-water commercial fisheries expanded, and the early-mid 2000s, when several countries had simultaneous, coordinated surveys. Depths supplied ranged from 31–4500 m. The shallowest depth records primarily illustrate the shallow depths also utilised by *Galeus melastomus* (See Section 4.1.). The deepest depths were surveyed using Remote-Operating Vehicles (ROVs) rather than trawl or net surveys, due to depth limitations discussed in Section 3.2.

Table 3.1 (below) is a list of all surveys for which data was provided, by country. It also lists some surveys from which additional data may be available, but for which data were not provided, for various reasons. For example, some UK data from the 1980s have not yet been digitized.

Table 3.1 Details of surveys provided for ICES data call.

Survey name	Country	Acronym	Survey description	Periods	ICES statistical areas	Top 5 species	Other significant species
Irish Deep-water Survey	Ireland	IDS	Trawl survey	1993-1996, 2006-2009	27.6 and 27.7	*Chimaera monstrosa, Galeus melastomus, Deania calcea, Hydrolagus mirabilis, Centroselachus crepidater*	*Apristuridae*
Longline survey	Ireland	NA	Longline survey	1993-1997	27.6 and 27.7	*Centrophorus squamosus, Galeus melastomus, Daenia calceus, Etmopterus princeps, Centroscelachus crepidater*	*Bathyraja richardsonii*
SeaRover	Ireland	SeaRover	ROV survey	2017-2019	27.6 and 27.7	*Galeus melastomus, Hydrolagus mirabilis, Neoraja caerulea, Hydrolagus affinus, Centrophorus squamosus*	*Pseudotriakis microdon*
Irish Groundfish Survey	Ireland	IGFS	Trawl survey	2003-present	27.6 and 27.7	*Galeus melastomus, Chimaera monstrosa, Etmopterus spinax, Galeus murinus, Hexanchus griseus*	No
Irish Anglerfish and Megrim survey	Ireland	IAMS	Trawl survey	2016-present	27.6 and 27.7	*Chimaera monstrosa, Galeus melastomus, Deania calcea, Etmopterus princeps, Centrophorus squamosus*	*Scymnodon ringens, Hexanchus griseus*
German Greenland ground-fish survey	Germany	GGS	Trawl survey	1982-2017	27.14	*Rajella fyllae, Somniosis microcephalus, Centroscyllium fabricii, Etmopterus spinax*	No
International Blue Whiting Survey	Netherlands	BWHTS	Pelagic trawl survey	2004-present	27.6 and 27.7	*Centroselachus crepidater, Deania calcea, Etmopterus spinax, Centrophorus squamosus*	No
Swedish IBTS	Sweden	IBTS	Trawl survey	2016-present	27.3a	*Chimaera monstrosa, Etmopterus spinax, Rajella fyllae*	No
Ad-hoc surveys	France	NA	Trawl survey	1996, 1999	27.6 and 27.8	*Centroselachus crepidater, Deania calcea, Centroscymnus coelolepis, Etmopterus princeps, Harriotta raleighana*	*Apristuridae*
Trawl survey of Hatton Bank	Spain	EcoVul	Trawl survey	2005-2007	27.6b	*Centroscyllium fabricii, Centroscymnus coelolepis, Deania calcea, Chimaera monstrosa, Etmopterus princeps*	No

Survey name	Country	Acronym	Survey description	Periods	ICES statistical areas	Top 5 species	Other significant species
Spanish Porcupine survey	Spain	SpPGFS-WI-BTS-Q4	Trawl survey	2001-Present	27.7	*Galeus melastomus, Chimaera monstrosa, Etmopterus spinax, Deania calcea, Scymnodon ringens*	*Hexanchus griseus, Dipturus nidarosiensis*
Spanish Groundfish survey	Spain	SpGFS-WIBTS-Q4	Trawl survey	1983-Present	27.7 and 27.8	*Galeus melastomus, Chimaera monstrosa, Etmopterus spinax, Deania profundorum, Galeus atlanticus*	*Deania calcea, Hexanchus griseus*
Spanish ARSA Q1 survey	Spain	SP-ARSAQ1	Trawl survey	1993-Present	27.9	*Galeus melastomus, Etmopterus spinax, Chimaera monstrosa, Galeus atlanticus, Centrophorus granulosus*	*Deania calcea*
Norwegian North Sea shrimp survey	Norway	Reketokt	Trawl survey	1990-Present	27.3	*Etmopterus spinax, Chimaera monstrosa. Galeus melastomus, Rajella fyllae*	No
Norwegian Sea deep-water fish survey - Autumn	Norway	EggaSor	Trawl survey	2012-Present	27.2 and 27.3	*Chimaera monstrosa, Etmopterus spinax, Galeus melastomus, Amblyraja hyperborea, Rajella fyllae*	No
Norwegian Sea deep-water fish survey - Spring	Norway	EggaNord	Trawl survey	1994-Present	27.2 and 27.3	*Amblyraja hyperborea, Chimaera monstrosa, Rajella fyllae, Etmopterus spinax, Somniosus microcephalus*	No
Icelandic demersal surveys	Iceland	IS-SMB & IS-SMH	Trawl survey	1969-Present	27.5.a	*Centroscyllium fabricii, Chimaera monstrosa, Etmopterus spinax, Etmopterus princeps, Centroselachus crepidater*	*Amblyraja hyperborea, Galeus murinus*
Portuguese Crustacean Survey / Nephrops TV Survey (Ongoing)	Portugal	PT-CTS (UWTV (FU 28–29))	Trawl survey	1997-2018	27.9.a	*Galeus* spp. (incl. *Galeus melastomus*), *Etmopterus spinax, Chimaera monstrosa, Scymnodon ringens, Deania* spp. (*Deania calcea*)	*Centrophorus* spp., *Dipturus nidarosiensis*
Research Project (Survey onboard commercial fishing vessels using longlines)	Portugal	PT-FISHSURV-LLS	Longline survey	2014-2015	27.9.a	*Centroscymnus coelolepis, Deania calcea, Centrophorus squamosus, Scymnodon ringens, Galeus melastomus*	*Centrophorus granulosus*
Q1 Portuguese GroundFish survey	Portugal	PT-GFS-Q1	Trawl survey	1992-2008	27.9.a	*Galeus* spp., *Etmopterus spinax*, *Chimaera monstrosa, Deania* spp., *Scymnodon ringens*	*Centrophorus* spp.

Survey name	Country	Acronym	Survey description	Periods	ICES statistical areas	Top 5 species	Other significant species
Q3 Portuguese GroundFish Survey	Portugal	PT-GFS-Q3	Trawl survey	1989-2001	27.9.a	*Etmopterus spinax, Galeus* spp., *Chimaera monstrosa, Deania* spp., *Scymnodon ringens*	*Dalatias licha*
Q4 Portuguese GroundFish survey	Portugal	PtGFS-WIBTS-Q4	Trawl survey	1981-2001	27.9.a	*Galeus* spp., *Etmopterus spinax, Chimaera mosntrosa, Deania* spp., *Scymnodon ringens*	*Dalatias licha, Centrophorus* spp.
Q3 International Bottom Trawl Survey (ongoing)	UK (E&W)	IBTS-Q3-England	Trawl survey	1977-Present	27.4.a	*Galeus melastomus, Chimaera monstrosa* (also as Chimaeridae), *Etmopterus spinax, Dipturus oxyrinchus*	No
Historic tows using a Granton trawl in the Irish Sea (ongoing survey using beam trawl only)	UK (E&W)	UK(E&W)-Q3-BTS	Trawl survey	1988-1991	27.7.a	*Galeus melastomus, Chimaera monstrosa*	No
Q1 Southwest Ecosystem Survey	UK (E&W)	Eng-Q1-BTS (Q1SWECOS)	Trawl survey	2017	27.7.f	*Galeus melastomus*	No
Ad-hoc Elasmo surveys (commercial gillnetters) (Periodic)	UK (E&W)	NA	Gillnet survey	2015-2017	27.7.e, 27.7.h	*Hexanchus griseus*	No
Q4 Bottom Trawl Survey (Ceased)	UK (E&W)	EngW-WIBTS-Q4	Trawl survey	2007, 2009	27.7.g	*Galeus melastomus*	No
UK (E&W) Q1 Celtic Sea groundfish survey (Ceased)	UK (E&W)	UK (E&W) Q1 Celtic Sea groundfish survey	Trawl survey	1982-2004	27.7.b-c,27.7.f-h,27.7.j, 27.8.b-d	*Etmopterus spinax, Chimaera monstrosa* (also as Chimaeridae), *Galeus melastomus, Hexanchus griseus, Dipturus oxyrinchus*	*Dalatias licha, Dipturus nidarosiensis*
UK (E&W) Q4 Celtic Sea groundfish survey (Ceased)	UK (E&W)	UK (E&W) Q4 Celtic Sea groundfish survey	Trawl survey	1983, 1985	27.7.g, 27.8.b	*Galeus melastomus, Hexanchus griseus*	No
Q4 International Bottom Trawl Survey (Ceased)	UK (E&W)	IBTS-Q4-England	Trawl survey	1993-1996	27.4.a	*Galeus melastomus*	No
MEMFISH Research Project (Ceased)	UK (E&W)	NA	Trawl survey	2009-2011	27.6.a, 27.7.a	*Galeus melastomus*	No

Survey name	Country	Acronym	Survey description	Periods	ICES statistical areas	Top 5 species	Other significant species
Various historic surveys	UK (E&W)	NA	Trawl survey	1956-2010	27.2, 27.6, 27.7 and 27.8	*Galeus melastomus, Dalatias licha, Centrophorus granulosus, Etmopterus spinax, Deania calcea*	*Somniosus microcephalus*
Ongoing E&W Offshore observer programme (Data for 2005 includes Deepwater surveys as part of a Fisheries Science Partnership project)	UK (E&W)	NA	Various	2002-2018	27.7	*Centrophorus squamosus, Deania calcea, Galeus melastomus, Pseudotriakis microdon, Dalatias licha*	*Hydrolagus pallidus, Somniosus microcephalus, Harriotta spp.*
Deep-water surveys timeseries	UK (Scotland)	NA	Trawl survey	1998-Present	27.4.a, 27.5.b, 27.6.a-b	*Chimaera monstrosa, Galeus melastomus, Etmopterus spinax, Centroscyllium fabricii, Hydrolagus mirabilis*	*Apristurus laurussonii, Rhinochimaera atlantica, Rajella fyllae, Amblyraja hyperborea, Oxynotus paradoxus*
Various deep-water surveys	UK (Scotland)	NA	Trawl survey	1996-2018	27.4.a, 27.5.b-c, 27.6.a-b	*Chimaera monstrosa, Hydrolagus mirabilis, Etmopterus spinax, Galeus melastomus, Centroscyllium fabricii*	*Chlamydoselachus anguineus*
GroundFish survey in the West Coast in both Q1 and Q4	UK (Scotland)	SCO-WC-GFS Q1 and Q4	Trawl survey	2011-Present	27.6.a	*Chimaera monstrosa, Galeus melastomus, Etmopterus spinax, Hexanchus griseus*	No
GroundFish survey in the West Coast in both Q1 and Q4	UK (Scotland)	SCO-WC-IBTS Q1 and Q4	Trawl survey	1998-2010	27.6.a, 27.7.b	*Chimaera monstrosa, Galeus melastomus, Etmopterus spinax, Hexanchus griseus*	No
Historic exploratory surveys	France	NA	Trawl survey	1963-1976	27.2, 27.4-7, 27.12	*Chimaera monstrosa, Etmopterus spinax, Deania calcea, Galeus melastomus, Centroscyllium fabricii*	*Oxynotus centrina, Hydrolagus affinis, Rajella bathyphila*

Data not currently provided

Survey name	Country	Acronym	Survey description	Periods	ICES statistical area	Top 5 species	Other significant species
Annual deep-water long line survey targeting deep-water sharks (600-2400 m)	Spain (Basque Country)	PALPROF	Longline	2015-present	27.8c		
Evaluation Halieutique Ouest De l'Europe	France	EVHOE	Trawl survey		27.7 and 27.8	*Galeus melastomus*	None
Historic Deep-water surveys (Several not currently available electronically - Cirolana 4a/73, Cirolana 6b/1973, Cirolana 1/1974, Cirolana 5b/1974, Luneda (Feb 1974), Swanella 1973/Parts 1-2, Cirolana 9/1978)	UK (E&W)	NA	Trawl survey	1973, 1974 and 1978			
Fisheries Science Partnership project - Deep-water surveys, not currently available electronically (Ceased)	UK (E&W)	NA	various	2004, 2006			
Portuguese Azorean Longline Survey	Portugal (Azores)	ARQDAÇO	Longline	1995-present	27.10.a	Blackspot red seabream; Blackbelly rosefish; Common mora	Arrowhead dogfish; Tope shark; velvet belly lanternshark

3.2 Limitations of the data

There are limitations to the data presented in this report that must be taken into account when using these data.

Firstly, maps are produced based on surveys carried out by national or international surveys. These surveys do not cover the entire North-East Atlantic. Surveys may have geographic or depth restrictions, limiting the amount of data available for plotting. For example, the Mid-Atlantic Ridge has only been surveyed by two time-series: The Icelandic survey series and the Norwegian Mar-Eco project. This means that it has been less-intensively surveyed than e.g., the Porcupine bank area. In addition, data from the Azorean region were unavailable. The surveys conducted in the Azores by Portugal are an invaluable source of data on the distribution of deep-water sharks in that area, and it is hoped that future exercises could bring these data to the table.

Depth restrictions are also a factor. Due to gear limitations, mainly caused by the increasing pressure at depth, most trawl surveys do not sample below 2000 m. Areas primarily consisting of rough or rocky ground, or areas that have not previously been fished or surveyed using multibeam sonars, may not be sampled at all due to the risk of gear damage.

Differing gear types may produce different results. An example here would be long-lines vs trawls. Long-lines may not catch small elasmobranch specimens, as fish must be of a minimum size to be able to be caught by the hook. Therefore, an area where a species has a juvenile or nursery area that is surveyed with this gear may show a different result if surveyed by trawl.

Taxonomy can be a confounding issue for some elasmobranch families, e.g. the Apristuridae. New species such as *Apristurus melanoasper* were described during the time-period of these surveys (Iglesias *et al*., 2004). Prior to 2005, this species will not appear in the records. Identification of similar species can also occur. *A. microps* and *A. murinus* in particular can be difficult to tell apart. An unknown percentage of records of either of these two species may be incorrect.

The data available only represent the recorded catches of those sharks from stations where fishing occurred. The terrain of the deep sea is such that many areas cannot have survey gear deployed in them, and hence the distributions shown must be interpreted in that context.

In the future, it may be possible to conduct habitat modelling of deep-water shark distributions. However, this is currently not possible, because insufficient training data exist. The deep sea environment is very complex, and predicted distributions may not reflect the true picture, especially in areas like the mid-Atlantic Ridge and sea mounts.

3.3 Distribution of species

Maps were compiled using depth ranges taken from the literature and available survey and other relevant data (Table 3.3.1). This was necessary as all deep-water sharks occupy a specific depth interval, which often varies from region to region, depending on the hydrographic conditions. As an example, Figure 3.3.1 illustrates the depth range of the more abundant species in the area west of Scotland.

The results of GIS modelling per species are presented below.

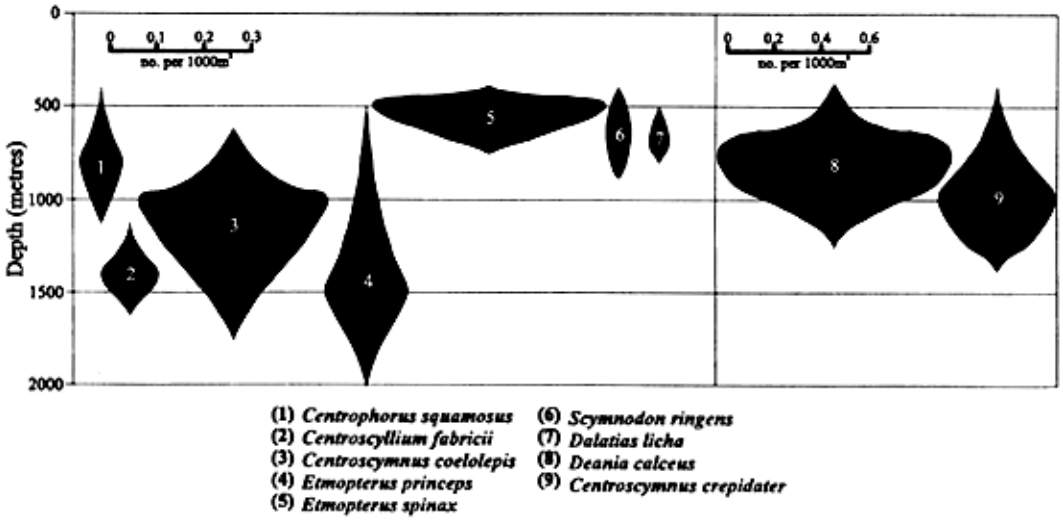

Figure 3.3.1. Distribution, by depth, of deep-water sharks in ICES Subarea 6. This illustrates that for most species, waters shallower than 500 m are not of importance. The exception is *Etmopterus spinax*. Reproduced from Gordon (1999).

Assessment Method

The components of the analysis are:

- Shark species data from the Joint OSPAR and NEAFC Request for advice on deep sea sharks, rays and chimaeras.
- A bathymetry layer showing the depth range based on the distribution of shark species data
- Spatial area data to delineate species distribution interpreted from expert judgement.
- Species depth range data from literature review and expert judgement

Assessment Criteria

The assessment has been prepared by combining the species depth range, and data from Gebco's gridded bathymetry for user defined areas. ICES statistical areas data used to delineate the total spatial area where shark species occur. For this assessment, specific ICES areas have been selected to represent areas of depth range. Areas not covered by the ICES data were produced from discussions in WKSHARK6.

Step1: Mapping species data:

The shark data were added to the GIS environment as a layer (event layer) using the add XY data option. This layer was exported to a new shapefile, the event layer does not have an ObjectID field; making further analysis such as feature selection, attribute edits impossible. The new shark species data layer was saved as "all_SharkData_Update.shp". The ICES areas shapefile was subdivided into Area27_10a1_2, Area27_2to4, Area27_5a_14ab, and Area27_5b_9 using the Select by Attribute tool and subsequently saved as individual shapefiles using the Copy Features tool. The remaining areas of Zone A, B, C, D, E were constructed and saved as individual shapefiles.

Shark species present within the various areas were mapped using the Select by Location tool. The all_SharkData_Update layer is chosen as the target layer and the area you are delineating by is chosen as the source layer. This process highlights all shark species data contained in the source layer; which can then be saved as a shapefile using the Copy Features tool. This process

was repeated for the nine individual areas described earlier. Individual shapefiles of shark species in each area were constructed using the Species Iterator model (Figure 3.3.2). The model uses the shark species data in a specific area, then iterates through the species column; compiles all records of the individual species and saves them as shapefiles. These shapefiles can be further analyzed at the species level if required.

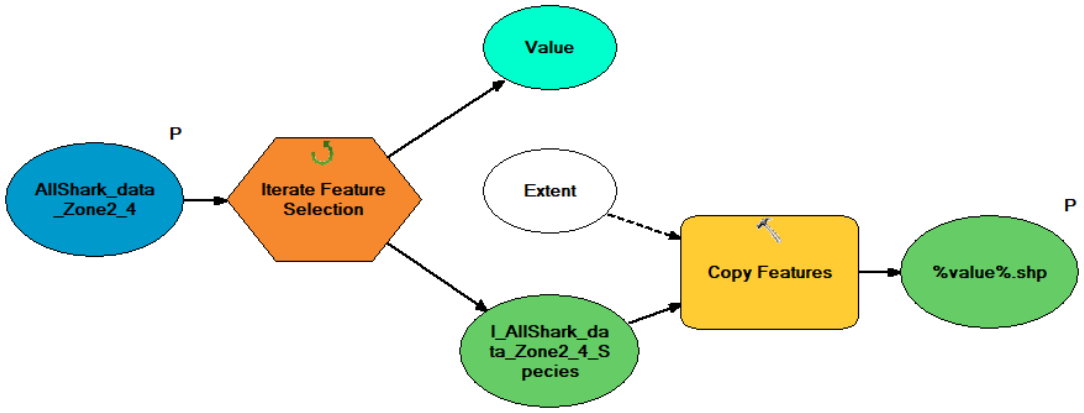

Figure 3.3.2 Species Iterator model.

Step 2 Mapping bathymetry data:

Bathymetry data downloaded in ESRI ASCII format, was applied in preparation of the depth range associated with species of shark, located in the areas mentioned earlier. A specific depth range was constructed for all shark species associated within individual areas.

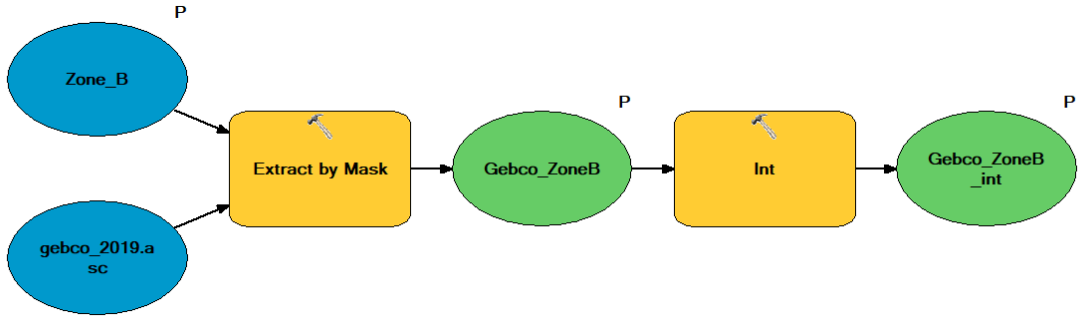

Figure 3.3.3 Area Extraction Model.

The bathymetry data specific to Zone B (Area in Figure 3.3.3 above) is selected, extracted and converted from a floating point to an integer raster. The output raster (Figure 3.3.3 Gebco_ZoneB_int) now contains an attribute table containing depth values. This process is performed for all areas.

Step 3 Depth ranges:

The depth range analyses apply the information contained within the depth range table, prepared from expert judgement and maps the corresponding ranges. The output of the Area Extraction model (Figure 3.3.3) is used as one of the inputs in the Depth Range Model (Figure 3.3.4).

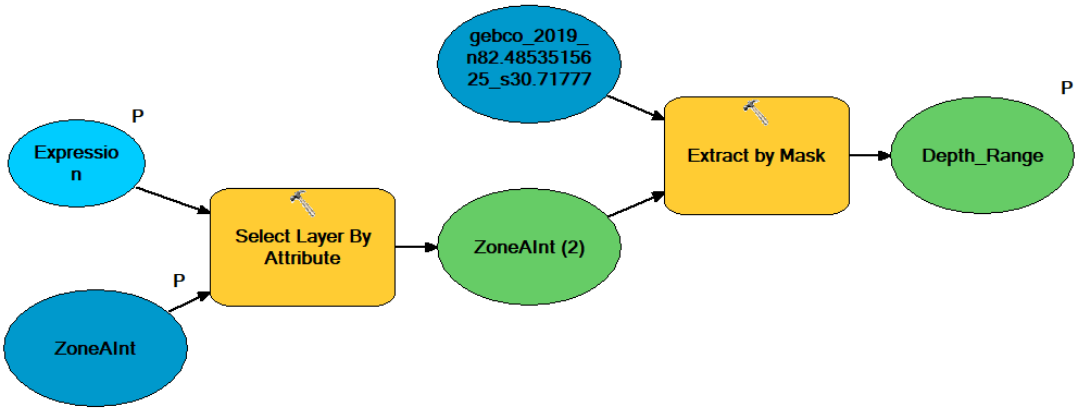

Figure 1.3.4 Depth Range Model.

In the model example shown in Figure 3.3.4, the ZoneA_Int raster is the input to the Select Layer by Attribute tool. The expression parameter enters the depth range e.g. the depth range for Centroscyllium fabricii in Area27_5b_9 is 800 – 1600 m deep, the expression would read as Value <= -800 AND Value >= -1600. The model selects all cells in the ZoneA_int raster that are within that range. This selection is then extracted from the original Gebco raster as the depth range for the above mentioned species (Figure 3.3.5).

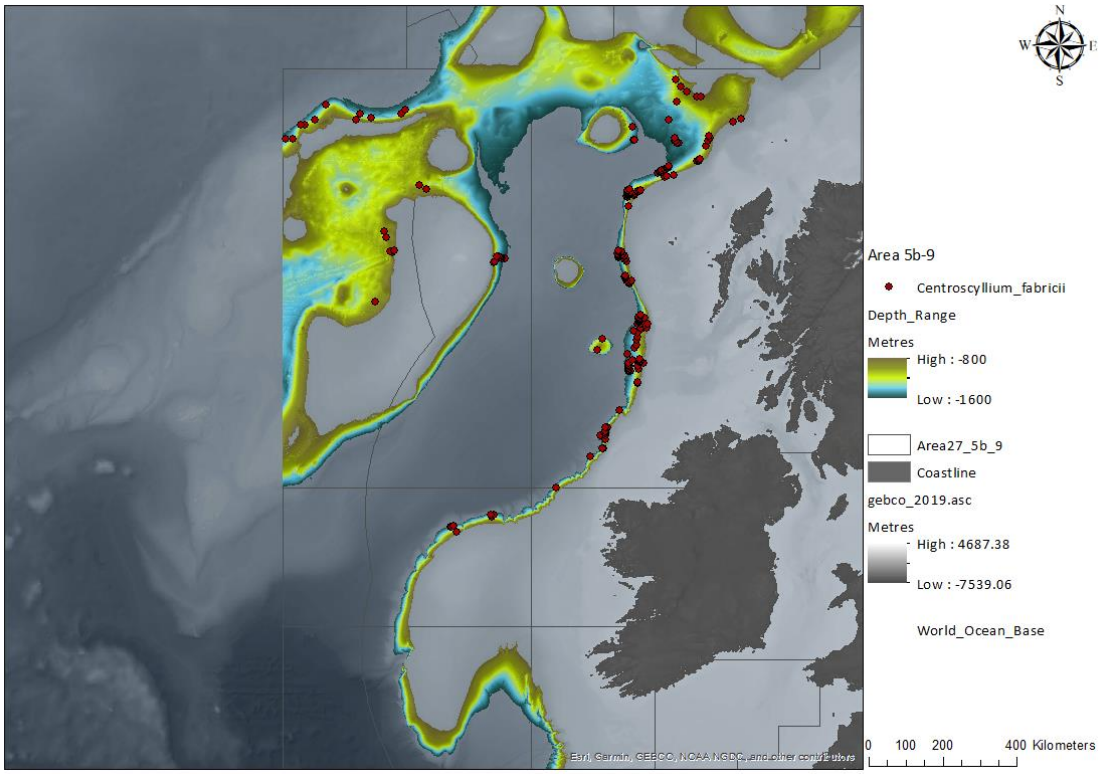

Figure *3.3.5 Centroscyllium fabricii* in Area27_5b_9 800 – 1600 m depth range.

Table 3.3.1. Depth distributions assumed for each area, with sources.

Area	Species	Depth (Min)	Depth (Max)	Source
Reykjanes Ridge	*Apristurus laurussonii*	814	1674	Icelandic data, unpublished
Reykjanes Ridge	*Centrophorus squamosus*	878	970	Icelandic data, unpublished; Hareide and Garnes, 2001
Reykjanes Ridge	*Centroscyllium fabricii*	500	1674	Icelandic data, unpublished; Hareide and Garnes, 2001
Reykjanes Ridge	*Centroscymnus coelolepis*	818	1900	Icelandic data, unpublished; Hareide and Garnes, 2001
Reykjanes Ridge	*Centroscymnus crepidater*	814	1515	Icelandic data, unpublished
Reykjanes Ridge	*Chimaera monstrosa*	878	915	Icelandic data, unpublished
Reykjanes Ridge	*Deania calcea*	500	814	Icelandic data, unpublished; Hareide and Garnes, 2001
Reykjanes Ridge	*Etmopterus princeps*	500	1900	Hareide and Garnes, 2001
Reykjanes Ridge	*Etmopterus spinax*	1600		Hareide and Garnes, 2001
Reykjanes Ridge	*Galeus melastomus*	600	700	Hareide and Garnes, 2001
Reykjanes Ridge	*Galeus murinus*	814	1695	Icelandic data, unpublished
Reykjanes Ridge	*Hydrolagus mirabilis*	1352	1674	Icelandic data, unpublished
Reykjanes Ridge	*Rhinochimaera atlantica*	842		Icelandic data, unpublished
Reykjanes Ridge	*Somniosus microcephalus*	500	1400	Hareide and Garnes, 2001
Sub-areas 2-4	*Amblyraja hyperborea*	700	1600	Data call data
Sub-areas 2-4	*Chimaera monstrosa*	150	500	Data call data
Sub-areas 2-4	*Etmopterus spinax*	150	500	Data call data
Sub-areas 2-4	*Galeus melastomus*	150	350	Data call data
Sub-areas 5-9	*Amblyraja hyperborea*	400	1400	Datacall
Sub-areas 5-9	*Apristurus laurussonii*	800	2000	Datacall
Sub-areas 5-9	*Centrophorus granulosus*	400	1300	Datacall, Banon et al. 2008
Sub-areas 5-9	*Centrophorus squamosus*	700	1300	Gordon, 1999, Datacall
Sub-areas 5-9	*Centroscyllium fabricii*	800	1600	Gordon, 1999, Datacall
Sub-areas 5-9	*Centroscymnus coelolepis*	600	1900	Gordon, 1999, Datacall
Sub-areas 5-9	*Centroscymnus crepidater*	700	1500	Gordon, 1999, Datacall
Sub-areas 5-9	*Chimaera monstrosa*	150	750	Datacall
Sub-areas 5-9	*Chlamydoselachus anguineus*	120	1280	Fishbase (commonly found)
Sub-areas 5-9	*Dalatias licha*	300	800	Datacall
Sub-areas 5-9	*Deania calcea*	550	1300	Gordon, 1999, Datacall
Sub-areas 5-9	*Dipturus nidarosiensis*	50	1300	Datacall
Sub-areas 5-9	*Etmopterus princeps*	900	1850	Datacall
Sub-areas 5-9	*Etmopterus spinax*	150	700	Gordon, 1999, Datacall
Sub-areas 5-9	*Galeus melastomus*	150	800	Datacall
Sub-areas 5-9	*Galeus murinus*	800	1550	Datacall
Sub-areas 5-9	*Hexanchus griseus*	50	850	Datacall
Sub-areas 5-9	*Hydrolagus mirabilis*	550	1500	Datacall
Sub-areas 5-9	*Oxynotus paradoxus*	265	720	FAO Guide 2013
Sub-areas 5-9	*Rajella fyllae*	200	1150	Datacall
Sub-areas 5-9	*Rhinochimaera atlantica*	950	1850	Datacall
Sub-areas 5-9	*Scymnodon ringens*	550	1600	Datacall, FAO 2013 (deeper limit)
Sub-areas 5-9	*Somniosus microcephalus*	50	1800	Datacall
Sub-area 5	*Amblyraja hyperborea*	167	1363	Icelandic data, unpublished
Sub-area 5	*Apristurus laurussonii*	185	1443	Icelandic data, unpublished
Sub-area 5	*Centrophorus squamosus*	215	939	Icelandic data, unpublished
Sub-area 5	*Centroscyllium fabricii*	144	1443	Icelandic data, unpublished
Sub-area 5	*Centroscymnus coelolepis*	407	1443	Icelandic data, unpublished
Sub-area 5	*Centroscymnus crepidater*	185	1333	Icelandic data, unpublished
Sub-area 5	*Chimaera monstrosa*	104	1420	Icelandic data, unpublished
Sub-area 5	*Deania calcea*	417	1363	Icelandic data, unpublished
Sub-area 5	*Etmopterus princeps*	196	1449	Icelandic data, unpublished
Sub-area 5	*Etmopterus spinax*	173	1213	Icelandic data, unpublished
Sub-area 5	*Galeus melastomus*	523	523	Icelandic data, unpublished
Sub-area 5	*Galeus murinus*	181	1404	Icelandic data, unpublished
Sub-area 5	*Hydrolagus mirabilis*	431	1321	Icelandic data, unpublished
Sub-area 5	*Rajella fyllae*	125	1753	Icelandic data, unpublished
Sub-area 5	*Rhinochimaera atlantica*	422	1443	Icelandic data, unpublished
Sub-area 5	*Somniosus microcephalus*	50	2808	Icelandic data, unpublished

Amblyraja hyperborea

Amblyraja hyperborea, the Arctic skate, is a northern-species, of cold water. There are few records from ICES subareas 27.6–27.12. The majority of records occur in the Norwegian Sea, north to Svalbard (Figure 3.3.6), around Iceland (Figure 3.3.7) and north of the Wyville-Thompson Ridge (Figure 3.3.8) south of which it does not occur.

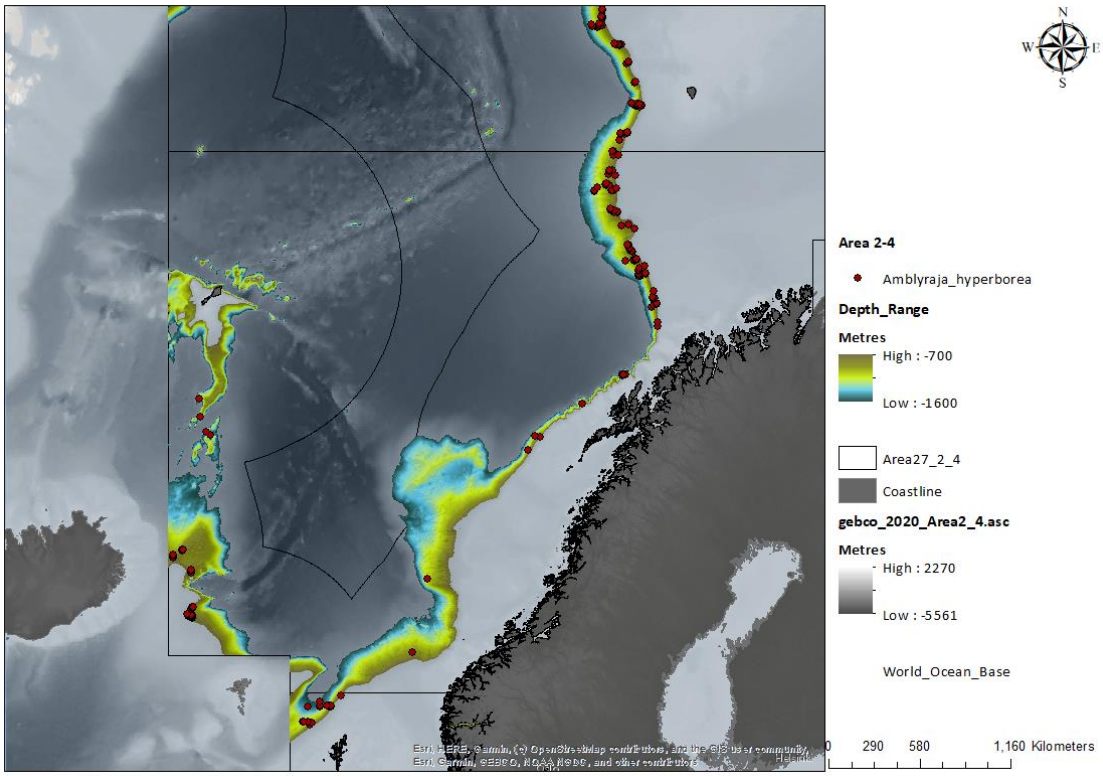

Figure 3.3.6. Recorded distribution of *Amblyraja hyperborea* in ICES subareas 27.2–27.4

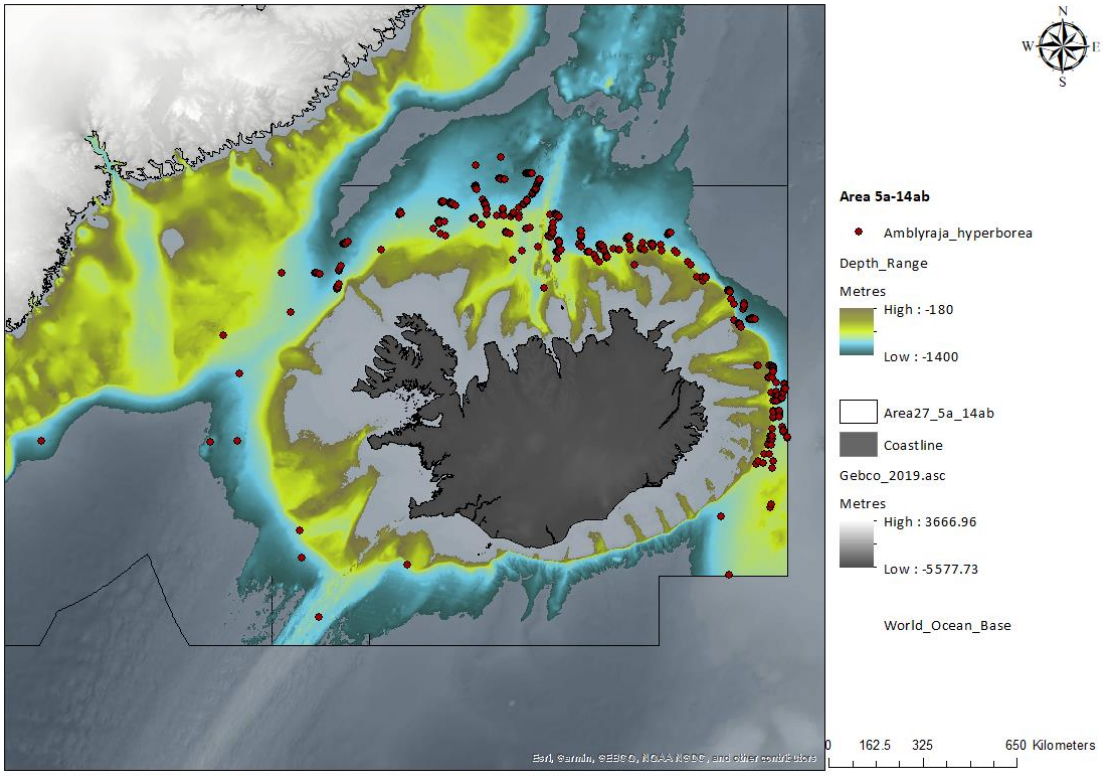

Figure 3.3.7. Recorded distribution of *Amblyraja hyperborea* in ICES divisions 27.5.a, 27.14.

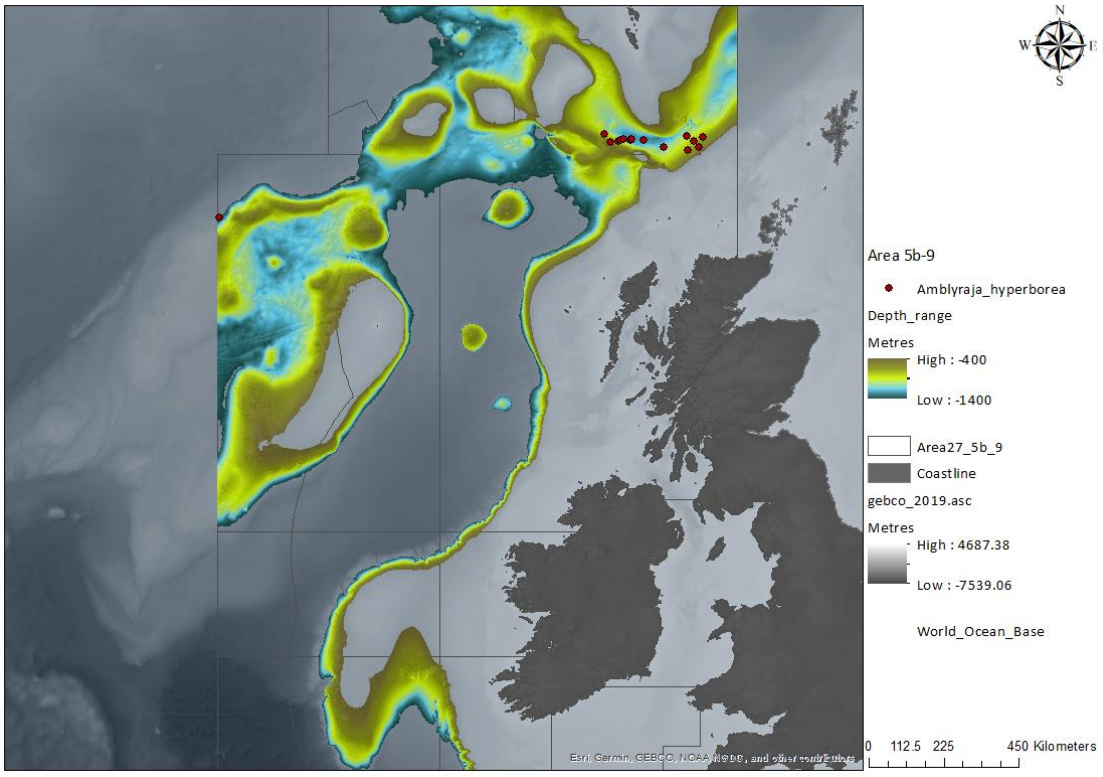

Figure 3.3.8. Recorded distribution of *Amblyraja hyperborea* in ICES divisions 27.5.b-27.9.

Apristurus laurssonii

There is a clear northern component to the distribution of this species, with only two records from ICES Division 27.8. Around Iceland, the species is distributed to the south of the country, with no records from the northern coast (Figures 3.3.9, 3.3.10.). Records are also available from the west coast of Ireland, west of Scotland, with none reported from the Porcupine area (Figure 3.3.11). In Biscay and Iberia, there are records south of Brittany, France.

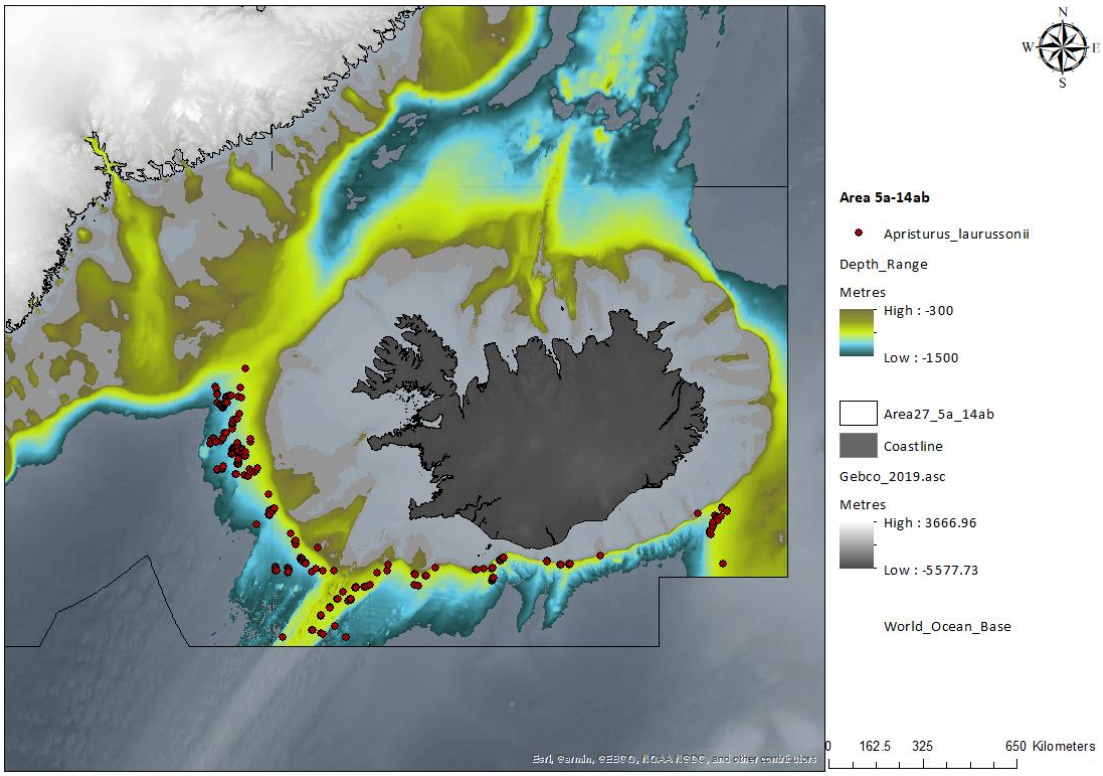

Figure 3.3.9. Recorded distribution of *Apristurus laurussoni* in ICES divisions 27.5.a, 27.14.

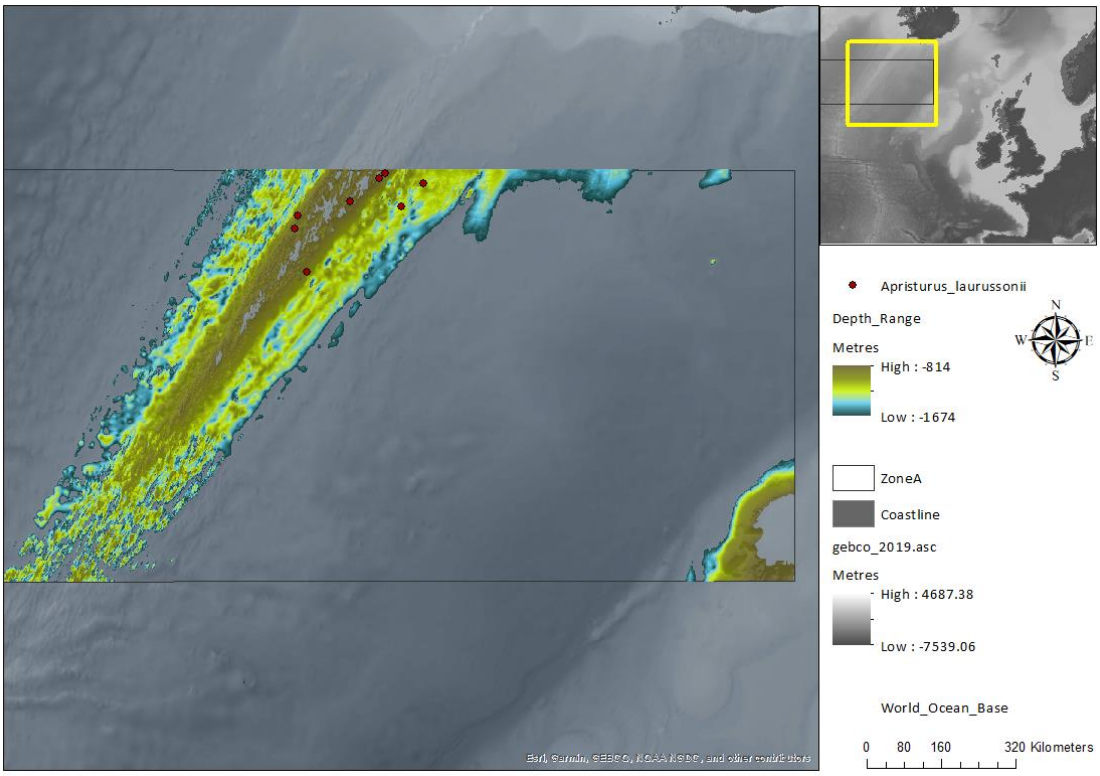

Figure 3.3.10. Recorded distribution of *Apristurus laurussoni* in ICES divisions 27.14.c.

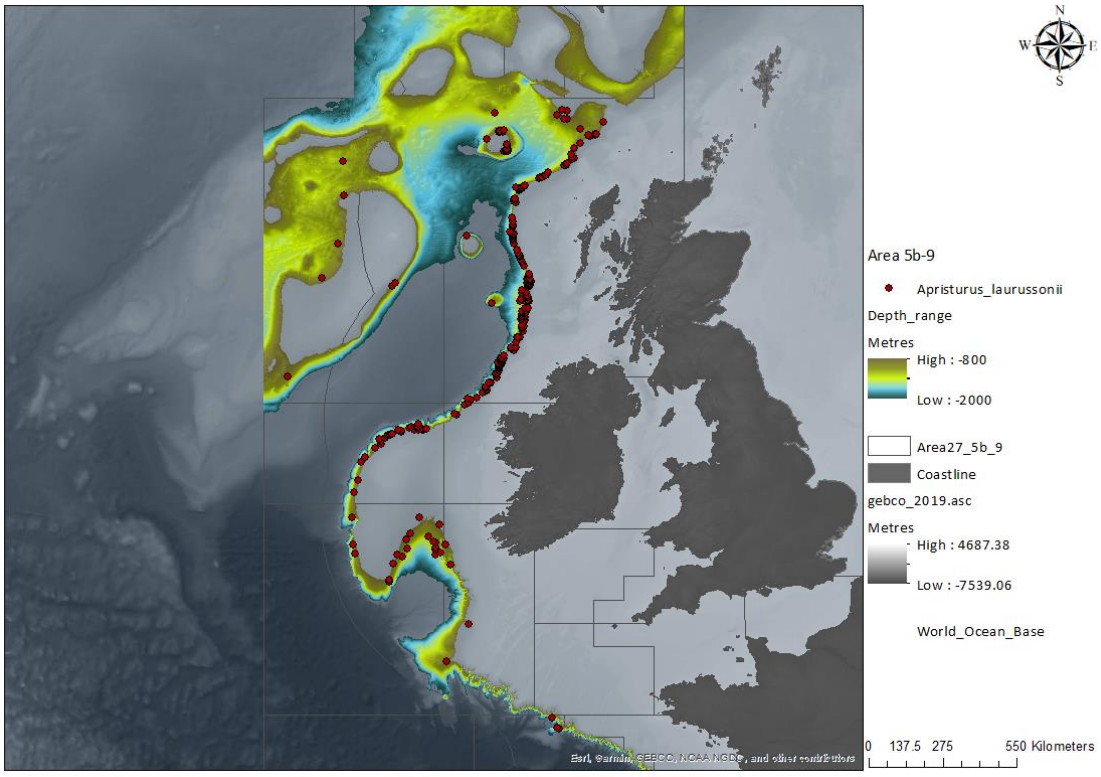

Figure 3.3.11. Recorded distribution of *Apristurus laurussoni* in ICES divisions 27.5.b-27.9.

Centrophorus squamosus

Records of *C. squamosus* are from south of Iceland (Figure 3.3.12) and on the continental slopes and offshore banks south of the Wyville Thompson Ridge (Figure 3.3.13). It is known to occur on the Mid-Atlantic Ridge south of Iceland (Figure 3.3.14) and north of the Azores (Hareide and Garnes, 2001), though survey data are not available for that area in this analysis.

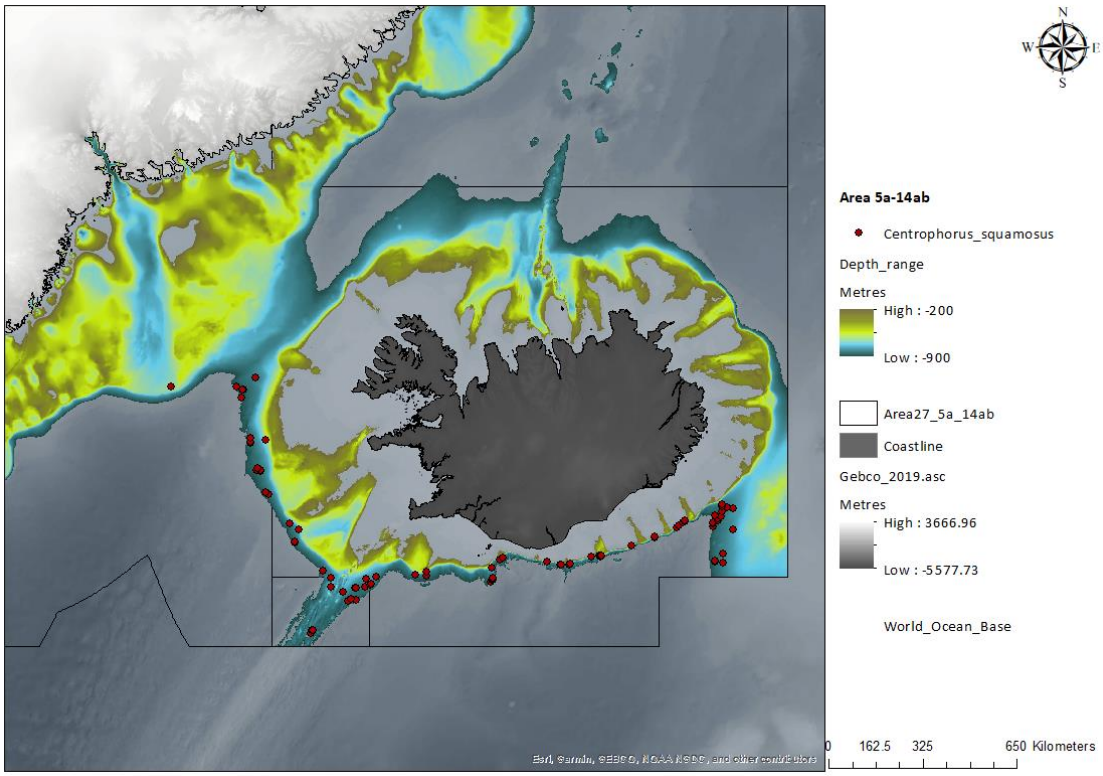

Figure 3.3.12. Recorded distribution of *Centrophorus squamosus* in ICES divisions 27.5.a, 27.14ab.

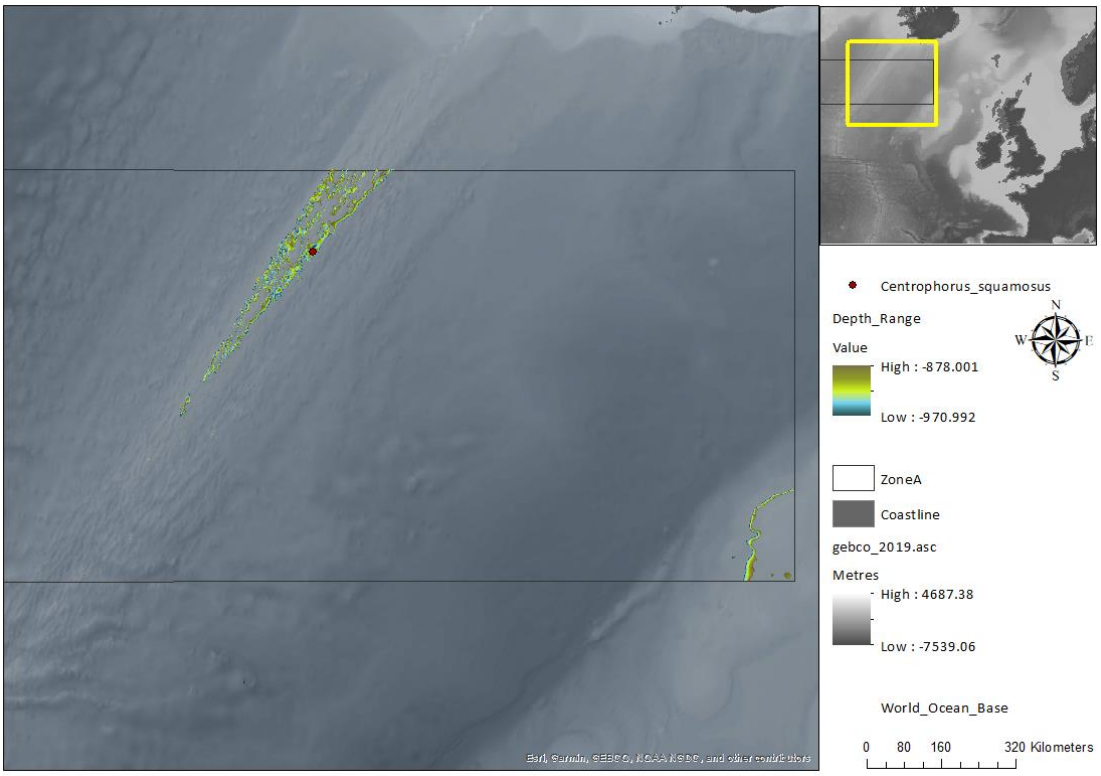

Figure 3.3.13 Recorded distribution of *Centrophorus squamosus* in ICES Division 27.12a.

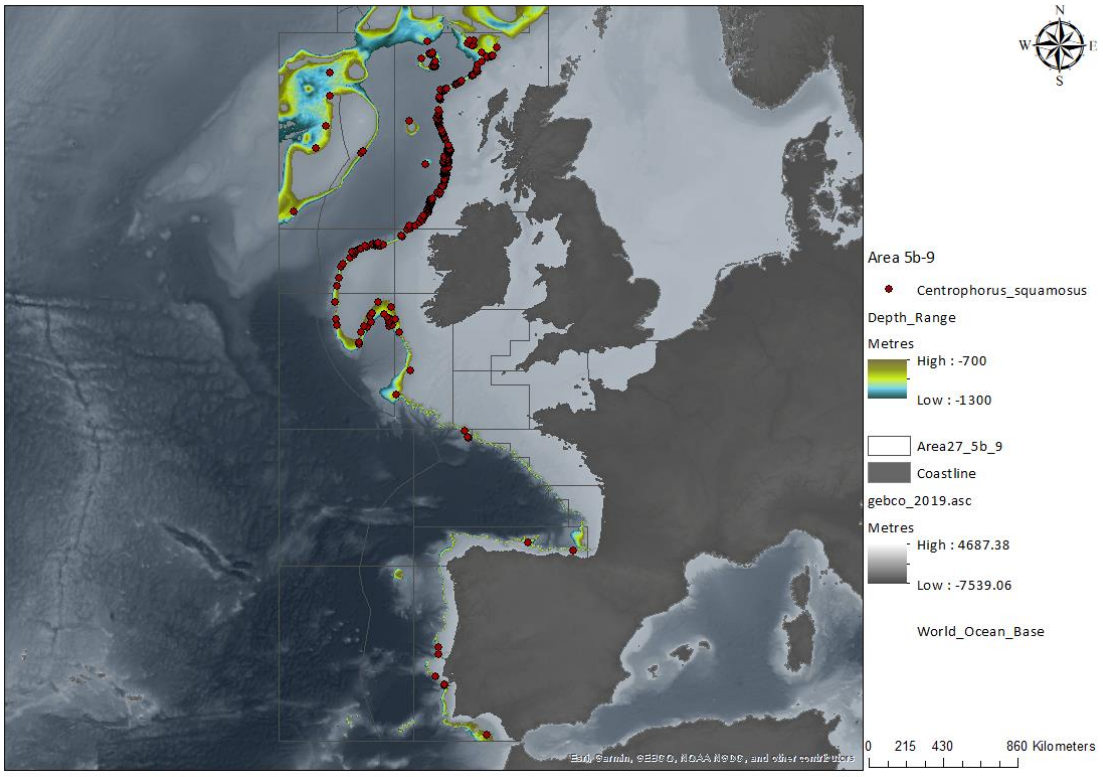

Figure 3.3.14. Recorded distribution of *Centrophorus squamosus* in ICES divisions 27.5.b-27.9.

Centroscyllium fabricii

There is a northern trend in the distribution of *C. fabricii*, distributed south and west of Iceland (Figure 3.3.15) and Reykjanes Ridge (Figure 3.3.16). In the eastern Atlantic there are no records south of the Porcupine Bank (Figure 3.3.17). Likewise, there are no reported records from the Mid-Atlantic Ridge.

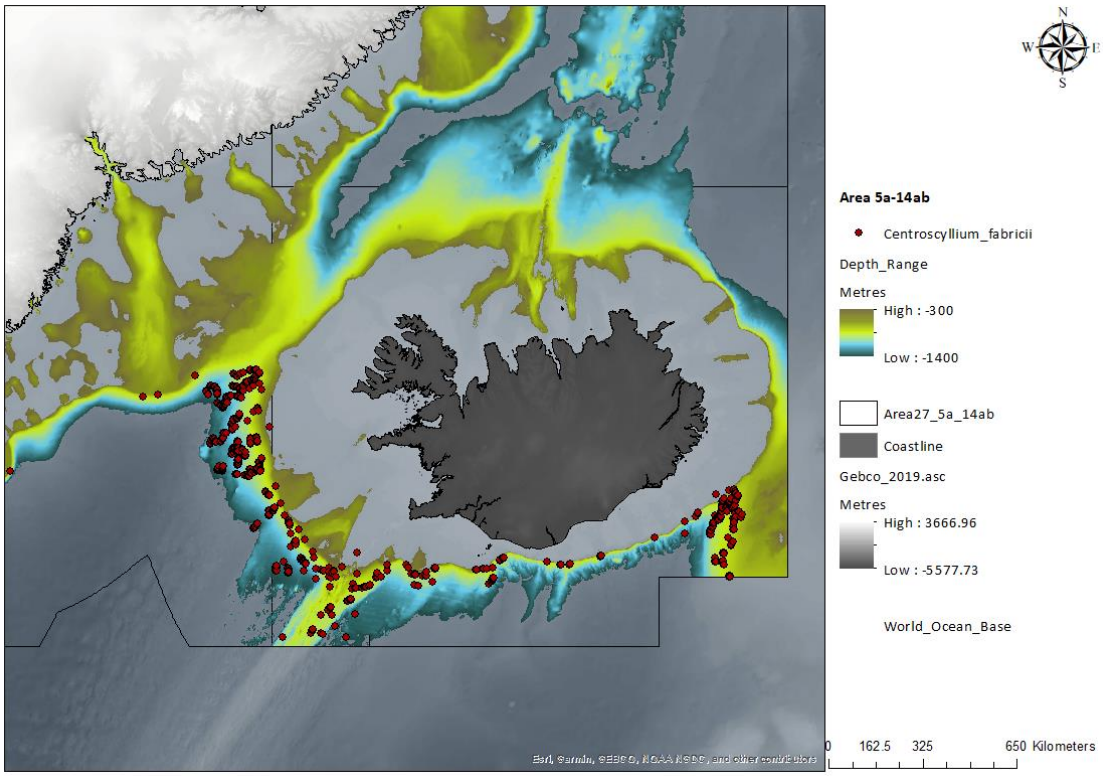

Figure 3.3.15. Recorded distribution of *Centroscyllium fabricii* in ICES divisions 27.5.a, 27.14ab.

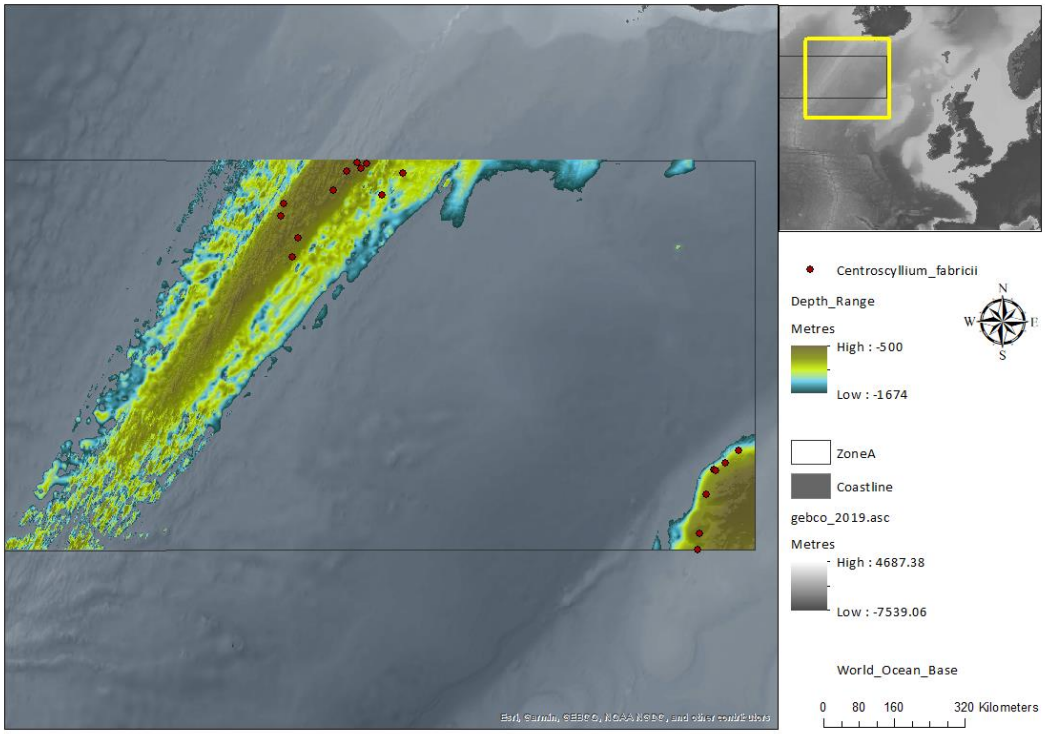

Figure 3.3.16. Recorded distribution of *Centroscyllium fabricii* in ICES Division 27.12a.

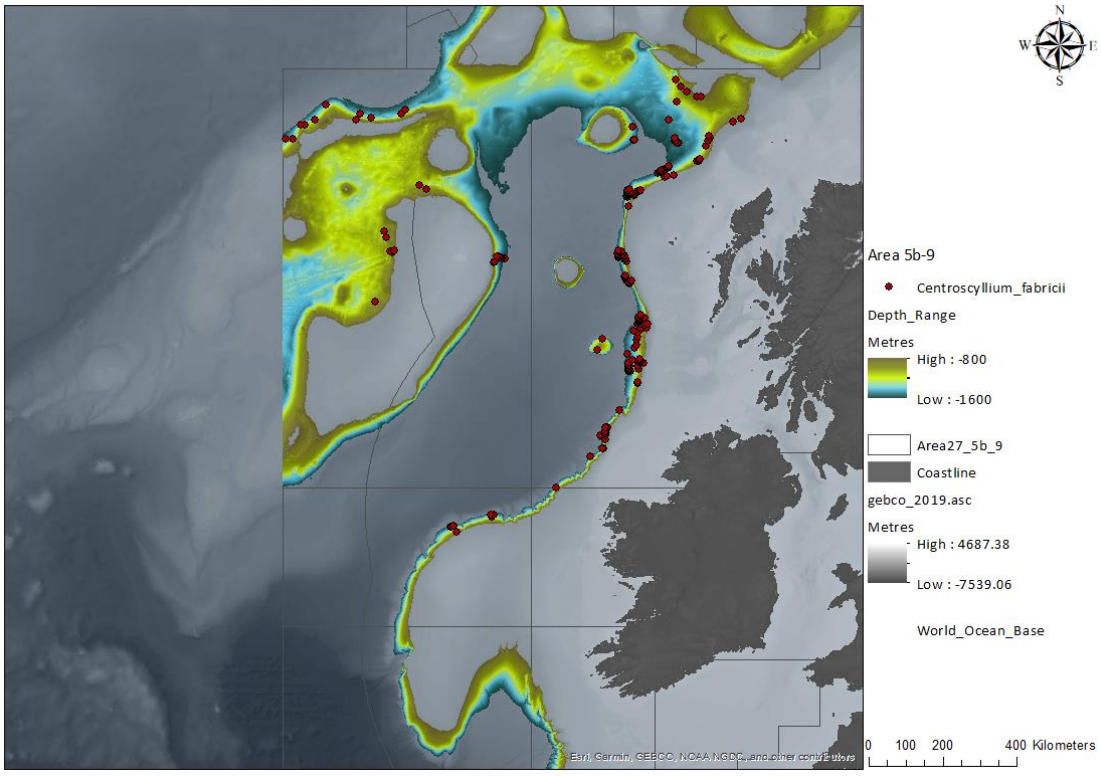

Figure 3.3.17. Recorded distribution of *Centroscyllium fabricii* in ICES divisions 27.5.b-27.7 (Divisions 27.8-9 not shown as no records).

Centroscymnus coelolepis

Centroscymnus coelolepis is found from south of Iceland to Portugal (Figures 3.3.18 – 3.3.21). It is only absent from the Norwegian coast. Most records of *C. coelolepis* are from the Northern part of its distribution. There are records from the north of Spain and the Portuguese coast. There are few records from the Bay of Biscay, but this is likely to represent survey effort.

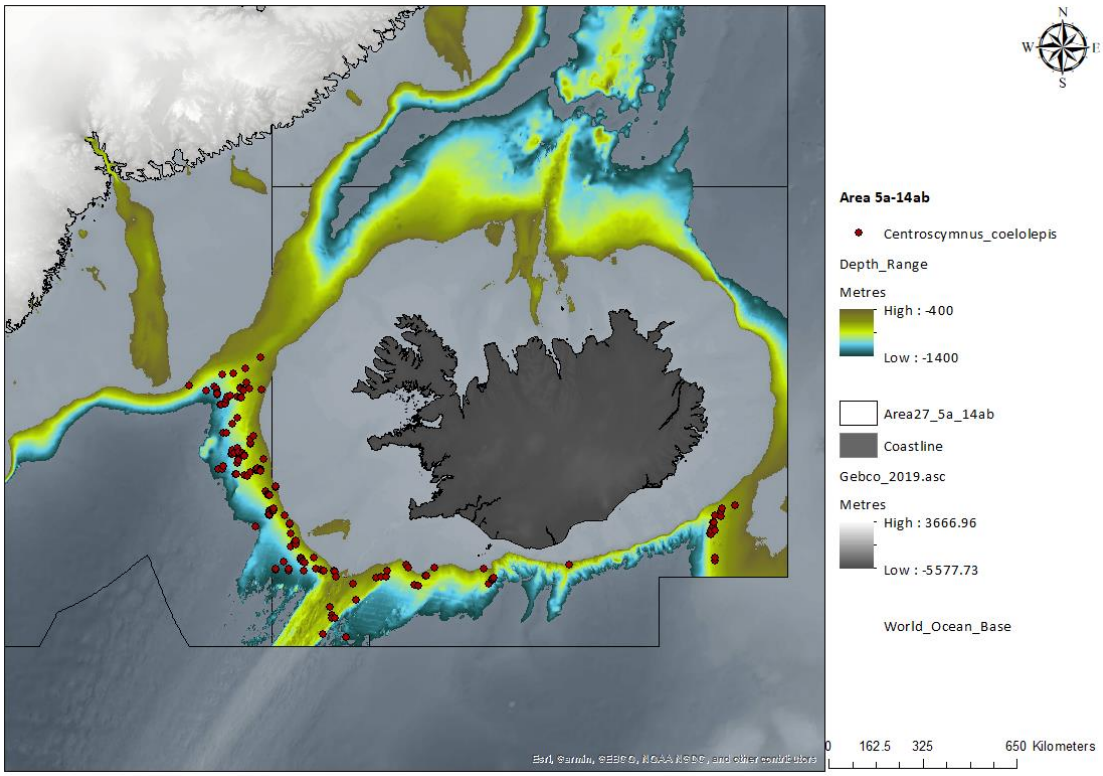

Figure 3.3.18. Recorded distribution of *Centroscymnus coelolepis* in ICES 27.5.a, 27.14.

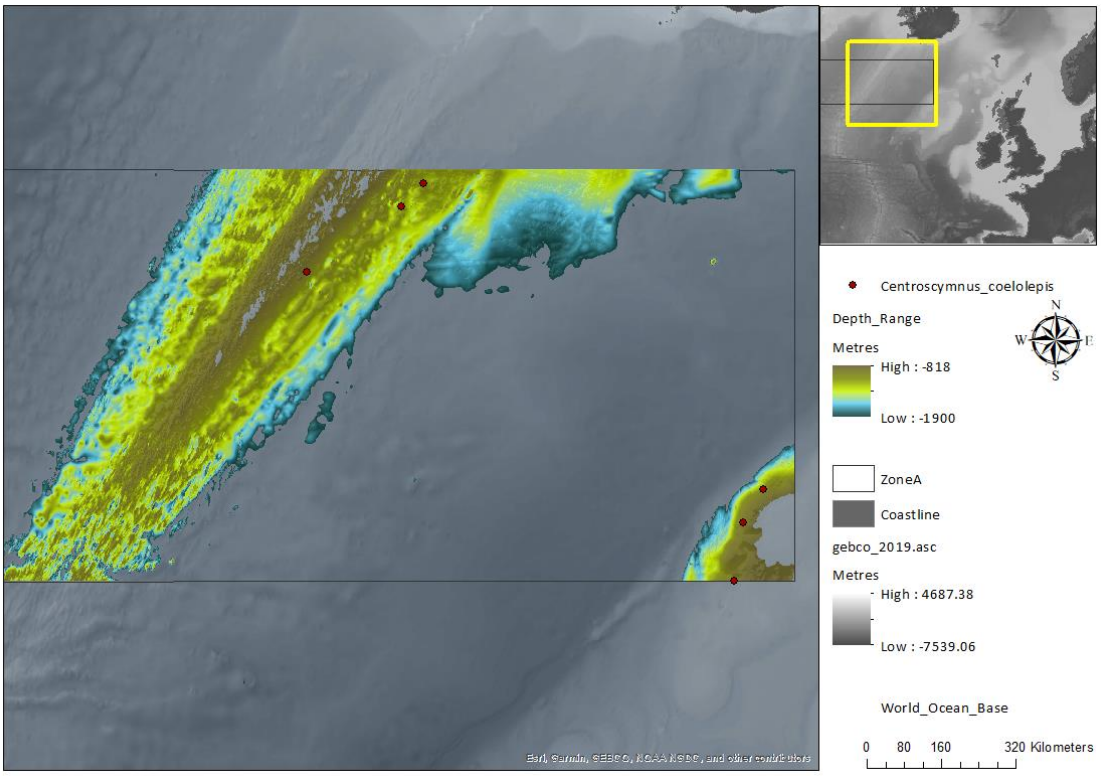

Figure 3.3.19. Recorded distribution of *Centroscymnus coelolepis* in ICES Division 27.12a.

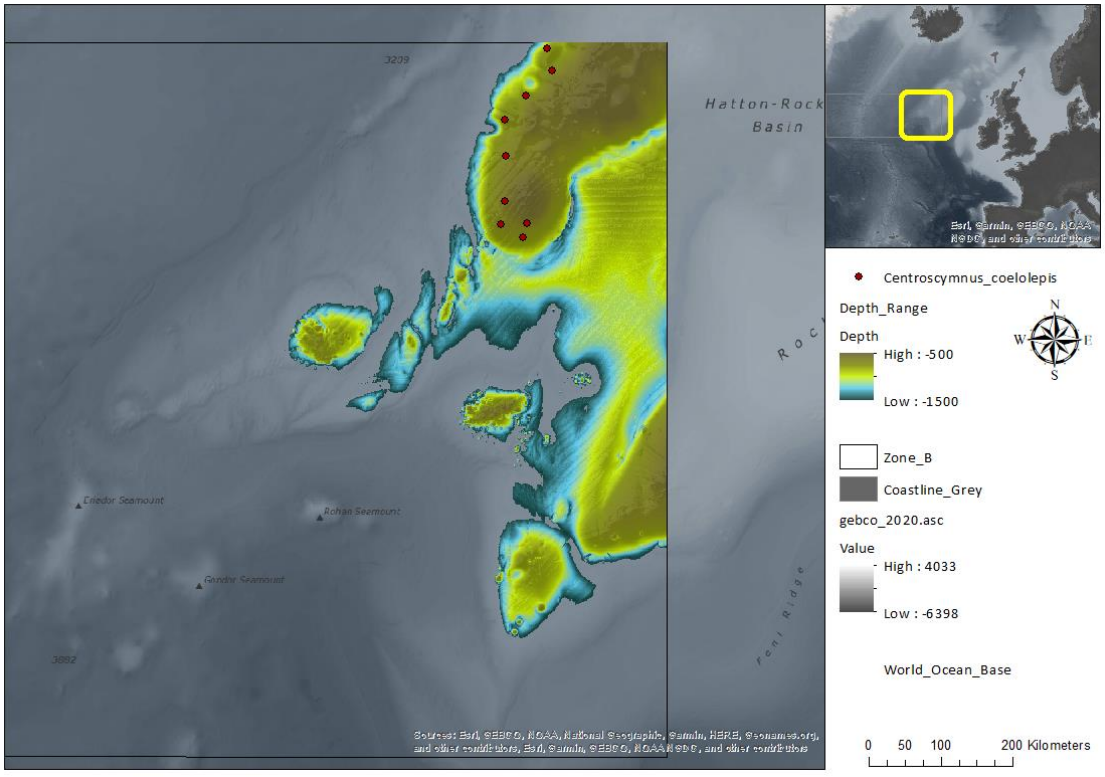

Figure 3.3.20. Recorded distribution of *Centroscymnus coelolepis* in ICES Division 27.6b.

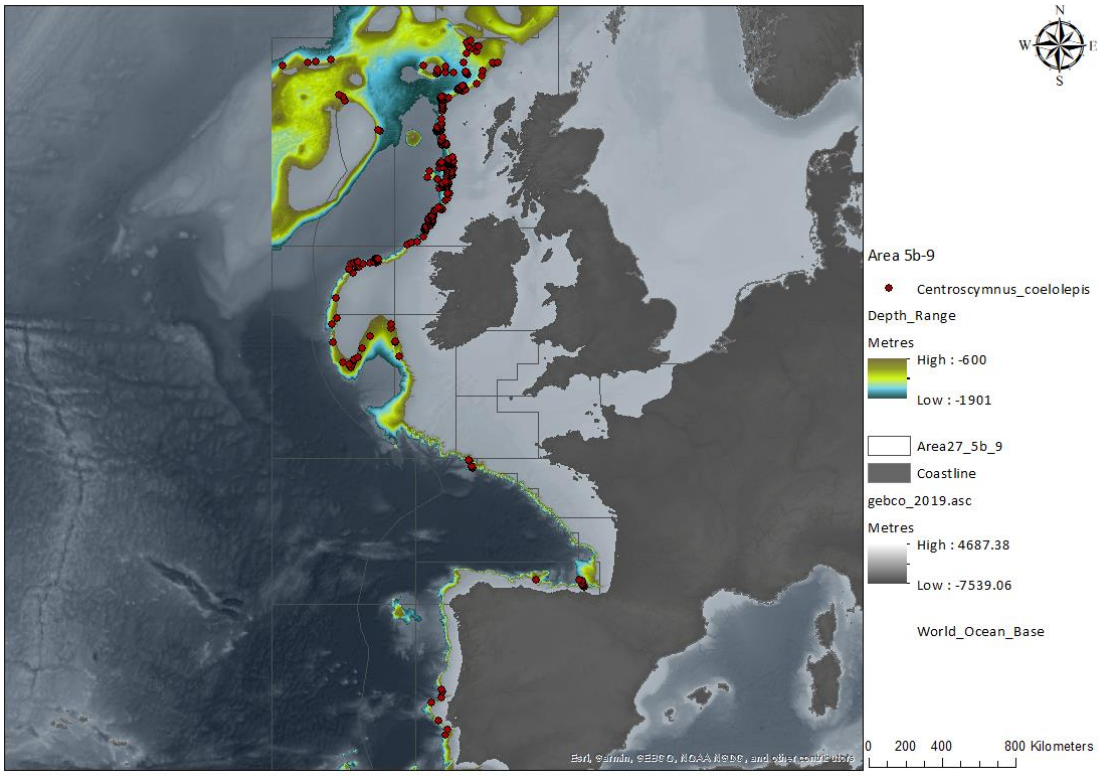

Figure 3.3.21. Recorded distribution of *Centroscymnus coelolepis* in ICES divisions 27.5.b-27.9.

Centroscymnus crepidater

Centroscymnus crepidater is a widespread species, with records from a variety of depths. Around Iceland, (Figure 3.3.22, Figure 3.3.23), it is mainly found to west and south of the country. To the west of Ireland (Figure 3.2.24), it is not just found along the shelf edge, but in deeper waters as well.

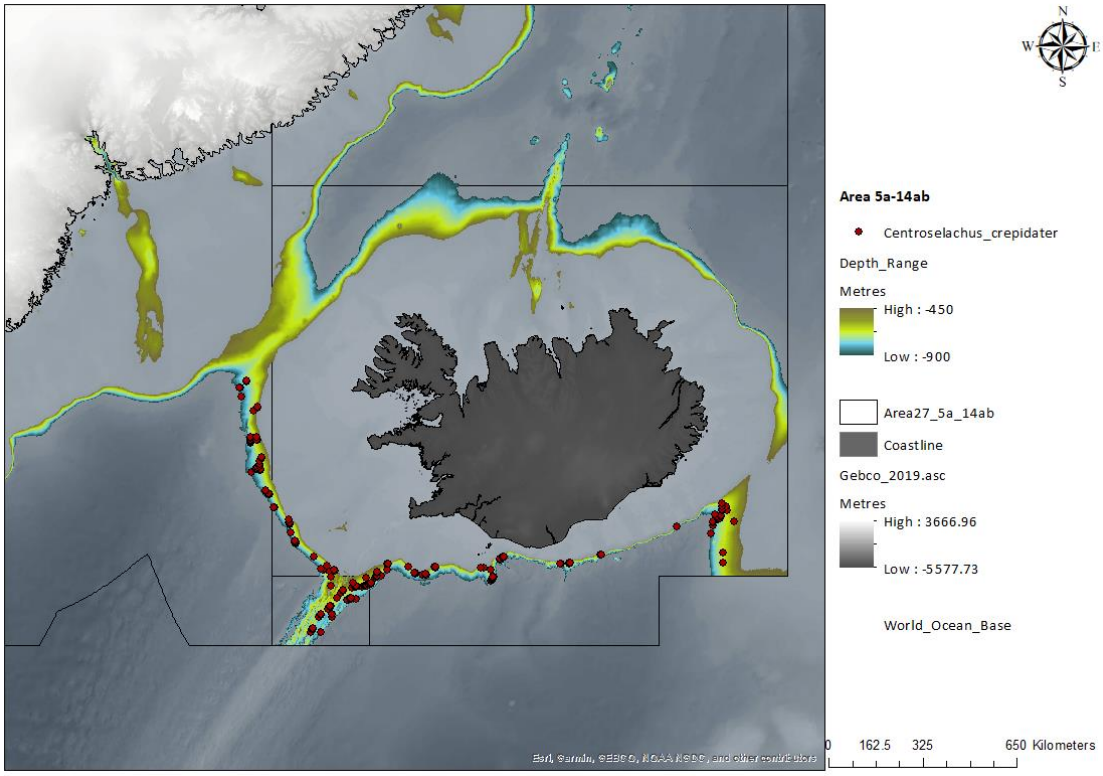

Figure 3.3.22. Recorded distribution of *Centroscymnus crepidater* in ICES divisions 27.5.a, 27.14ab.

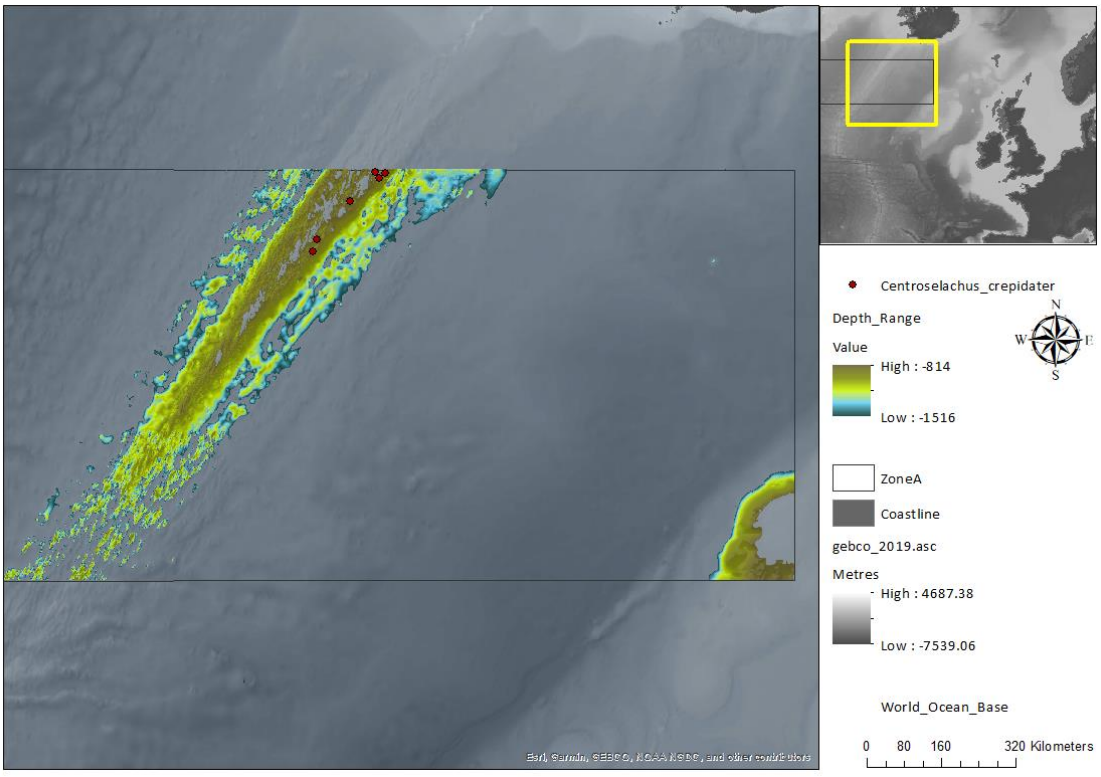

Figure 3.3.23. Recorded distribution of *Centroscymnus crepidater* in ICES Division 27.12a.

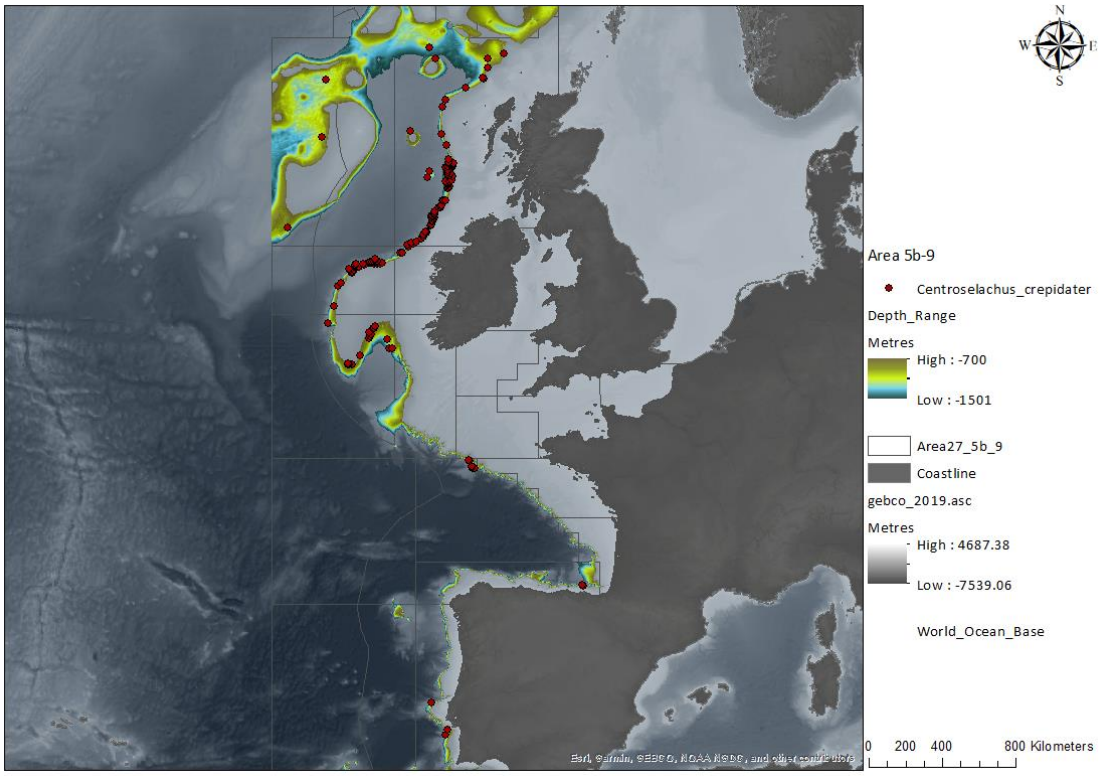

Figure 3.3.24. Recorded distribution of *Centroscymnus crepidater* in ICES divisions 27.5.b-27.9.

Chimaera monstrosa

Chimaera monstrosa is the most abundant of the chimaerids in European waters. It is distributed throughout the sampled range, with the exception of the north of Iceland (Figure 3.3.25) and Svalbard (Figure 3.3.26-27). Abundance hotspots appear to be around the Porcupine sea-bight and the Algarve coast of Portugal (Figure 3.3.28). There is also a hotspot in the deep-water in the Skaggerak and to the south of Norway. It should be noted that *Chimaera opalescens* was only recently described (Moura *et al.*, 2005). Records of *C. monstrosa* prior to this may also include *C. opalescens.*

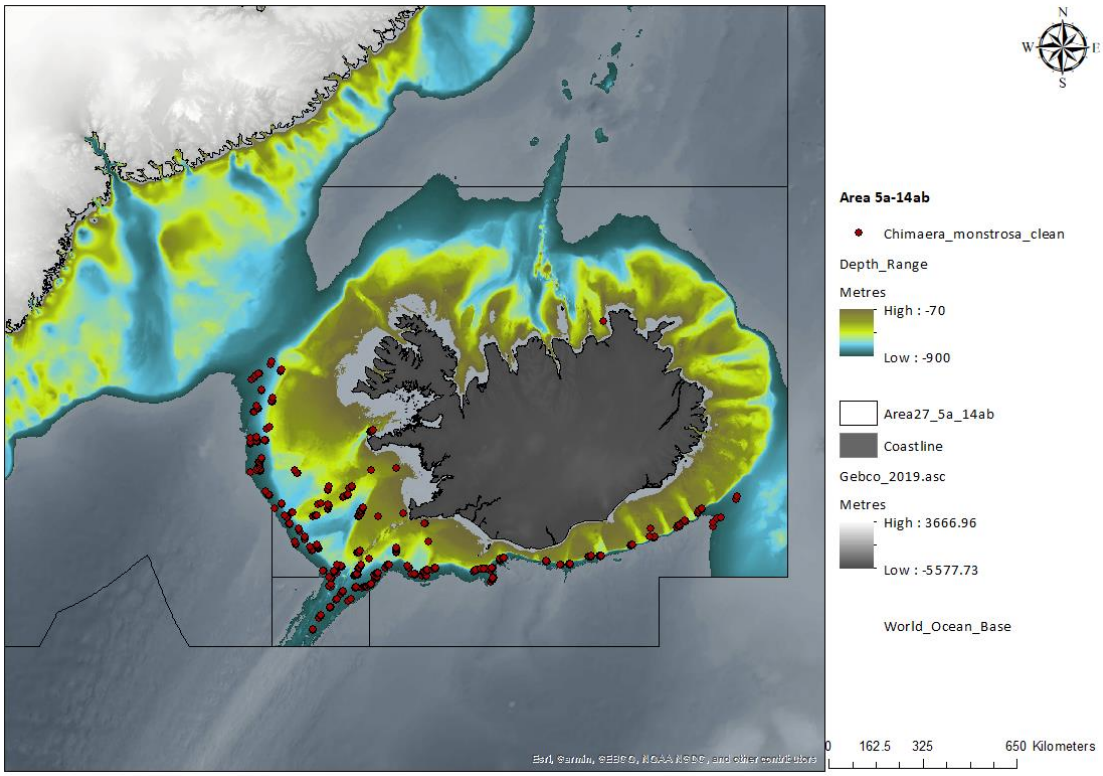

Figure 3.3.25. Recorded distribution of *Chimaera monstrosa* in ICES divisions 27.5.a, 27.14ab.

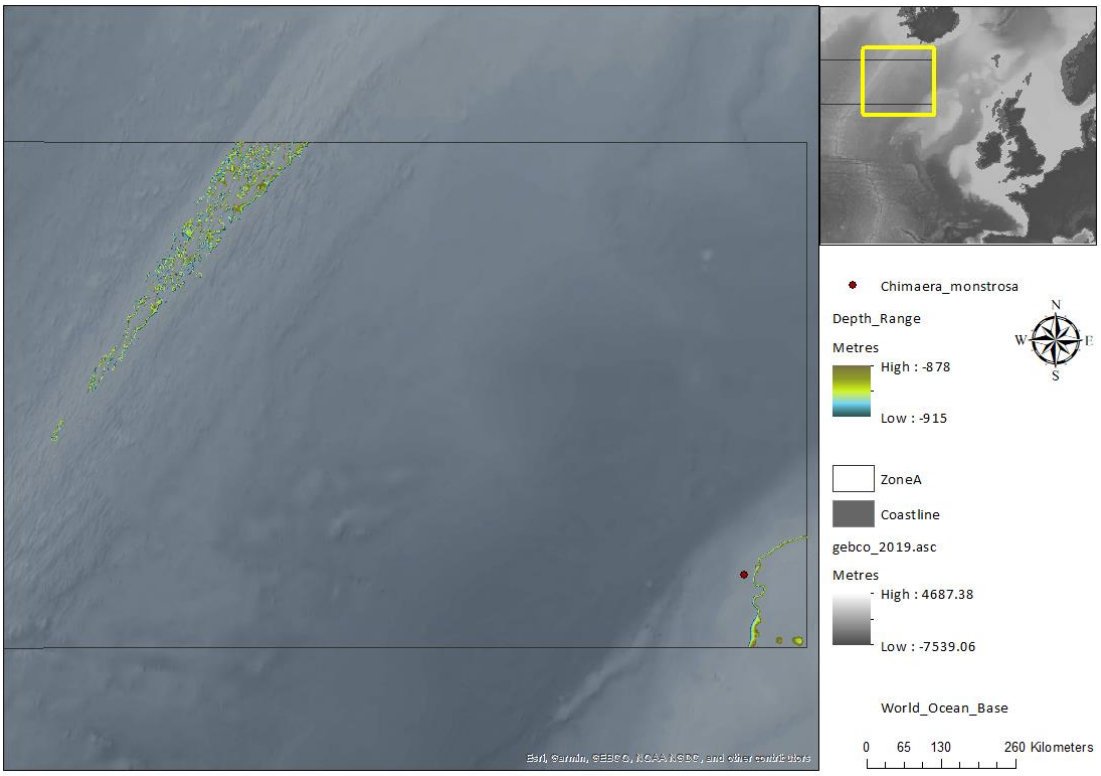

Figure 3.3.26. Recorded distribution of *Chimaera monstrosa* in ICES Division 27.12a.

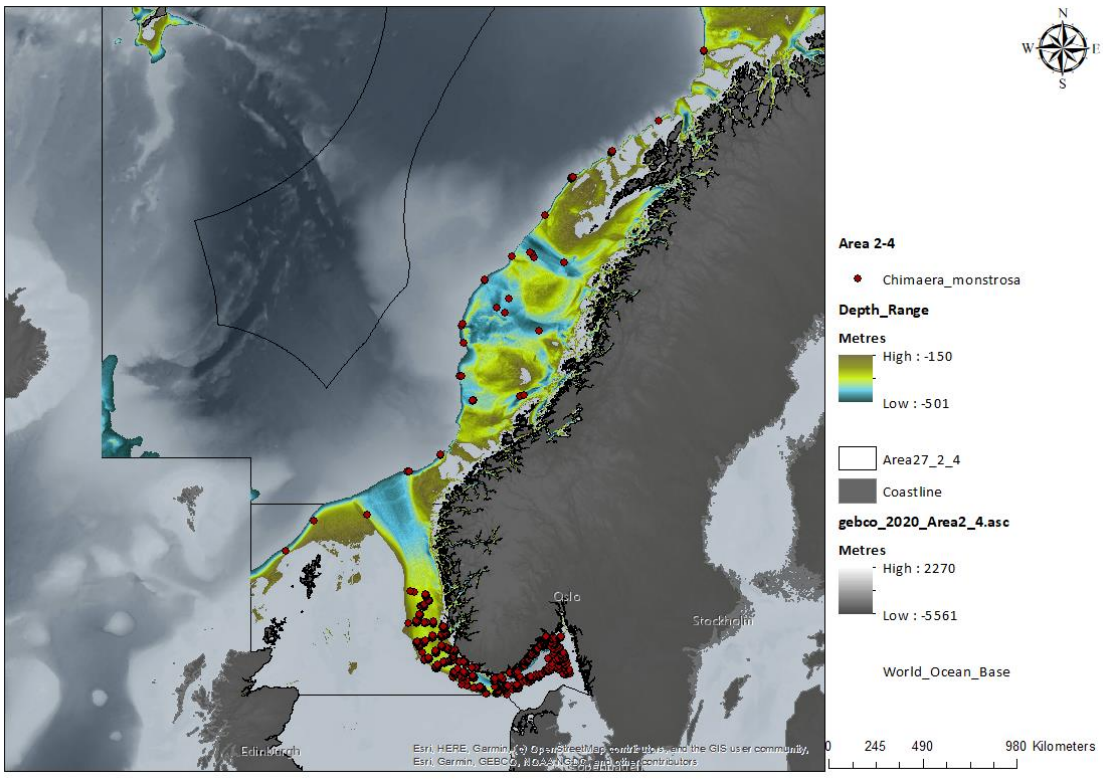

Figure 3.3.27. Recorded distribution of *Chimaera monstrosa* in ICES divisions 27.2-27.4.

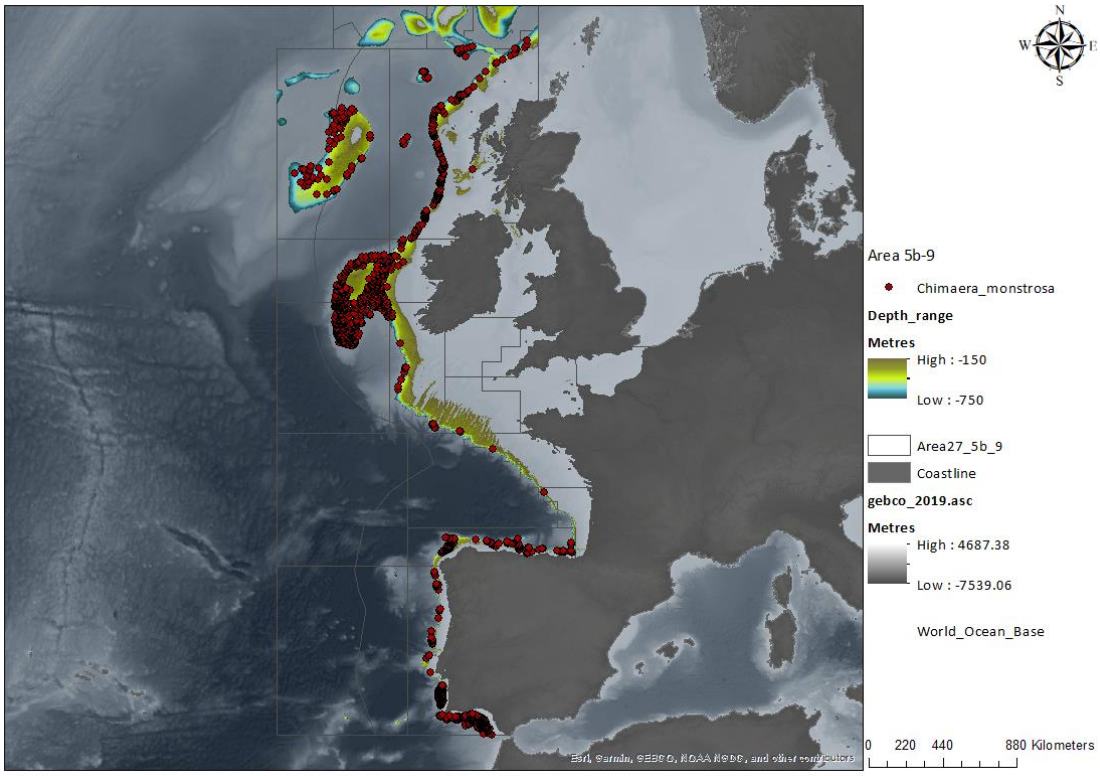

Figure 3.3.28. Recorded distribution of *Chimaera monstrosa* in ICES divisions 27.5.b-27.9.

Chlamydoselachus anguineas

There are only two records of *C. anguineus* reported from ICES divisions 27.5.b-27.9, and none from any other area (Figure 3.2.28). This is an un-abundant species.

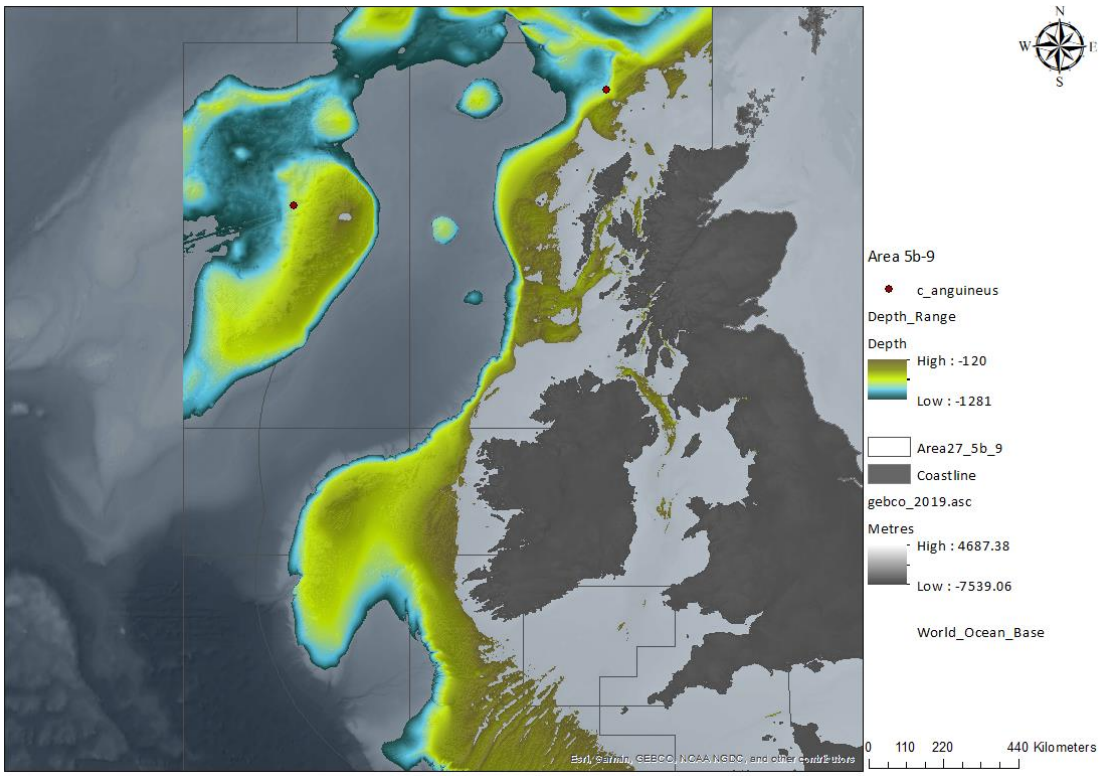

Figure 3.3.28. Recorded distribution of *Chlamydoselachus anguineas* in ICES divisions 27.5.b-27.7. Divisions 27.8-9 not illustrated as no records).

Dalatias licha

Dalatias licha is distributed throughout the sampled range in 27.5b-27.9. It has not been reported from Iceland or Norway. Records are available from around the Porcupine sea-bight and the Algarve coast of Portugal (Figure 3.3.29).

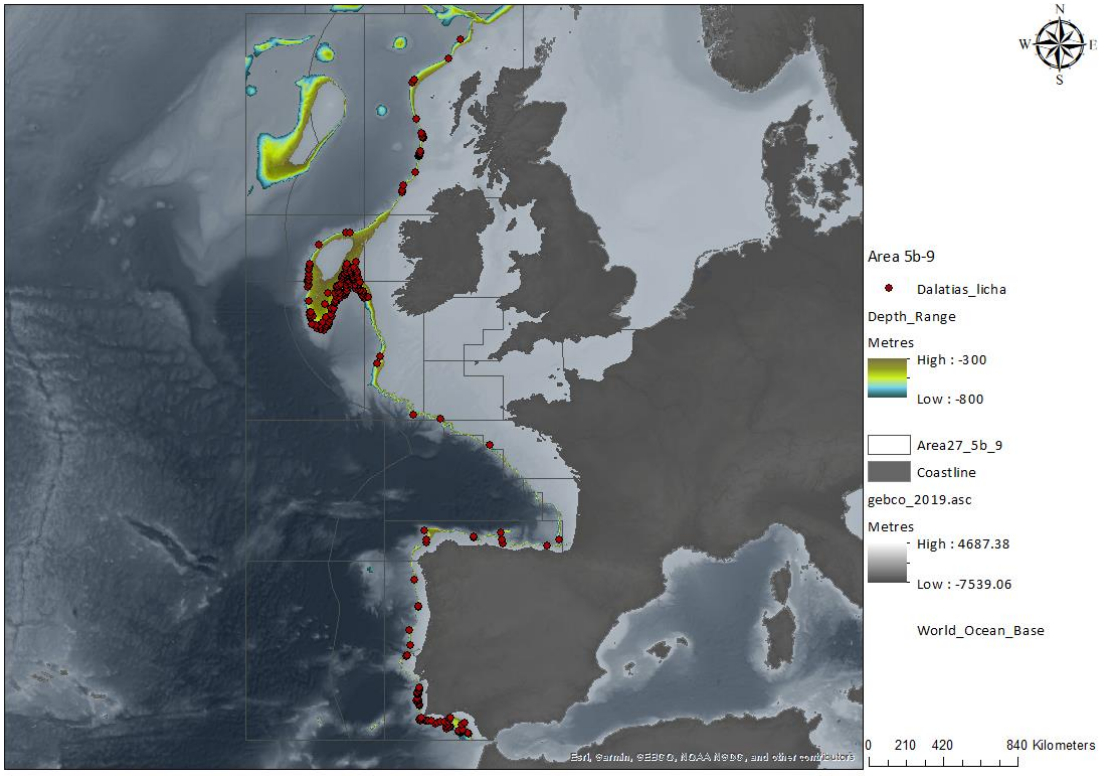

Figure 3.3.29. Recorded distribution of *Dalatias licha* in ICES divisions 27.5.b-27.9.

Deania calcea

Deania calcea is one of the most abundant deep-water shark species. It is distributed from the south coast of Iceland (Figures 3.3.30, 3.3.31), to the Portuguese coast (Figure 3.3.32), mainly following depth ranges of 500–900 m.

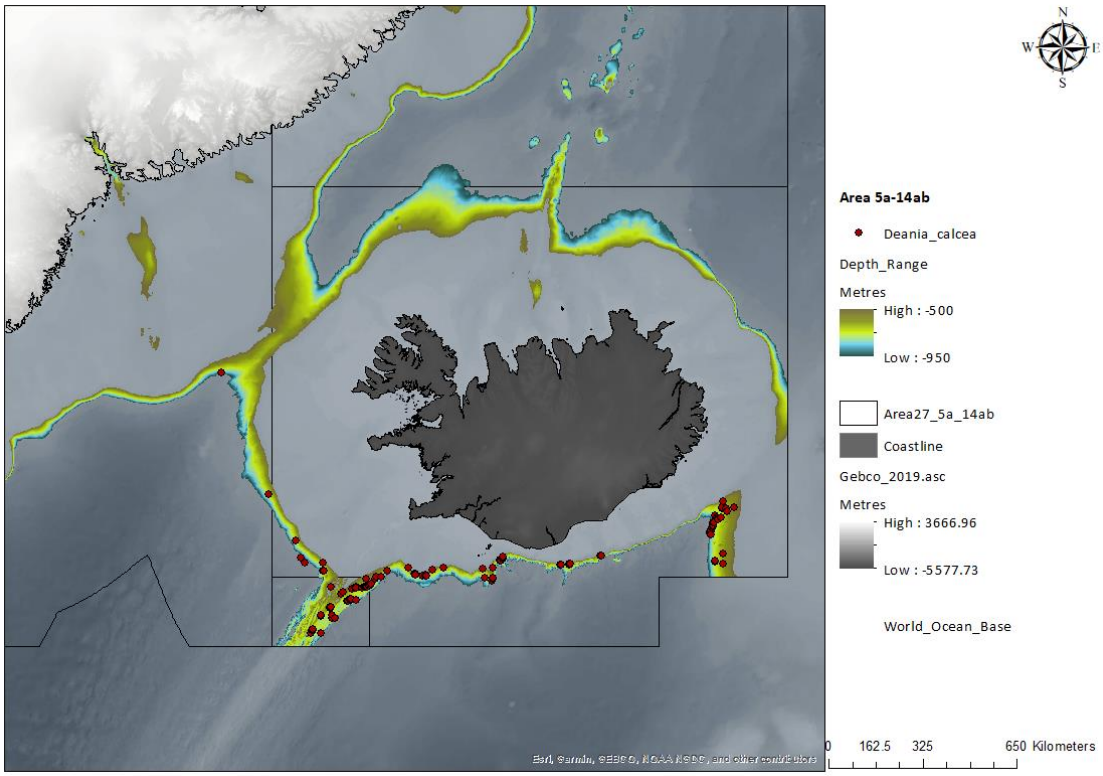

Figure 3.3.30. Recorded distribution of *Deania calcea* in ICES divisions 27.5, 27.14.

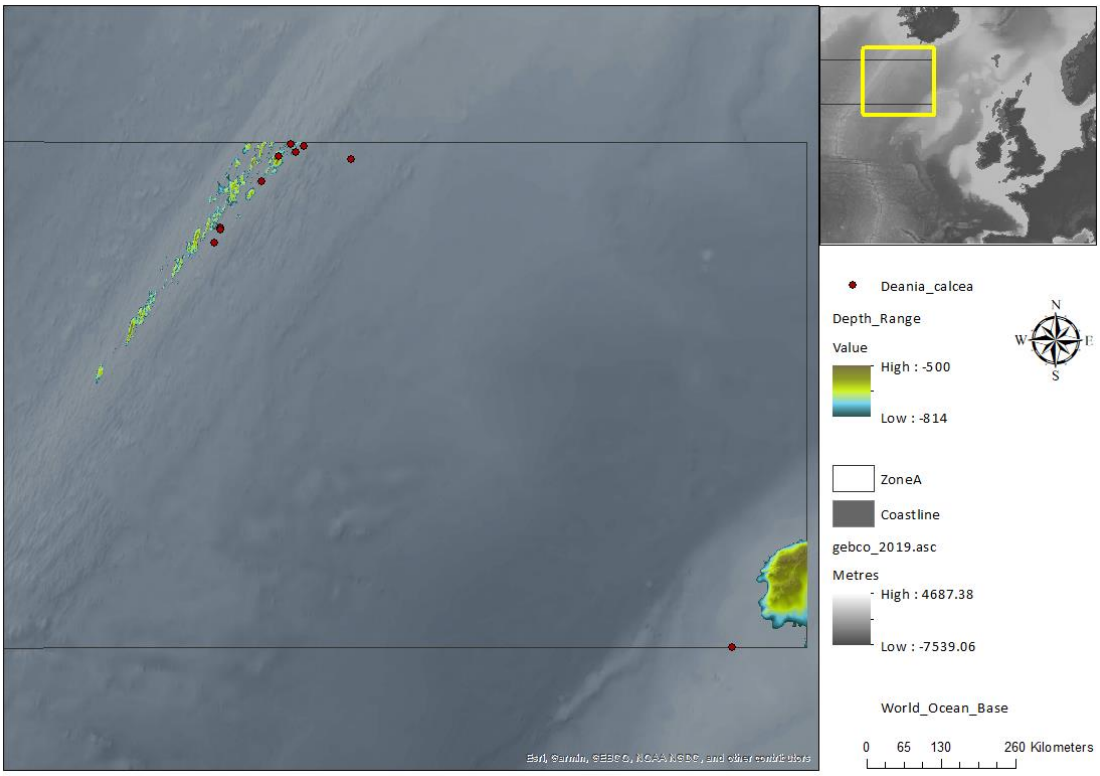

Figure 3.3.31. Recorded distribution of *Deania calcea* in ICES Division 27.12a.

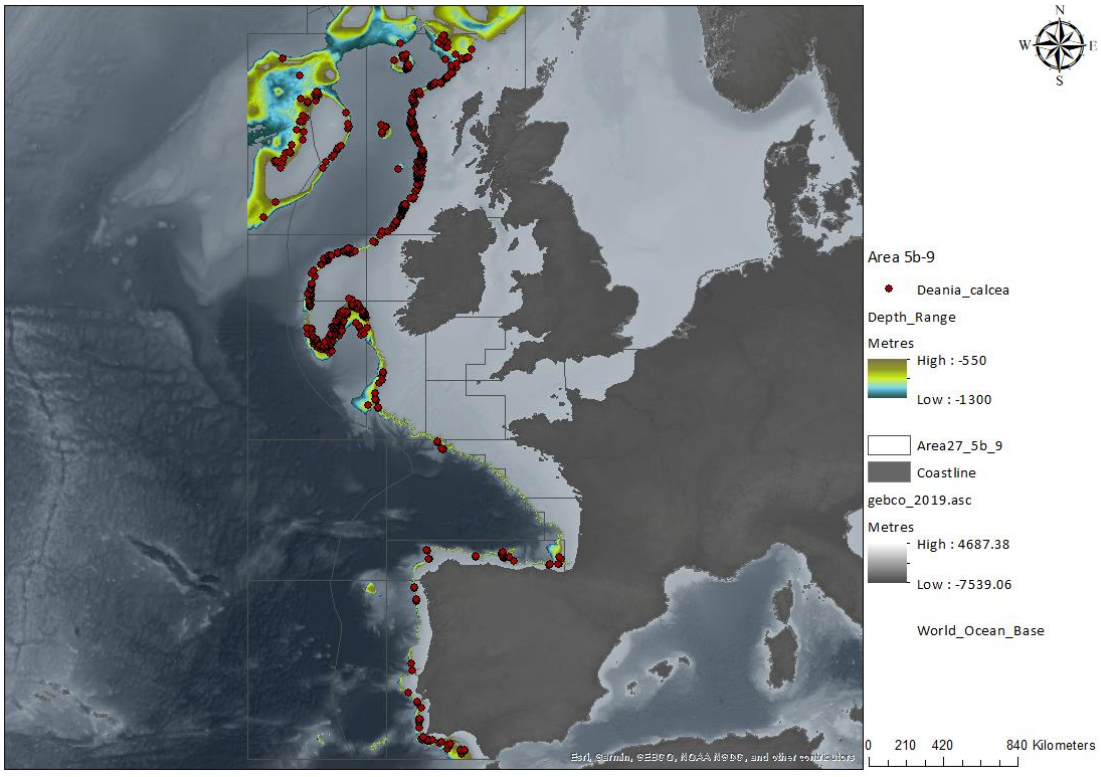

Figure 3.3.32. Recorded distribution of *Deania calcea* in ICES divisions 27.5.b-27.9.

Dipturus nidarosiensis

Dipturus nidarosiensis is only occasionally encountered in surveys. Records are primarily from the Porcupine sea-bight and the Rockall bank (Figure 3.3.33). There are a small number of records from Biscay and Iberia. Misidentification with *D. intermedius, D. batis* or *D. oxyrhinchus* may occur.

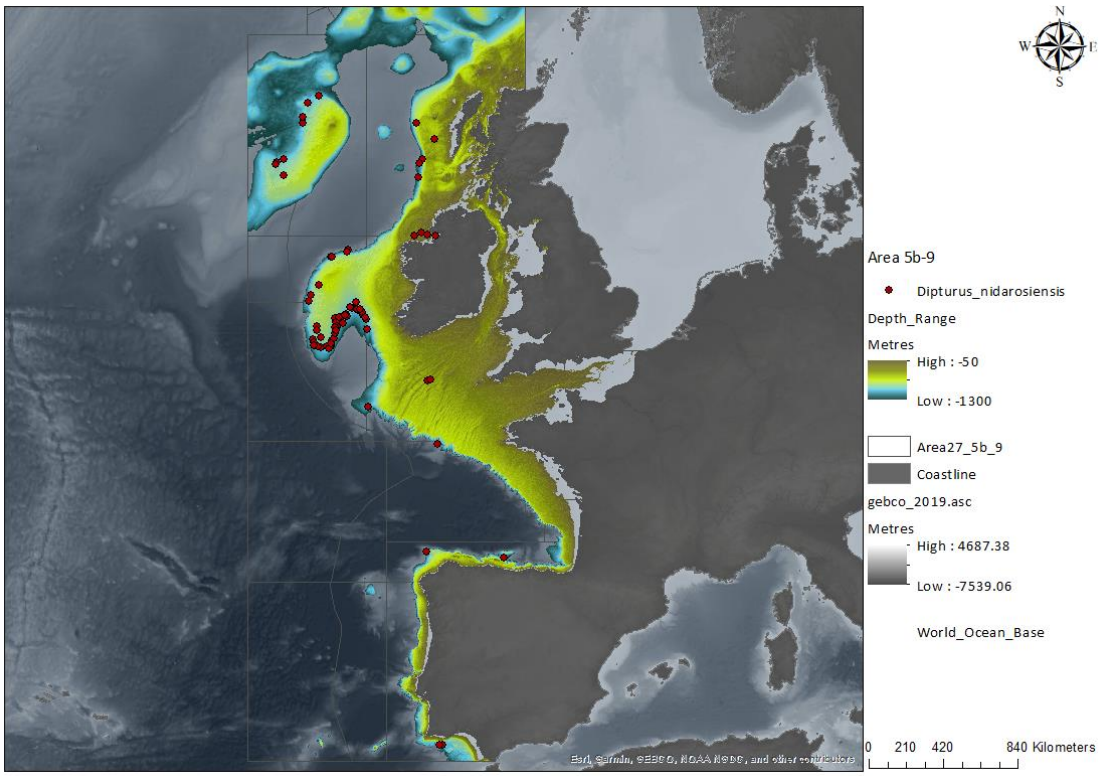

Figure 3.3.33. Recorded distribution of *Dipturus nidarosiensis* in ICES divisions 27.5.b-27.9.

Etmopterus princeps

Etmopterus princeps is the less common of the two Etmopteridae encountered in surveys. It is found throughout the ICES area, although with a northern bias. It is found throughout the southern coast of Iceland (Figures 3.3.34–3.3.35). From there, its distribution continues along the Rockall bank (Figure 3.3.36) and western shelf edge. There are few records from Biscay and Iberia (Figure 3.3.37)

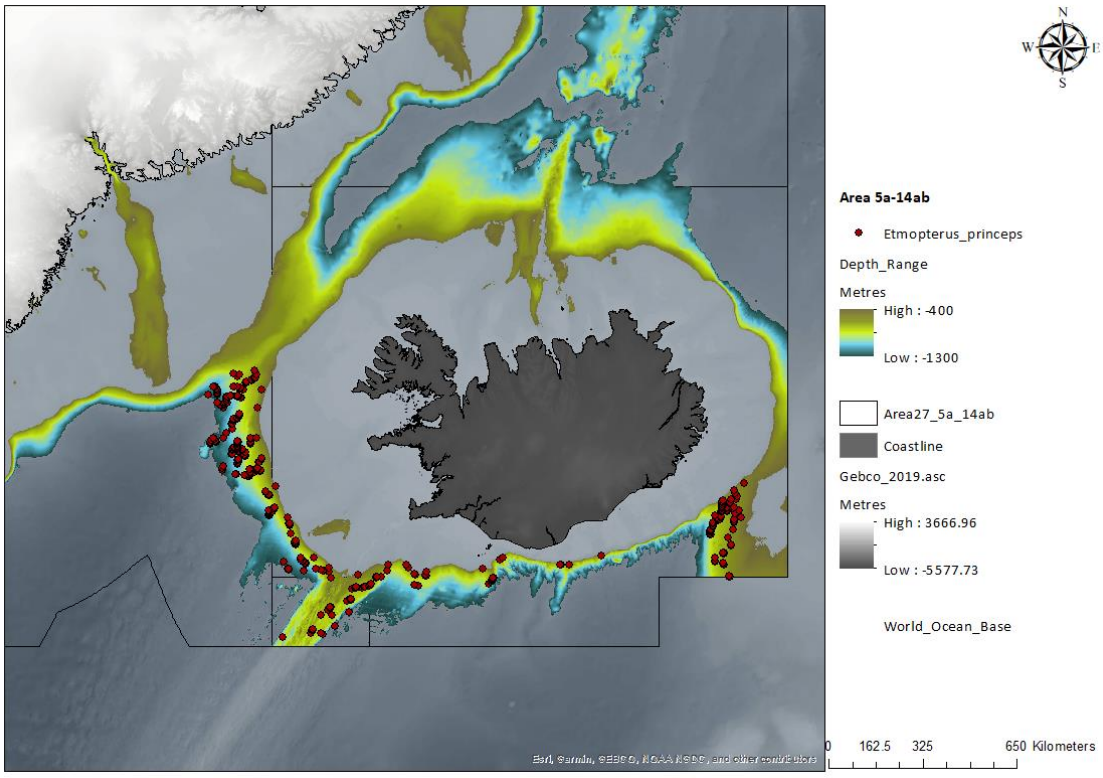

Figure 3.3.34. Recorded distribution of *Etmopterus princeps* in ICES divisions 27.5.a, 27.14ab.

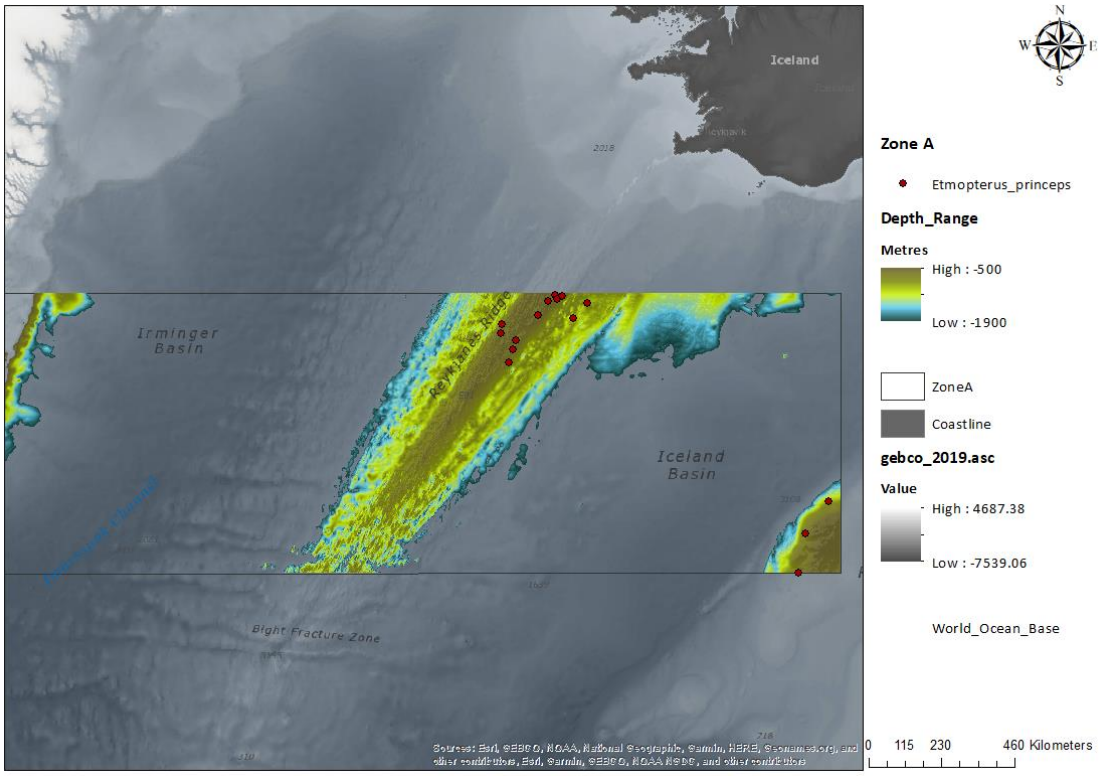

Figure 3.3.35. Recorded distribution of *Etmopterus princeps* in ICES divisions 27.5 and 27.14c.

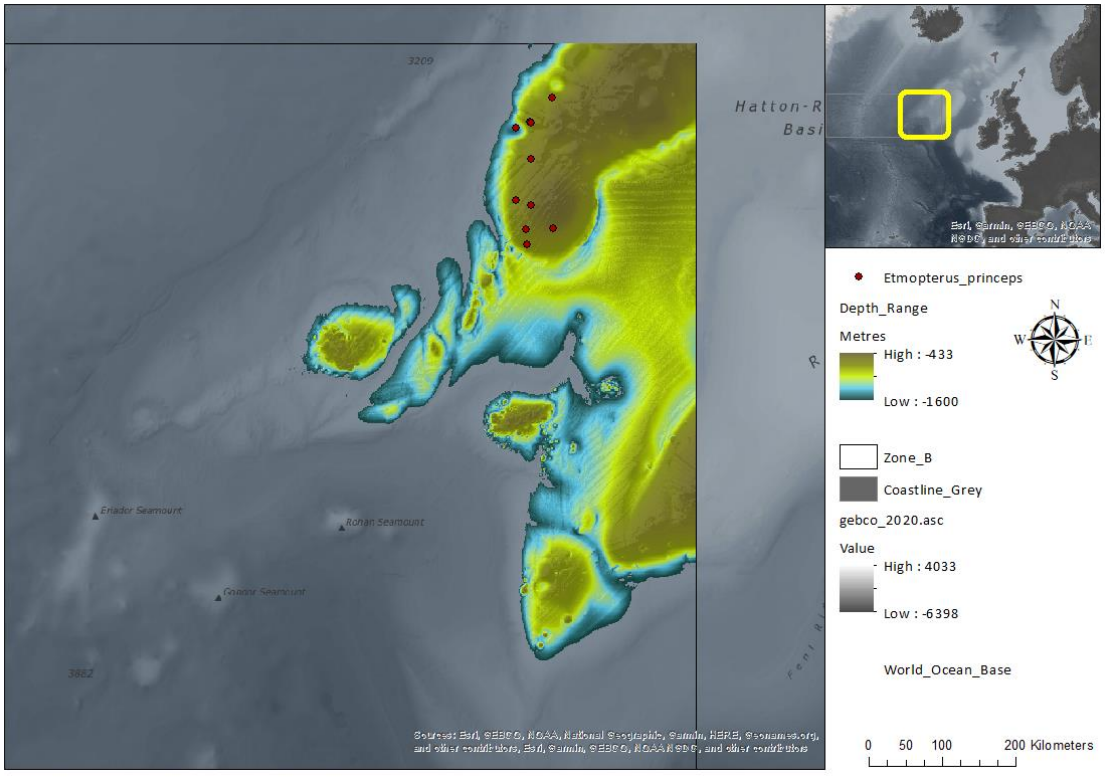

Figure 3.3.36 Recorded distribution of *Etmopterus princeps* in ICES divisions 27.12 (Mid-Atlantic Ridge).

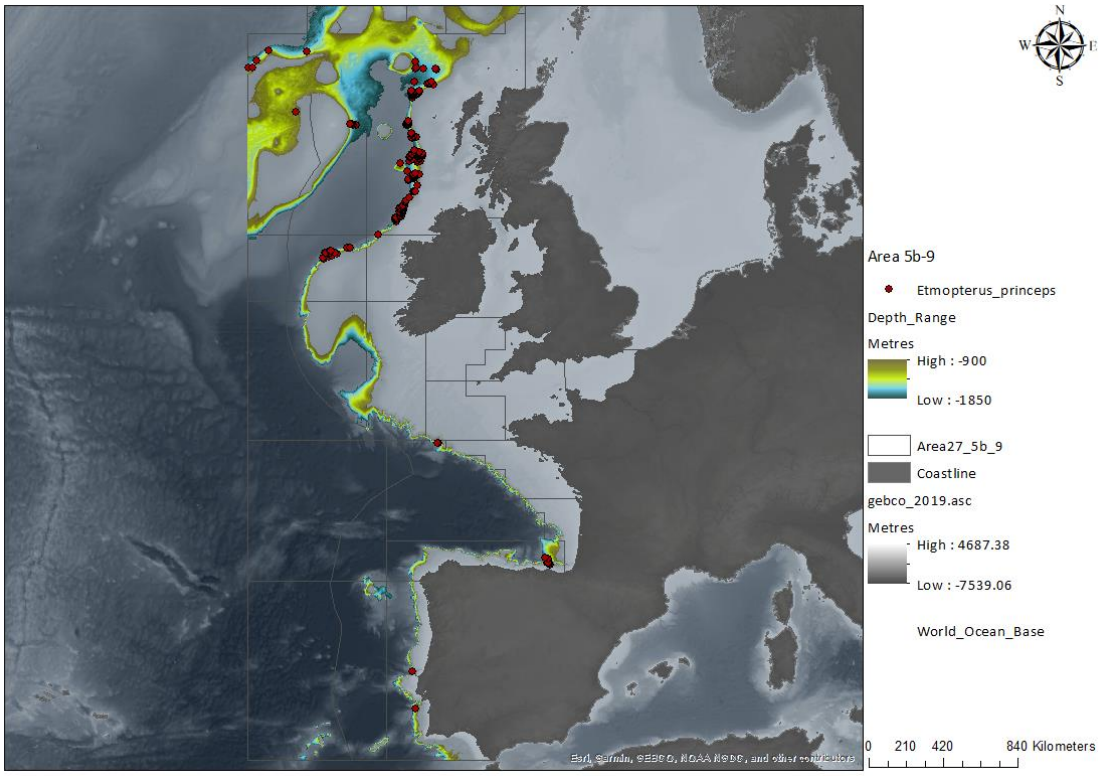

Figure 3.3.37. Recorded distribution of *Etmopterus princeps* in ICES divisions 27.5b-27.9.

Etmopterus pusillus

Etmopterus pusillus was not recorded in any of the submitted surveys.

Etmopterus spinax

Etmopterus spinax is the more common of the two Etmopteridae encountered in surveys. It is found throughout the ICES area. The main areas are around the southern Icelandic coast (Figure 3.3.38), the southern coast of Norway (Figure 3.3.39), the Porcupine sea-bight, and the Algarve coast of Portugal (Figure 3.3.40).

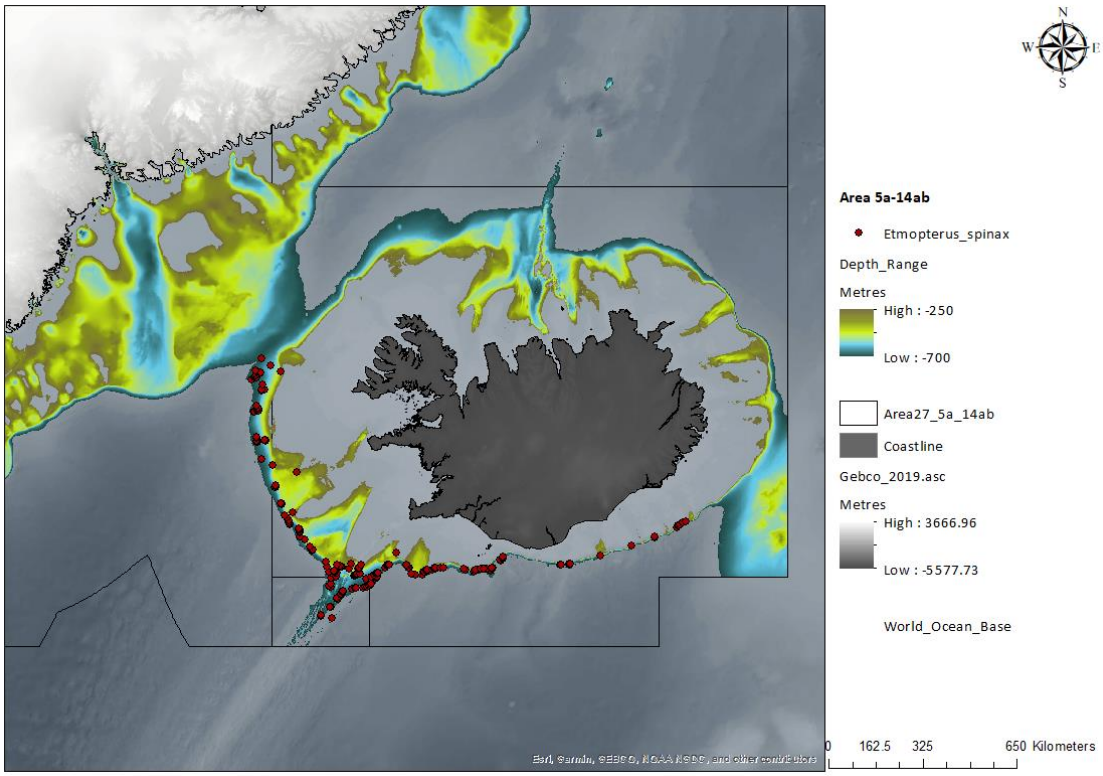

Figure 3.3.38. Recorded distribution of *Etmopterus spinax* in ICES divisions 27.5b, 27.14ab.

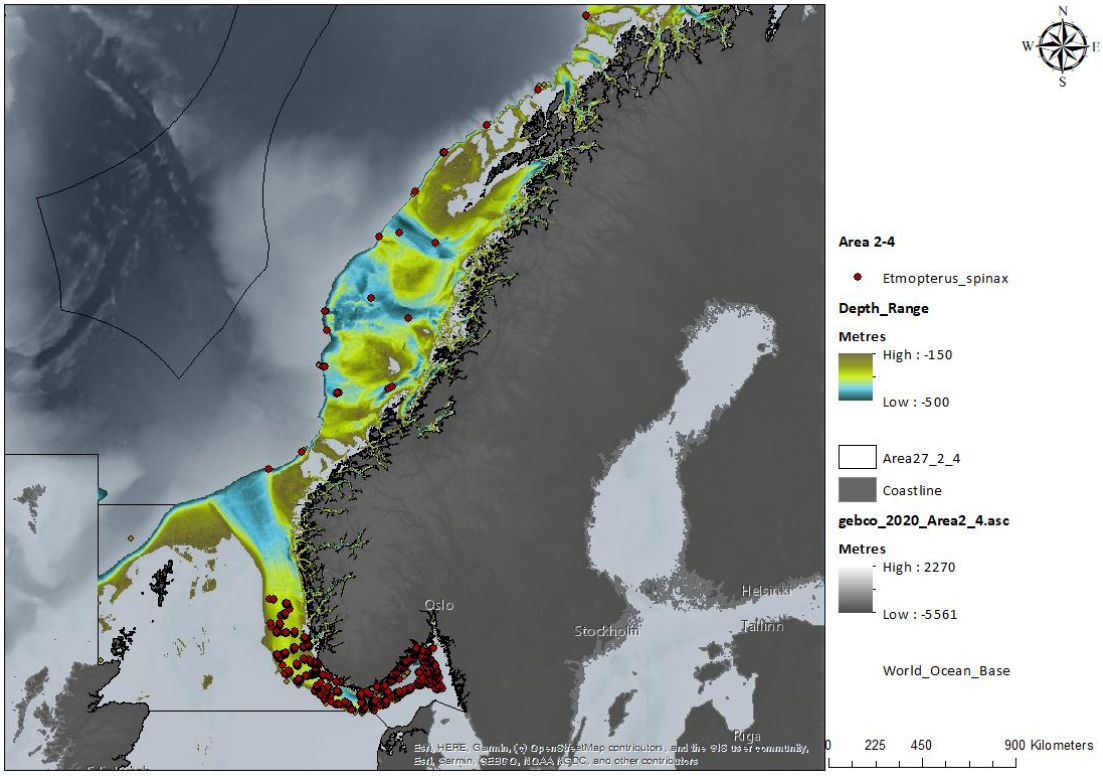

Figure 3.3.39. Recorded distribution of *Etmopterus spinax* in ICES subareas 27.2-27.4.

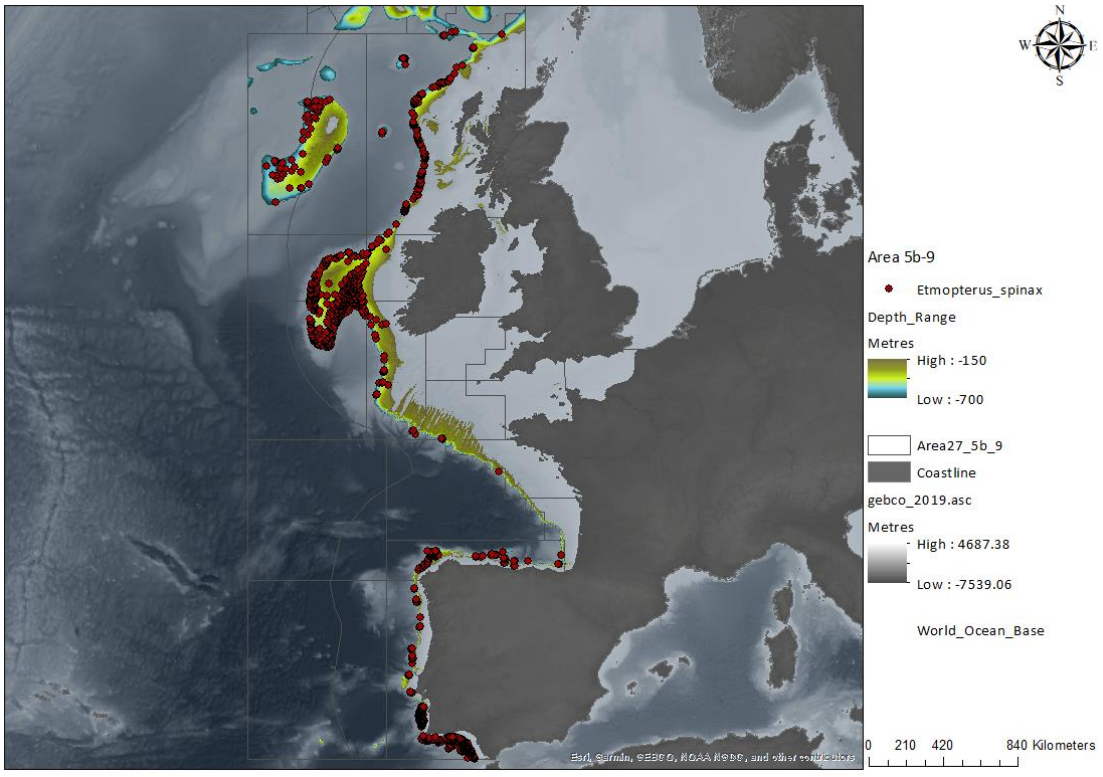

Figure 3.3.40. Recorded distribution of *Etmopterus spinax* in ICES divisions 27.5.b-27.9.

Galeus melastomus

Galeus melastomus is distributed from Norway (Figure 3.3.41) to Portugal in the ICES area (Figure 3.3.42). It is absent from Iceland. It is most abundant in the Porcupine Seabight area to the west of Ireland.

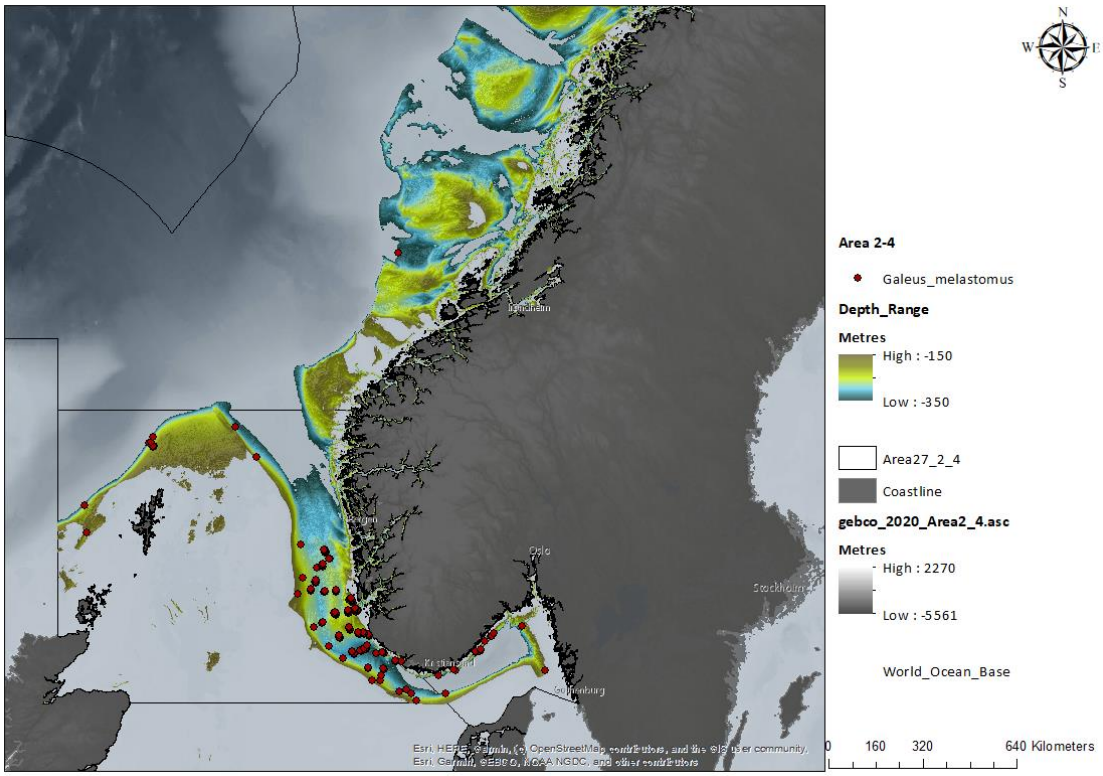

Figure 3.3.41. Recorded distribution of *Galeus melastomus* in ICES subareas 27.2-27.4.

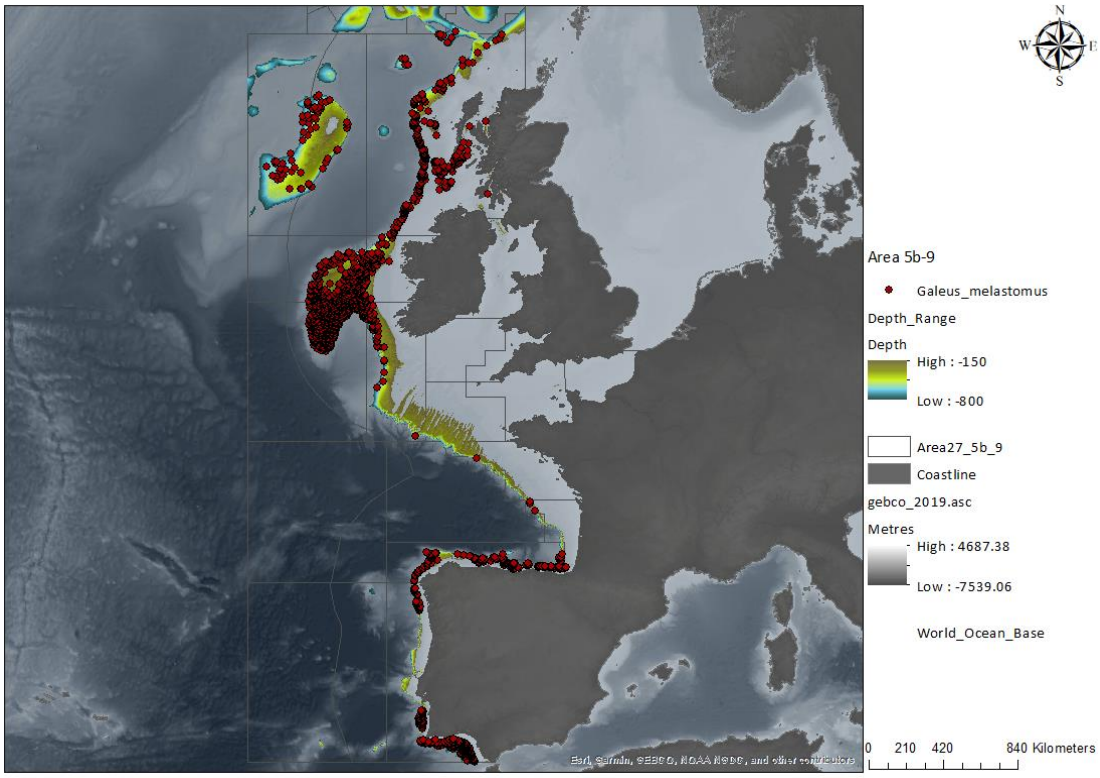

Figure 3.3.42. Recorded distribution of *Galeus melastomus* in ICES divisions 27.5.b-27.9.

Galeus murinus

Galeus murinus has a northern distribution bias. Most records are from Iceland (Figure 3.3.43, Figure 3.3.44), with no records reported south of the west of Ireland (Figure 3.3.45).

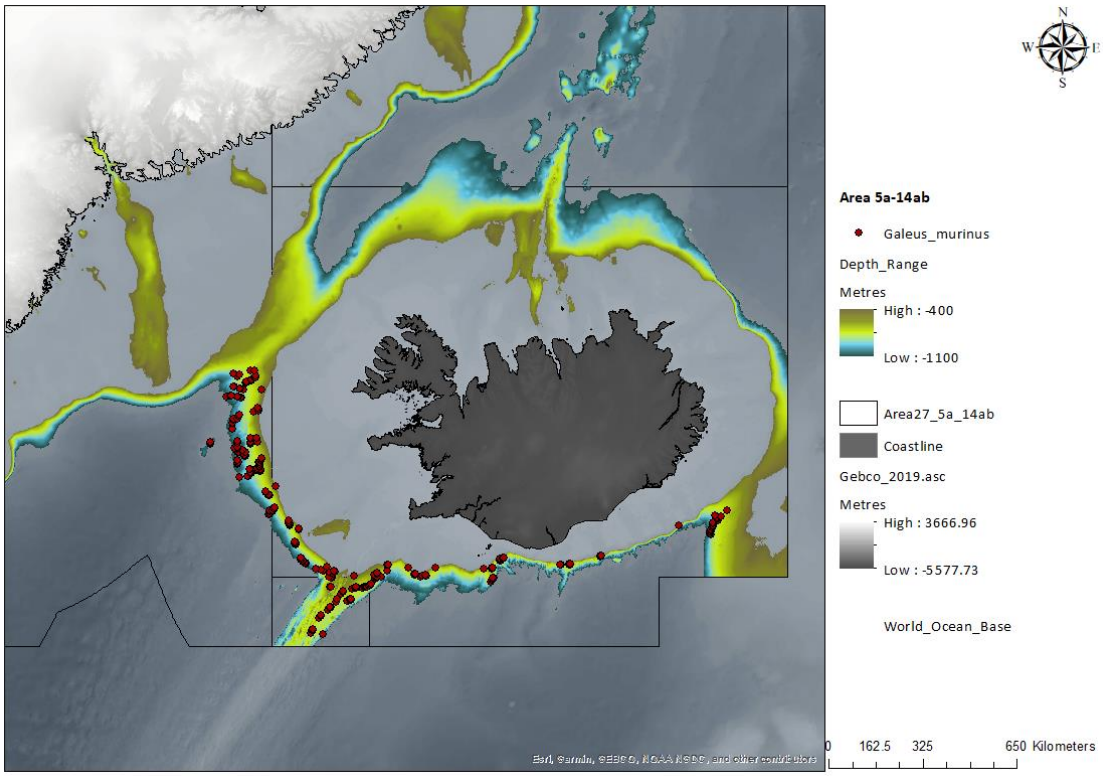

Figure 3.3.43. Recorded distribution of *Galeus murinus* in ICES divisions 27.5.a, 27.14ab

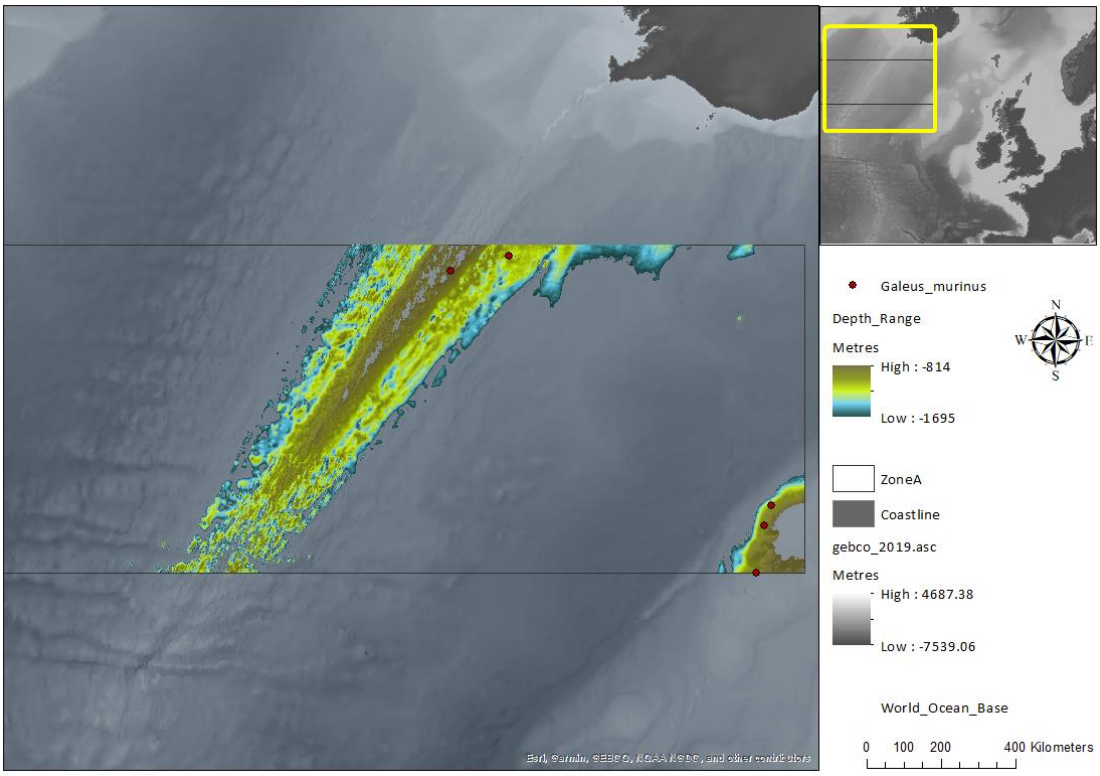

Figure 3.3.44. Recorded distribution of *Galeus murinus* in ICES Division 27.12a.

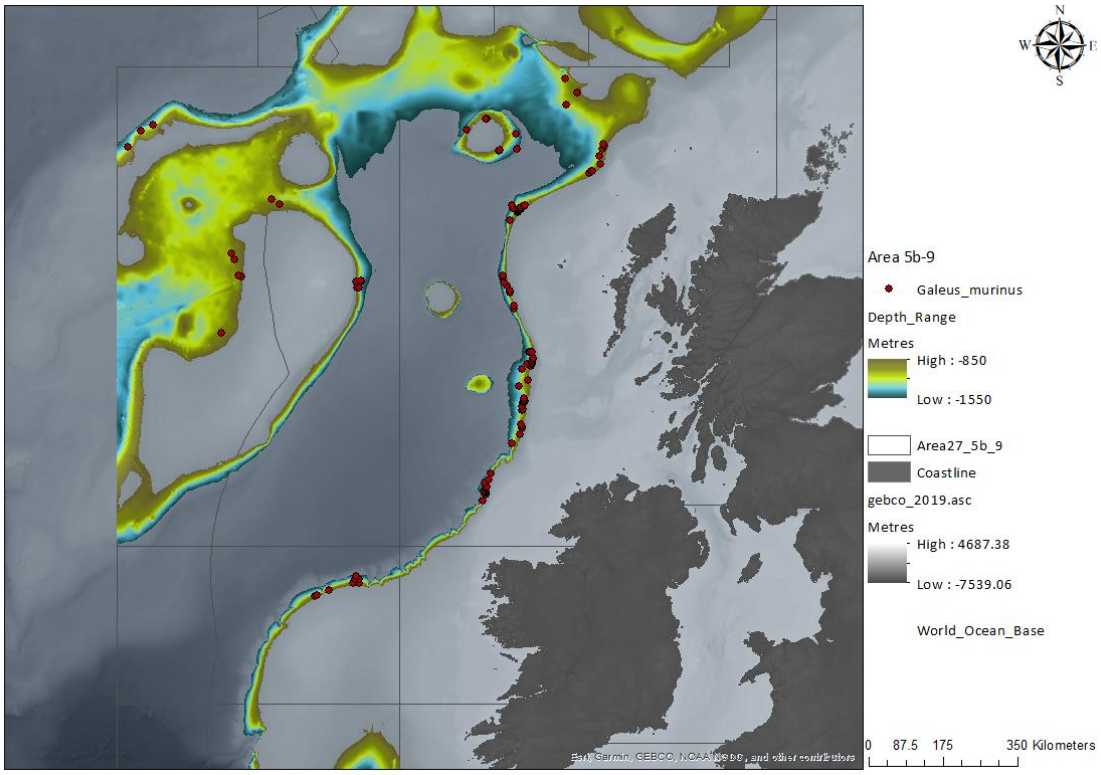

Figure 3.3.45. Recorded distribution of *Galeus murinus* in ICES divisions 27.5.b-27.9.

Hexanchus griseus

Hexanchus griseus is widely distributed in the ICES area, although with a southerly bias (Figure 3.3.46). There are no reports from ICES subareas 27.1-27.5. The main abundance appears to be around the Porcupine Sea-bight. However, it should be noted that these are mainly juveniles. Adults are much less reported in surveys.

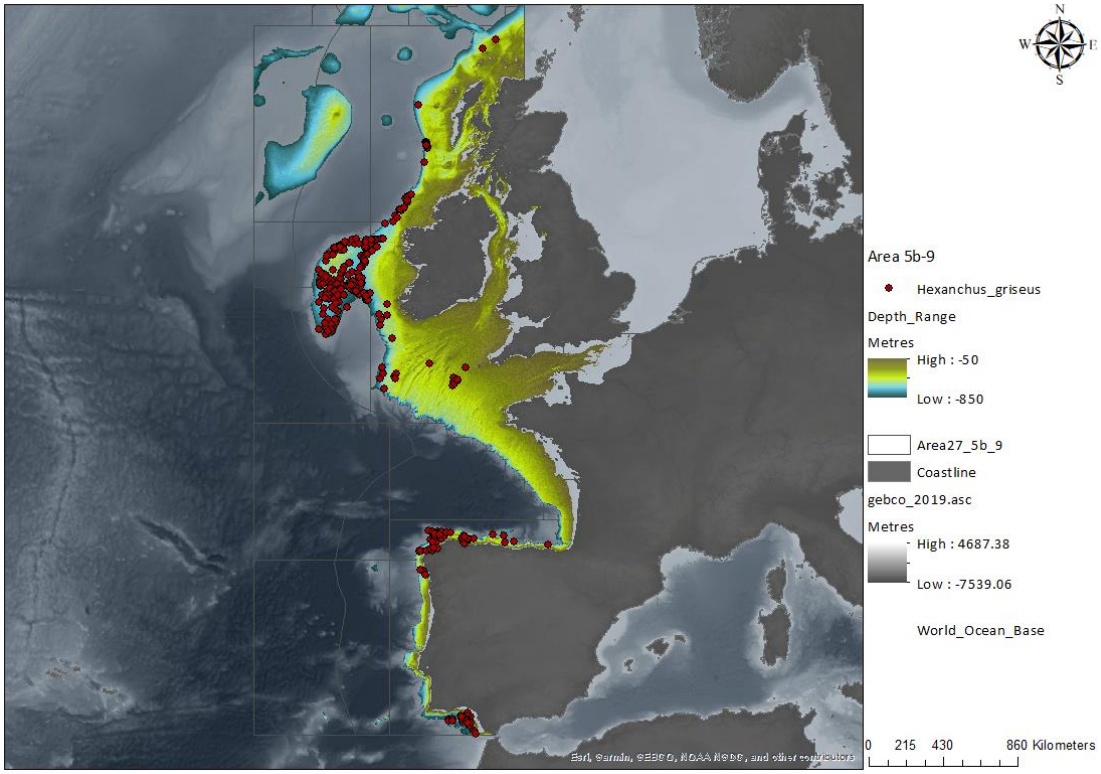

Figure 3.3.46 Recorded distribution of *Hexanchus griseus* in ICES divisions 27.5.b-27.9.

Hydrolagus mirabilis

Hydrolagus mirabilis is occasionally reported from Iceland (Figure 3.3.47, Figure 3.3.48). The distribution does not appear to extend down the Mid-Atlantic Ridge (MAR).

Most survey encounters are reported to the west of Ireland and the west and north of Scotland (Figure 3.3.49). There are a few reports from the north coast of Spain.

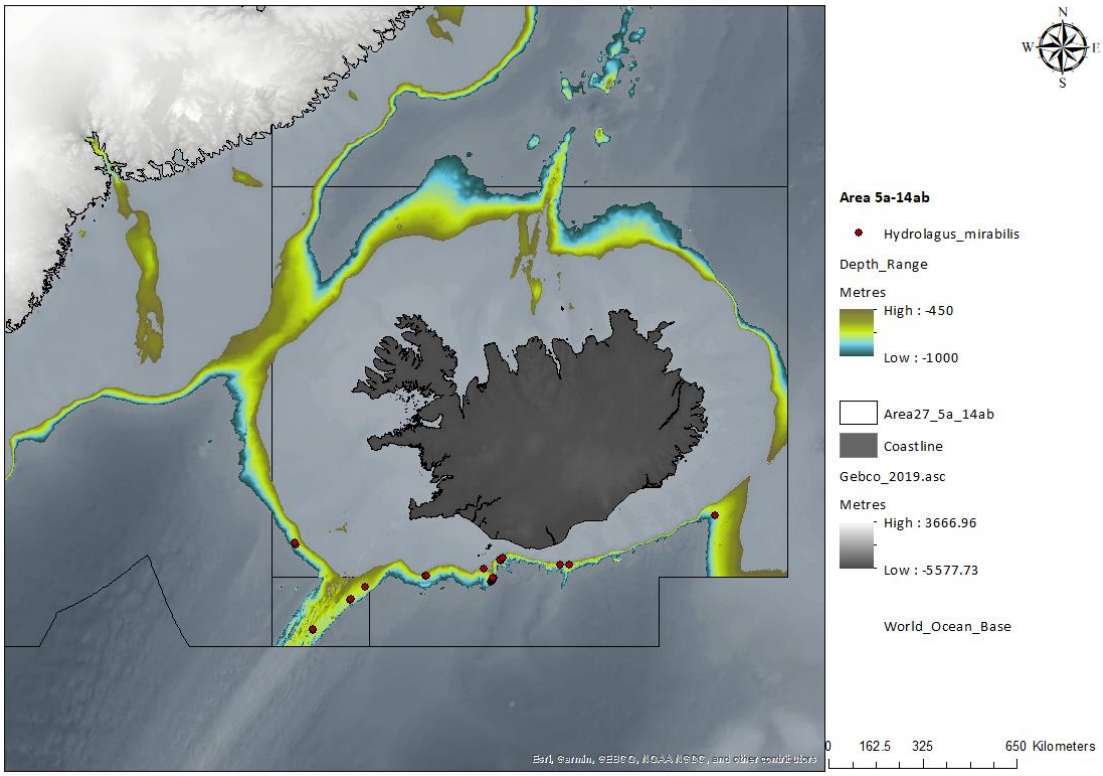

Figure 3.3.47. Recorded distribution of *Hydrolagus mirabilis* in ICES divisions 27.5.a, 27.14ab.

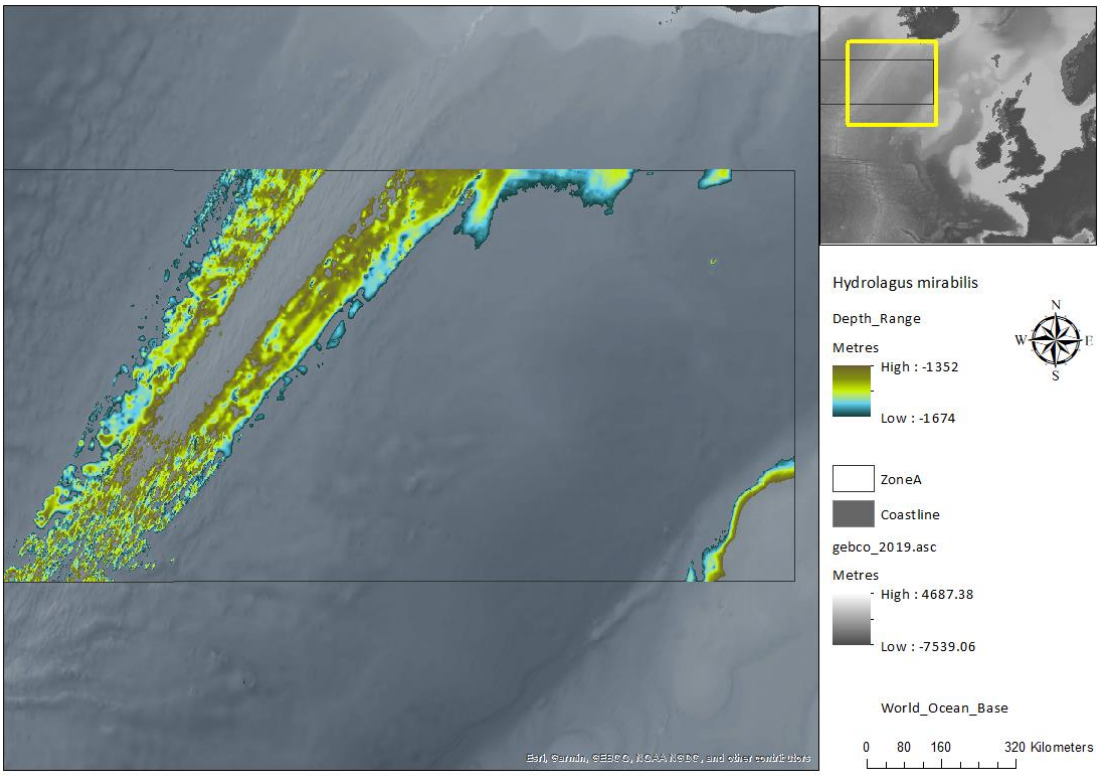

Figure 3.3.48. Recorded distribution of *Hydrolagus mirabilis* in ICES Division 27.12a.

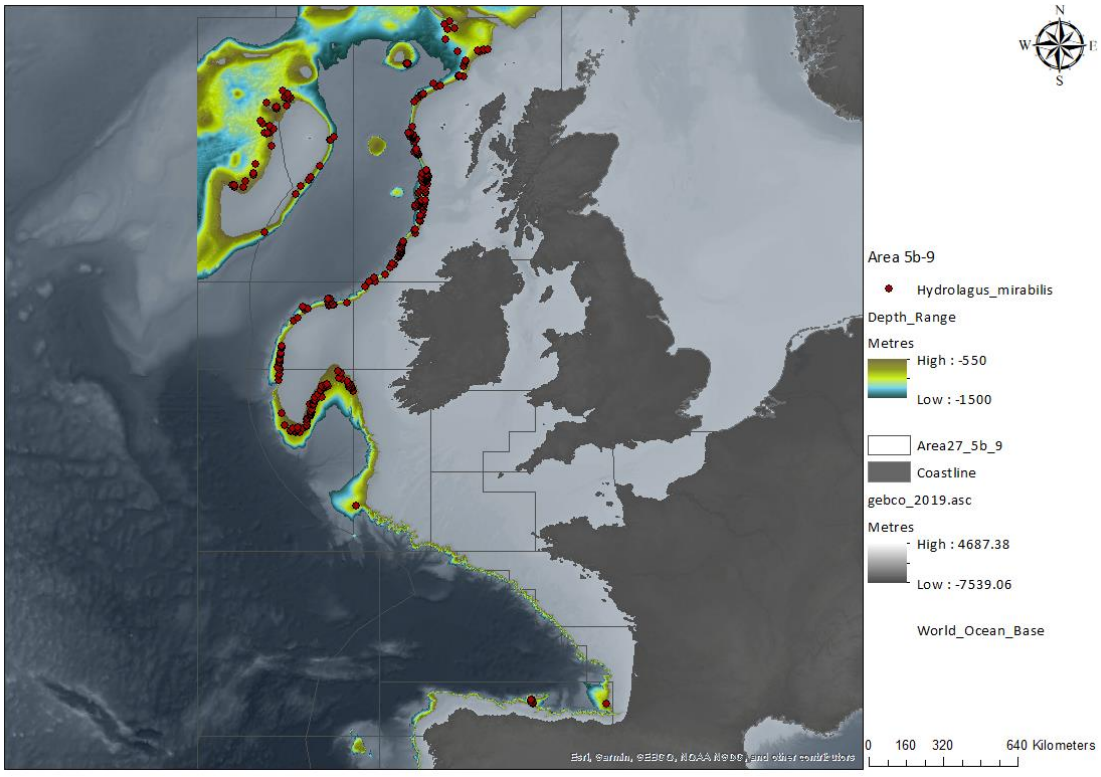

Figure 3.3.49. Recorded distribution of *Hydrolagus mirabilis* in ICES divisions 27.5.b-27.9

Oxynotus paradoxus

Only seven records of *Oxynotus paradoxus* have been reported in surveys in the ICES area (Figure 3.3.50). Six of these are to the West of Ireland and Scotland, with one record from the Rockall Bank. One record from the Mid-Atlantic Ridge has not been mapped below. This is not an abundant species in surveys.

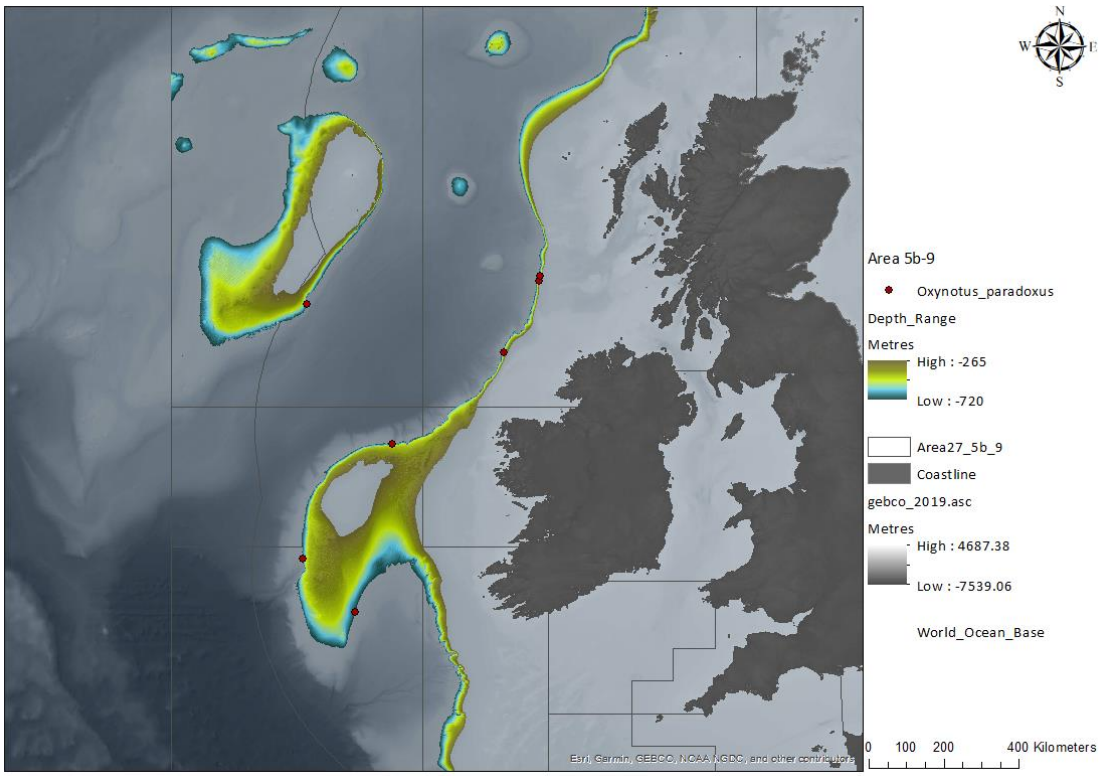

Figure 3.3.50. Recorded distribution of *Oxynotus paradoxus* in ICES divisions 27.5.b-27.9.

Rajella fyllae

Rajella fyllae are only found in the Northern part of the ICES area. There are no records from divisions 27.8 or 27.9. They are distributed from the eastern Greenland coast (Figure 3.3.51), to the southern part of Iceland, and along the Rockall bank and the Western Europe shelf (Figure 3.3.52).

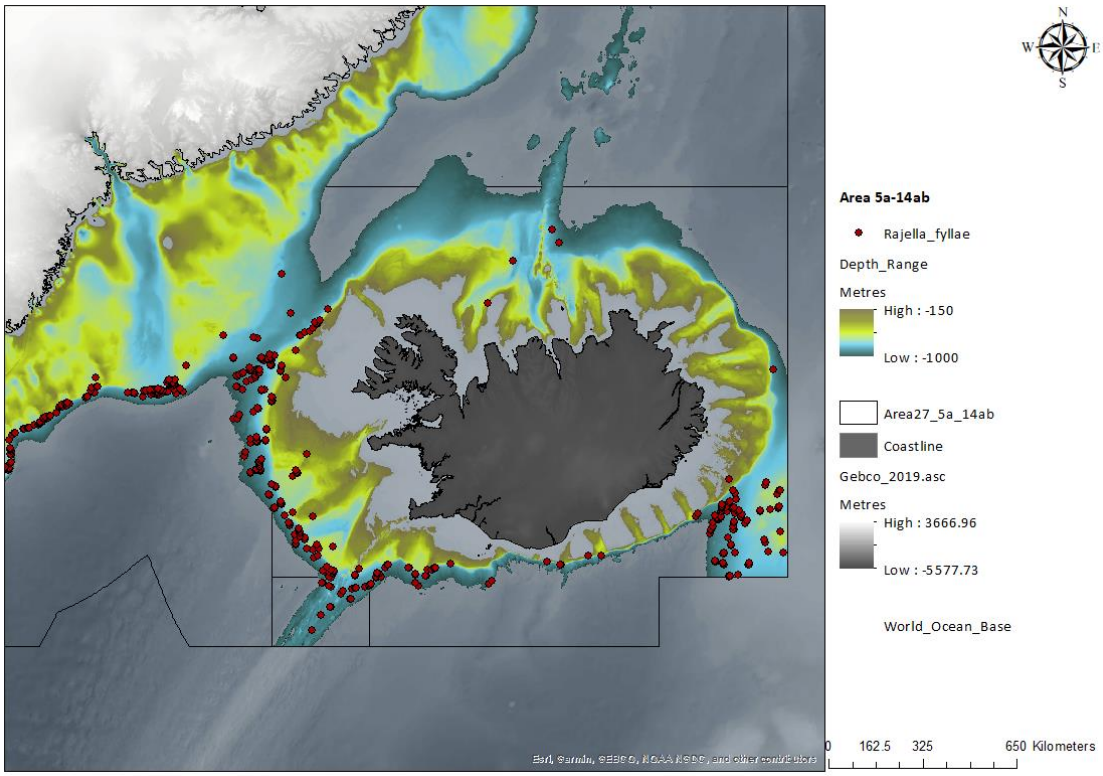

Figure 3.3.51. Recorded distribution of *Rajella fyllae* in ICES divisions 27.5.a, 27.14

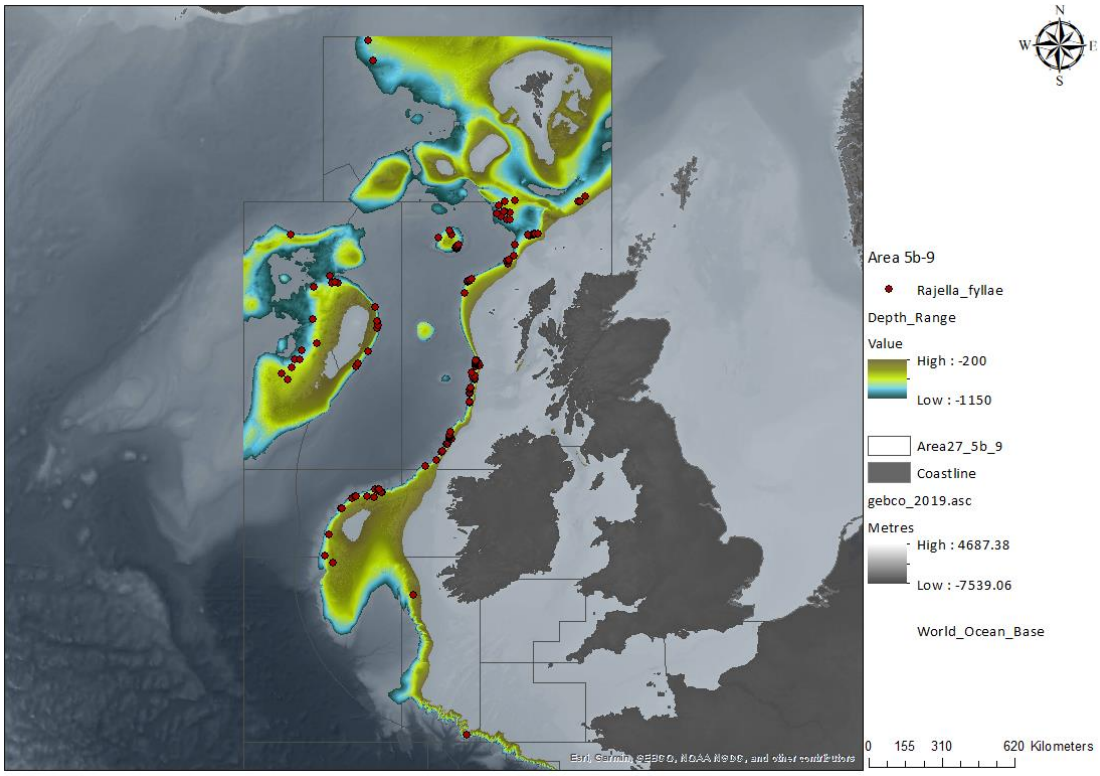

Figure 3.3.52. Recorded distribution of *Rajella fyllae* in ICES divisions 27.5b-27.9.

Rhinochimaera atlantica

Rhinochimaera atlantica are found to the south coast of Iceland (Figure 3.3.53), with some extension south to the Mid-Atlantic ridge (Figure 3.3.54). Further east, *R. atlantica* are only reported from the West of Ireland and Scotland and from the Rockall Bank (Figure 3.3.55). There is one report from the Bay of Biscay (ICES Subarea 27.8).

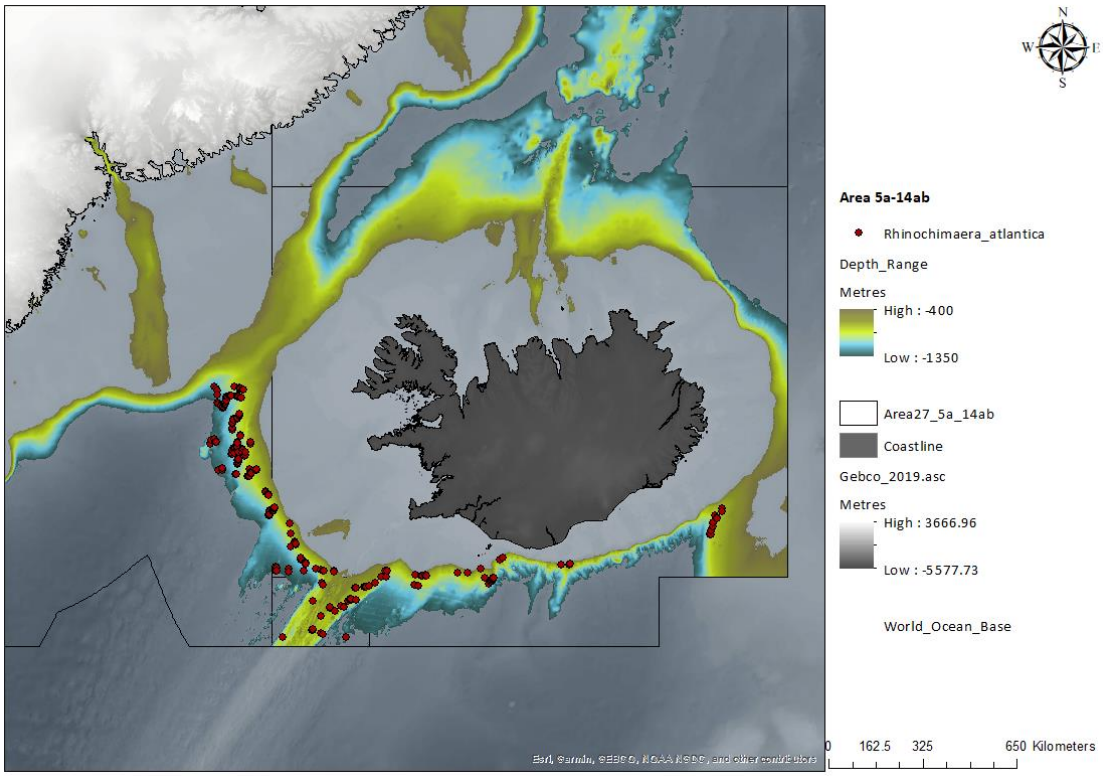

Figure 3.3.53. Recorded distribution of *Rhinochimaera atlantica* in ICES divisions 27.5.a, 27.14ab.

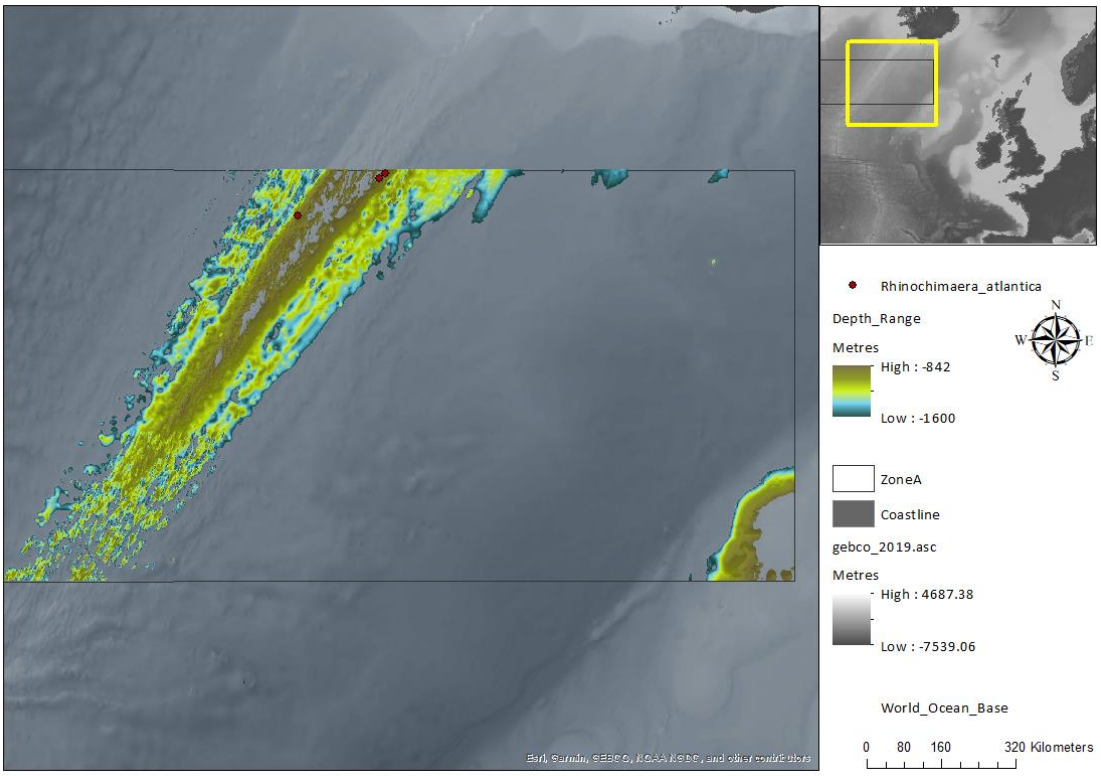

Figure 3.3.54 Recorded distribution of *Rhinochimaera atlantica* in ICES divisions 27.12.a.

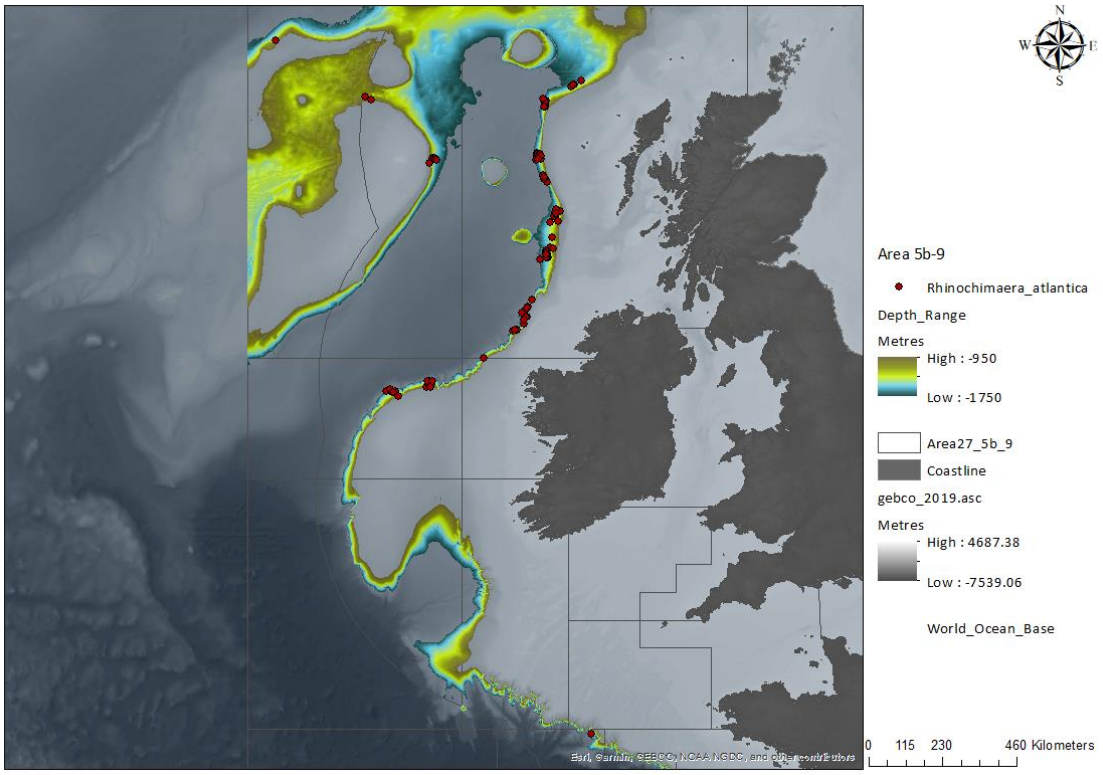

Figure 3.3.55. Recorded distribution of *Rhinochimaera atlantica* in ICES divisions 27.5.b-27.9.

Scymnodon ringens

Unlike most other species in this review, *Scymnodon ringens* has a southern bias to its distribution (Figure 3.3.56). There are many records from Iberia. While there is a large abundance around the Porcupine Sea-bight, there are few records further north than this, with none reported from the Rockall Bank or from Iceland or Norway.

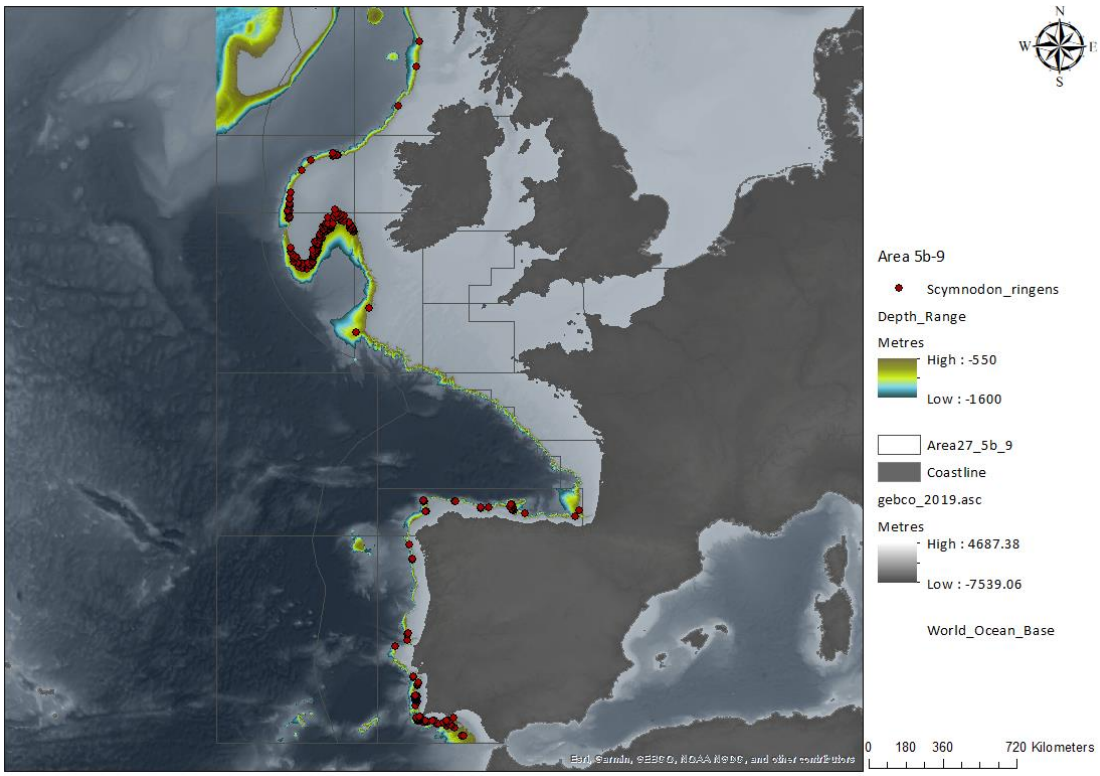

Figure 3.3.56. Recorded distribution of *Scymnodon ringens* in ICES divisions 27.5.b-27.9.

Somniosus microcephalus

This large bodied species occurs in northern waters and is not entirely a deep-water species, and so can occur elsewhere in the area. Most records of *Somniosus microcephalus* come from around Iceland, mainly between Iceland and Greenland (Figure 3.3.57, 3.3.58)). However, it is only a rare encounter in surveys. Outside this ecoregion, there are only two additional records of *S. microcephalus.* Both of these are from around the Porcupine Bank area (Figure 3.3.59).

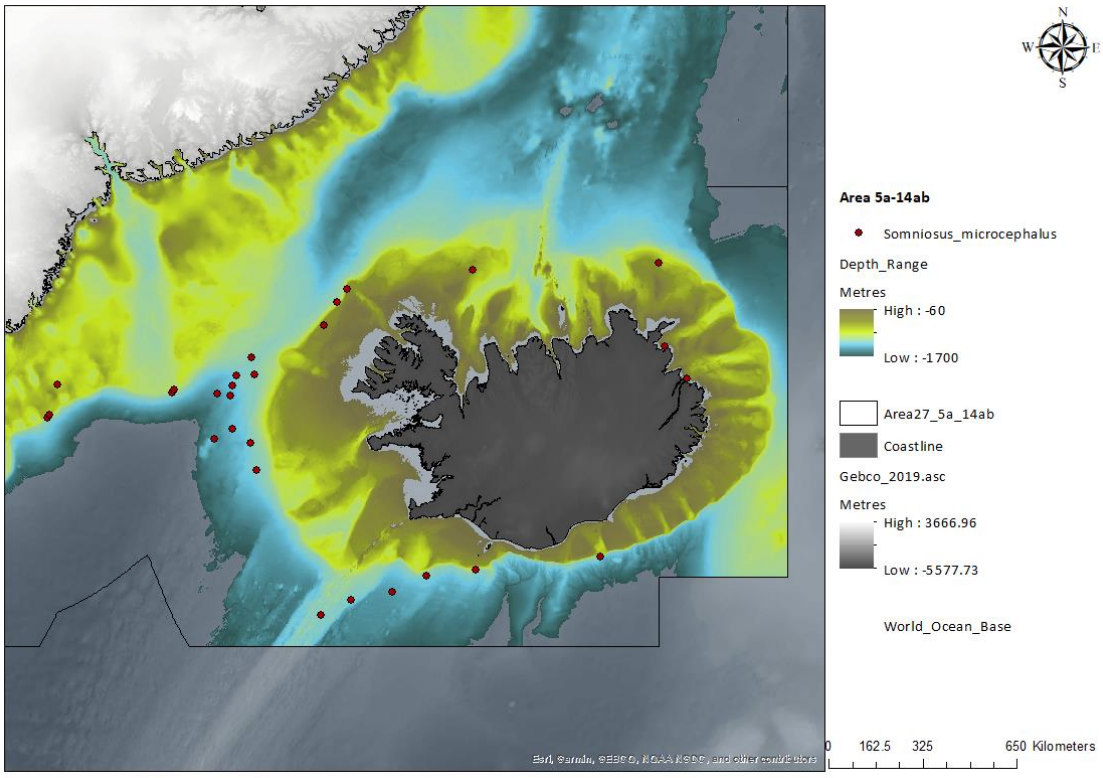

Figure 3.3.57. Recorded distribution of *Somniosus microcephalus* in ICES divisions 27.5.a, 27.14ab.

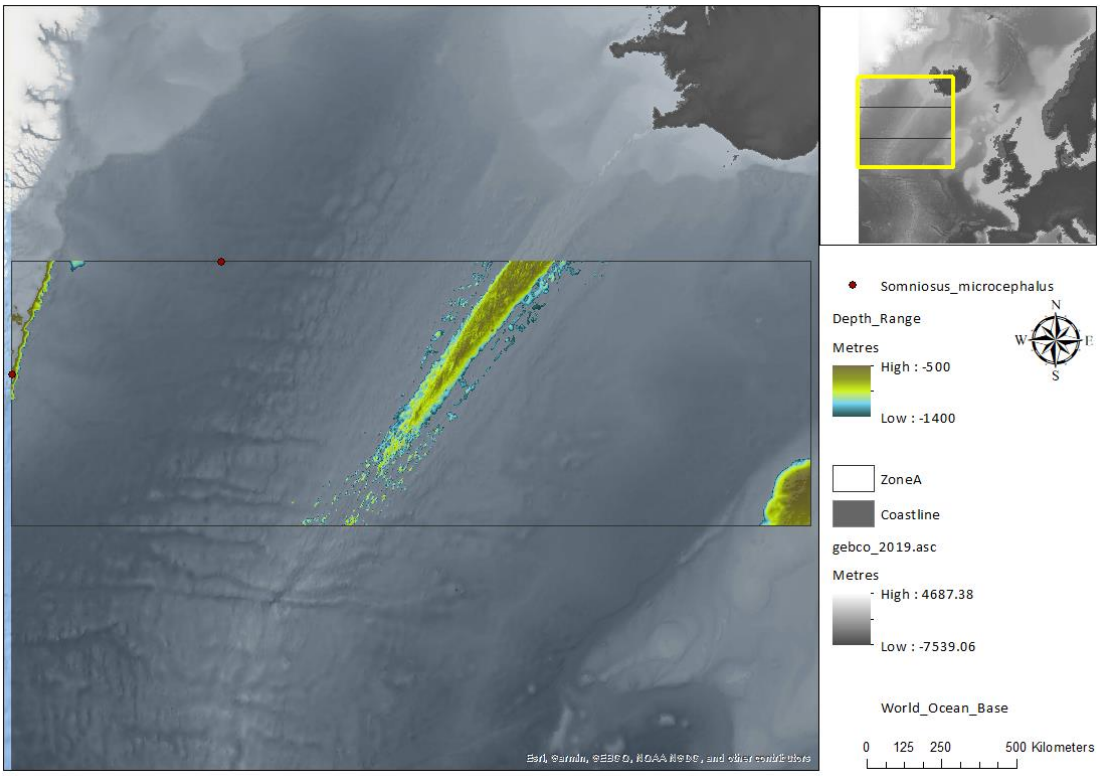

Figure 3.3.58. Recorded distribution of *Somniosus microcephalus* in ICES Division 27.12a.

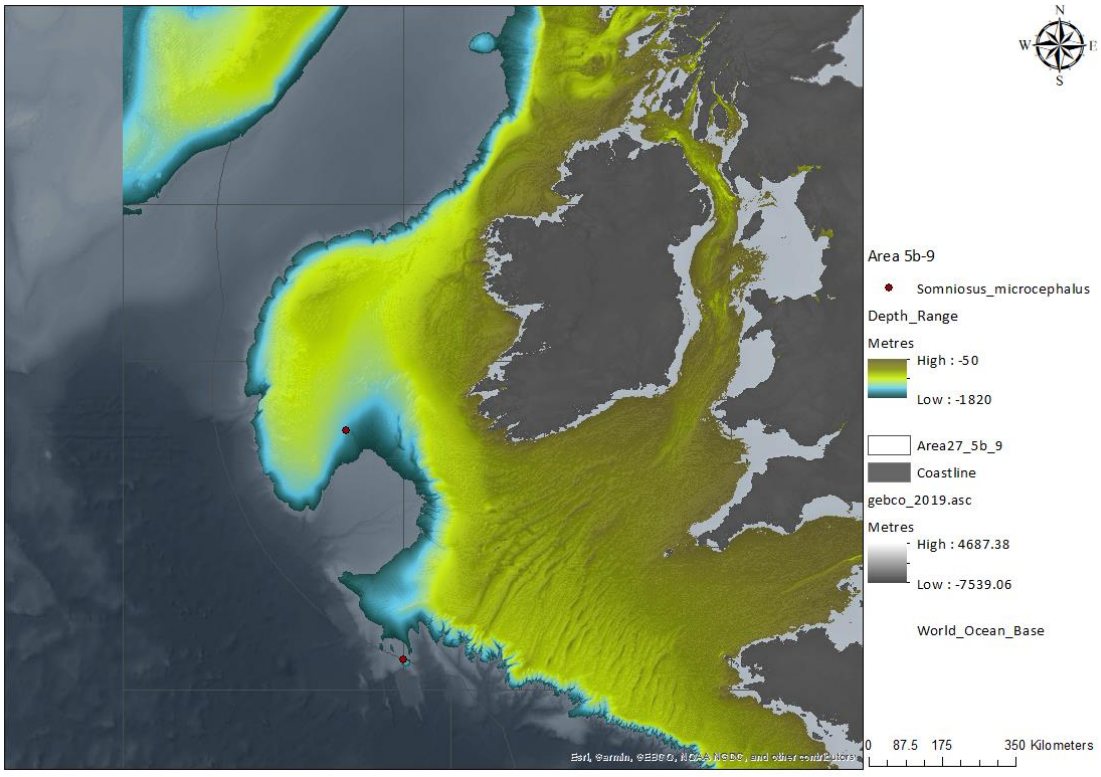

Figure 3.3.59. Recorded distribution of *Somniosus microcephalus* in ICES divisions 27.5b-27.9.

3.4 Data from Mid-Atlantic Ridge

The Mid-Atlantic Ridge area is within OSPAR Region 5 and runs north –south from ICES Sub area 5 (Iceland), through Subarea 12 (Mid-Atlantic Ridge mid-section) to Subarea 10 (Azores). It has not been well surveyed. Icelandic waters in the north are represented in the data call, but unfortunately, the Azorean Portuguese survey in Subarea 10 is not. As an example of the distribution of some shark and ray species in this area, Table 3.4, shows results of trawl and long line surveys conducted in the 1990s (Hareide and Garnes, 2001).

Table 3.4. Results of trawl and longline surveys for deep-water elasmobranchs in the Mid-Atlantic Ridge, from Hareide and Garnes (2001). Se Figure 3.4 for areas mentioned.

SPECIES	GEAR	Area	Min Depth	Max Depth
Centroscyllium fabricii	Longline	A	500	1300
Centroscymnus coelolepis	Longline	A	1400	1900
Deania calcea	Longline	A	500	700
Etmopterus princeps	Longline	A	500	1900
Etmopterus spinax	Longline	A	1600	1600
Galeus melastomus	Longline	A	600	700
Hydrolagus affinis	Longline	A	1400	1900
Bathyraja pallida	Longline	A	1500	1700
Somniosus microcephalus	Longline	A	500	1400
Centroscymnus coelolepis	Longline	B	500	1500
Centroscymnus crepidater	Longline	B	700	700
Etmopterus princeps	Longline	B	500	1600
Hydrolagus affinis	Longline	B	700	700
Somniosus microcephalus	Longline	B	900	900
Etmopterus princeps	Longline	C	600	1100
Galeus murinus	Longline	C	700	700
Hydrolagus affinis	Longline	C	700	1700
Prionace glauca	Longline	C	800	
Deania calcea	Trawl	D	700	900
Etmopterus princeps	Trawl	D	700	900
Raja batis	Trawl	D	900	900
Centrophours squamosus	Longline	E	400	900
Centroscymnus coelolepis	Longline	E	600	1100
Centroscymnus crepidater	Longline	E	700	1000
Deania calcea	Longline	E	600	900
Hexanchus griseus	Longline	E	700	700
Pseudotriakis microdon	Longline	E	600	700
Allocyttus verrucosus	Trawl	E	800	800
Centrophorus squamosus	Trawl	E	600	900
Centroscymnus coelolepis	Trawl	E	600	700
Chimaera monstrosa	Trawl	E	900	900
Chlamydoselachus anguineus	Trawl	E	500	600
Coelorinchus coelorinchus	Trawl	E	500	900
Dalatias licha	Trawl	E	500	700
Deania calcea	Trawl	E	500	700
Etmopterus princeps	Trawl	E	800	900
Hexanchus griseus	Trawl	E	500	900
Oxynotus paradoxus	Trawl	E	500	600

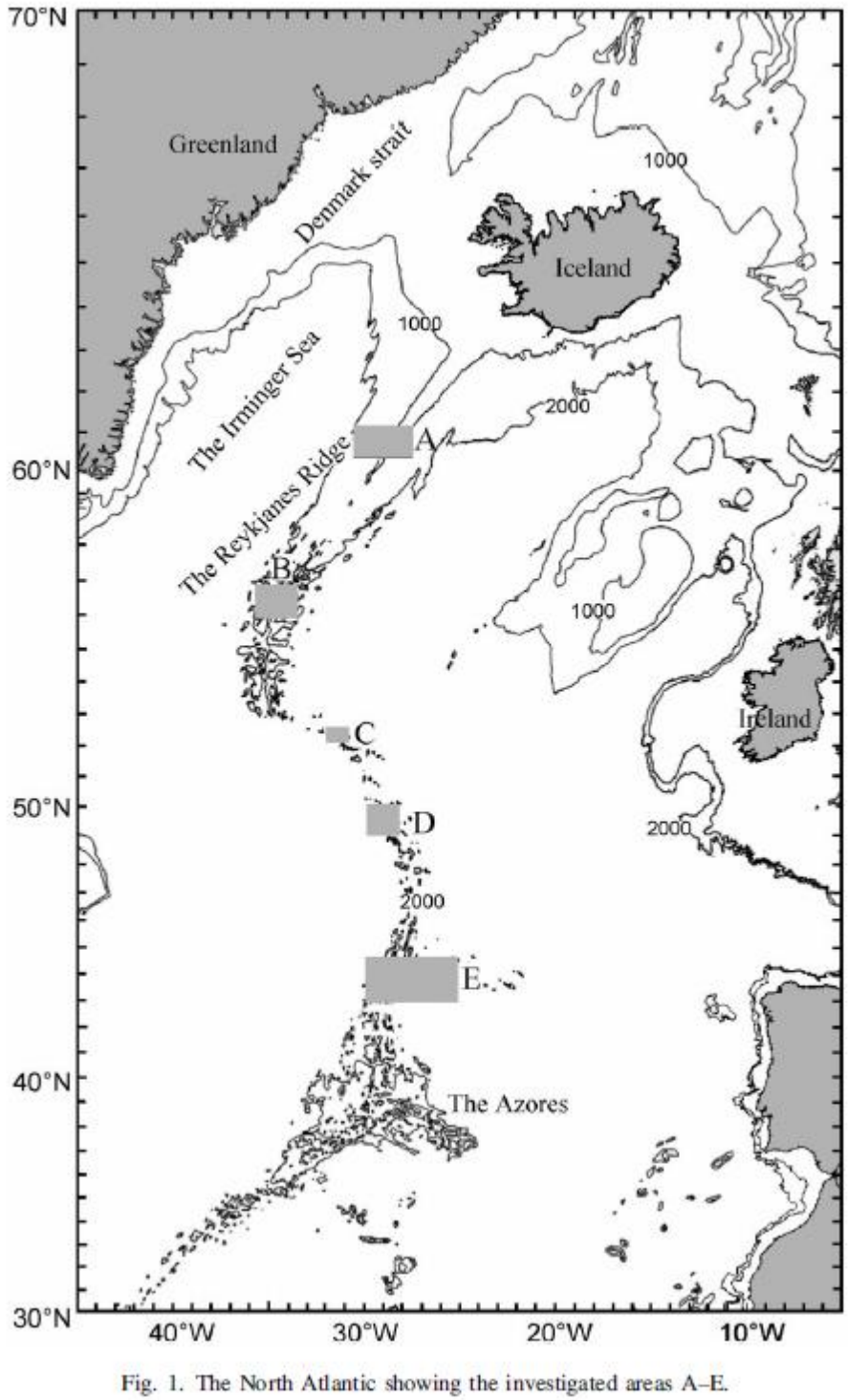

Figure 3.4. Survey areas mentioned in Table 3.4, re-drawn from Hareide and Garnes (2001).

Future work should focus on a full analysis of the shark distributions on the Mid-Atlantic Ridge from existing Icelandic and Portuguese surveys (Table 3.1), and historical Russian and Norwegian surveys, see also Fossen *et al.* (2008).

4 Fleets taking these species as by-catch

4.1 Management applicable

The EU TACs that have been adopted for deep-sea sharks in European Community waters and international waters at different ICES subareas are summarized below.

Year	ICES subareas		
	5–9	10	12 (includes also *Deania histricosa* and *Deania profondorum*)
2005 and 2006	6763	14	243
2007	2472(1)	20	99
2008	1646(1)	20	49
2009	824(1)	10(1)	25(1)
2010	0(2)	0(2)	0(2)
2011	0(3)	0(3)	0(3)
2012	0	0	0
2013	0	0	0
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	10(4)	10(4)	0
2018	10(4)	10(4)	0
2019	7(4)	7(4)	0
2020	7(4)	7(4)	0

(1) Bycatch only. No directed fisheries for deep-sea sharks are permitted.

(2) Bycatch of up to 10% of 2009 quotas is permitted.

(3) Bycatch of up to 3% of 2009 quotas is permitted.

(4) Exclusively for bycatch in longline fishery targeting black scabbardfish. No directed fishery shall be permitted.

Since 2013, the deep-sea shark category includes the following species (Council regulation (EC) No 1182/2013): Deep-water catsharks *Apristurus* spp., frilled shark *Chlamydoselachus anguineus*, gulper sharks *Centrophorus* spp., Portuguese dogfish *Centroscymnus coelolepis,* longnose velvet dogfish *Centroscymnus crepidater,* black dogfish *Centroscyllium fabricii*; birdbeak dogfish *Deania calcea*; kitefin shark *Dalatias licha*; greater lantern shark *Etmopterus princeps*; velvet belly *Etmopterus spinax*; mouse catshark Galeus murinus; six-gilled shark *Hexanchus griseus*; sailfin roughshark *Oxynotus paradoxus*; knifetooth dogfish Scymnodon ringens and Greenland shark *Somniosus microcephalus*.

Since 2015, the two species, leafscale gulper shark and Portuguese dogfish, have been included on the EU prohibited species list for Union waters of Division 2.a and Subarea 4 and in all waters of Subareas 1 and 14 (Council Regulation (EC) No 2014/0311, Art. 13:1(e)).

Since 2013, under NEAFC Recommendation 7 it was required that Contracting Parties prohibit vessels flying their flag in the Regulatory Area from directed fishing for deep-sea sharks on the following list: *Centrophorus granulosus, Centrophorus squamosus, Centroscyllium fabricii, Centroscymnus coelolepis, Centroscymnus crepidater, Dalatias licha, Etmopterus princeps, Apristurus spp, Chlamyd-oselachus anguineus, Deania calcea, Galeus melastomus, Galeus murinus, Hexanchus griseus, Etmopterus spinax, Oxynotus paradoxus, Scymnodon ringens* and *Somniosus microcephalus.*

In 2005, the use of trawls and gillnets in waters deeper than 200 m in the Azores, Madeira and Canary Island areas was banned (Council Regulation (EC) No 1568/2005). In 2007, the use of gillnets by Community vessels at depths greater than 600 m in ICES divisions 6.a–b, 7.b–c, 7.j–k and Subarea 12 was banned while a maximum bycatch of deep-water shark of 5% in hake and monkfish gillnet catches was allowed (Council Regulation (EC) No 41/2007). A gillnet ban in waters deeper than 200 m is also in operation in the NEAFC regulatory Area (all international waters of the ICES Area). NEAFC also ordered the removal of all such nets from NEAFC waters by 1 February 2006.

Since 2009, the "rasco (gillnet)" fishing gear was banned at depths lower than the 600 m isobath (EC Regulation 43/2009,). The regulation affected 4–6 boats in the Basque Country that used this technique. The "rasco" fleet targets anglerfish *Lophius* spp., which represents around 90% of catch weight. This métier is highly seasonal, with the highest activity occurring during winter months. Catches during these months tend to occur in deeper waters, where the nets are sunk to depths down to 1000 m.

A by-catch TAC for deep-water sharks was allowed for each of the years from 2017 to 2020, on a trial basis, in the directed artisanal deep-sea longline fisheries for black scabbardfish *Aphanopus carbo* (Council regulation (EU) 2016/2285; Council regulation (EU) 2018/2025). According to this limited landing of unavoidable by-catches of deep-sea sharks were allowed and Member States should develop regional management measures for the black scabbardfish fishery and establish specific data-collection measures for deep-sea sharks to ensure their close monitoring. Specifically, 10 tonnes were allowed for deep-sea sharks in Union and international waters of ICES subareas 5, 6, 7, 8 and 9, in Union and international waters of ICES Subarea 10 and in Union waters of CECAF 34.1.1, 34.1.2 and 34. 2. This allowance was in accordance with ICES indications according to which in the artisanal deep-sea longline fisheries for black scabbardfish, the restrictive catch limits lead to misreporting of unavoidable by-catches of deep-sea sharks, which are currently discarded dead.

The Council regulation (EU) 2016/2285 affects specifically the Portuguese deep-water longline fishery targeting black scabbardfish in ICES Division 9.a and Subarea 10. As a response, Portugal has proposed an action plan focusing the black scabbardfish fishery and this plan is coordinated by the Portuguese General Directorate of Fisheries. Among other objectives, under this plan different management strategies were expected to be evaluated.

From 2017 to 2019, there were NEAFC Recommendations applicable to some deep-water sharks (Recommendation 10/2017), some deep-water skates (Recommendation 11/2017) and some rabbitfish (Recommendation 12/2017). The NEAFC *Recommendation on the Conservation and Management Measures for Deep Sea Sharks in the NEAFC Regulatory Area* (2017–2019; https://www.neafc.org/system/files/Rec.10%20-%20Deep-Sea-Sharks.pdf) considered the following 17 taxa:

- Gulper shark *Centrophorus granulosus*
- Leafscale gulper shark *Centrophorus squamosus*
- Black dogfish *Centroscyllium fabricii*
- Portuguese dogfish *Centroscymnus coelolepis*
- Longnose velvet dogfish *Centroscymnus crepidater*

- Kitefin shark *Dalatias licha*
- Greater lanternshark *Etmopterus princeps*
- Catsharks *Apristuris* [sic] spp.
- Frilled shark *Chlamydoselachus anguineus*
- Birdbeak dogfish *Deania calcea*
- Blackmouth dogfish *Galeus melastomus*
- Mouse catshark *Galeus murinus*
- Bluntnose six-gilled shark *Hexanchus griseus*
- Velvet belly *Etmopterus spinax*
- Sailfin roughshark (Sharpback shark) *Oxynotus paradoxus*
- Knifetooth dogfish *Scymnodon ringens*
- Greenland shark *Somniosus microcephalus*

These taxa broadly mirror what the EU included as deep-water sharks (see Table 1), with the differences being that the EU no longer consider blackmouth dogfish/catshark *Galeus melastomus* as a deep-water species and, whilst the EU consider all *Centrophorus* spp. to be deep-water, the NEAFC regulations listed two species (*C. granulosus* and *C. squamosus*), despite the taxonomic problems associated with this genus.

There is a range of deep-water shark species that are not included on the lists of either the EU or NEAFC, many of which are poorly studied, including:

- Sharpnose sevengill shark *Heptranchias perlo*
- Bigeyed sixgill shark *Hexanchus nakamurai*
- Goblin shark *Mitsukurina owstoni*
- False catshark *Pseudotriakis microdo*
- Largetooth cookiecutter shark *Isistius plutodus*
- Spined pygmy shark *Squaliolus laticaudus*
- Roughskin dogfish *Centroscymnus owstonii*
- Azores dogfish *Scymnodalatias garricki*
- Little sleeper shark *Somniosus rostratus*
- Velvet dogfish *Zameus squamulosus*
- Angular roughshark *Oxynotus centrina*
- Rough longnose dogfish *Deania hystricosa*
- Arrowhead dogfish *Deania profundorum*
- Bramble shark *Echinorhinus brucus*

The NEAFC *Recommendation on Conservation and Management Measures for Deep Sea Rays (Rajiformes) in the NEAFC Regulatory Area* (2017–2019; https://www.neafc.org/system/files/Rec.11%20-%20Deep-Sea%20Rays%20%28Chondrichtyans%29_2017.pdf) listed three skate species, namely round skate *Raja fyllae* (current scientific name is *Rajella fyllae*), Arctic skate *Raja hyperborea* (current scientific name is *Amblyraja hyperborea*) and Norwegian skate *Raja nidarosiensis* (current scientific name is *Dipturus nidarosiensis*). The basis for these species being listed is unclear. Furthermore, one of the species (*Rajella fyllae*) is a small-bodied species (maximum length ca. 55 cm; Ebert and Stehmann, 2013), and so of limited commercial value. The majority of skates (Rajiformes) occurring in deep-water of the ICES area were not listed under the NEAFC Recommendation.

The NEAFC *Recommendation on Conservation and Management Measure for Deep Sea Chimaeras in the NEAFC Regulatory Area* (2017–2019; https://www.neafc.org/system/files/Rec.12%20-

%20Deep-Sea%20Chimaeras.pdf) considered three species, namely rabbitfish *Chimaera monstrosa*, large-eyed rabbitfish *Hydrolagus mirabilis* and straightnose rabbitfish *Rhinochimaera atlantica*. The basis for these species being listed is also unclear. It is also highlighted here that there have been several recently-described rabbitfish from the North-East Atlantic (e.g. Moura *et al.*, 2005; Luchetti *et al.*, 2011), such as *Chimaera opalescens* and *Hydrolagus lusitanicus.*

4.2 Deep-water chondrichthyans and their interactions with fisheries

ToR c) was to "*Create a table with the following: complete list of species; overview of fleets taking the species as bycatch both past (from mid-1980s) until present; and area covered by the fleet (see also WKSHARK1)*".

Updated list of chondrichthyans occurring in deep-water of the ICES area

The current lists of what are considered as deep-water sharks under EU regulations and what are considered as deep-water sharks, skates and rabbitfish under earlier NEAFC regulations are generally incomplete in terms of the chondrichthyans known to occur in the North-East Atlantic (ICES subareas 1–14). Ebert and Stehmann (2013) provide a recent synthesis of available information, although new species have been described in the area (e.g. Luchetti *et al.*, 2013).

The deep-water chondrichthyans of the ICES area comprises of more than 60 species from 15 families (Ebert and Stehmann, 2013). There are also some other species (e.g. blackmouth catshark *Galeus melastomus* and members of the common skate complex *Dipturus* spp.; denoted in square brackets below) that are more common on the outer shelf and, whilst having lower bathymetric limits that extend into 'deep-water' habitats, are not considered to be deep-water species *per se*.

ORDER HEXANCHIFORMES	
Family Hexanchidae	
Heptranchias perlo (Bonnaterre, 1788)	Sharpnose sevengill shark
Hexanchus griseus (Bonnaterre, 1788)	Bluntnose sixgill shark
Hexanchus nakamurai (Teng, 1962)	Bigeyed sixgill shark
Family Chlamydoselachiidae	
Chlamydoselachus anguineus (Garman, 1884)	Frilled shark
ORDER LAMNIFORMES	
Family Mitsukurinidae	
Mitsukurina owstoni (Jordan, 1898)	Goblin shark

ORDER CARCHARHINIFORMES

Family Pentanchidae

Apristurus aphyodes (Nakaya and Stehmann, 1998)	White ghost catshark
Apristurus laurussonii (Saemundsson, 1922)	Iceland catshark
Apristurus manis (Springer, 1979)	Ghost catshark
Apristurus melanoasper (Iglésias, Nakaya, and Stehmann, 2004)	Black roughscale catshark
Apristurus microps (Gilchrist, 1922)	Smalleye catshark
Galeus atlanticus (Vaillant, 1888)	Atlantic sawtail catshark
Galeus melastomus (Rafinesque, 1810)	Blackmouth catshark
Galeus murinus (Collett, 1904)	Mouse catshark

Family Pseudotriakidae

Pseudotriakis microdon (Capello, 1868)	False catshark

ORDER SQUALIFORMES

Family Dalatiidae

Dalatias licha (Bonnaterre, 1788)	Kitefin shark
Isistius plutodus (Garrick and Springer, 1964)	Largetooth cookiecutter shark
Squaliolus laticaudus (Smith and Radcliffe, 1912)	Spined pygmy shark

Family Etmopteridae

Centroscyllium fabricii (Reinhardt, 1825)	Black dogfish
Etmopterus princeps Collett, 1904	Great lanternshark
Etmopterus pusillus (Lowe, 1839)	Smooth lanternshark
Etmopterus spinax (Linnaeus, 1758)	Velvet belly

Family Somniosidae

Centroscymnus coelolepis (Bocage and Capello, 1864)	Portuguese dogfish
Centroscymnus owstonii (Garman, 1906)	Roughskin dogfish
Centroscymnus crepidater (Bocage and Capello, 1864)	Longnose velvet dogfish
Scymnodalatias garricki (Kukuev and Konovalenko, 1988)	Azores dogfish
Scymnodon ringens (Bocage and Capello, 1864)	Knifetooth dogfish
Somniosus microcephalus (Bloch and Schneider, 1801)	Greenland shark
Somniosus rostratus (Risso, 1827)	Little sleeper shark
Zameus squamulosus (Günther, 1877)	Velvet dogfish

Family Oxynotidae

Oxynotus centrina (Linnaeus, 1758)	Angular roughshark
Oxynotus paradoxus (Frade, 1929)	Sailfin roughshark

Family Centrophoridae	
Centrophorus granulosus (Bloch and Schneider, 1801)	Gulper shark
Centrophorus lusitanicus (Bocage and Capello, 1864)	Lowfin gulper shark
Centrophorus niaukang (Teng, 1959)	Taiwan gulper shark
Centrophorus squamosus (Bonnaterre, 1788)	Leafscale gulper shark;
Deania calcea (Lowe, 1839)	Birdbeak dogfish
Deania hystricosa (Garman, 1906)	Rough longnose dogfish
Deania profundorum (Smith and Radcliffe, 1912)	Arrowhead dogfish
ORDER ECHINORHINIFORMES	
Family Echinorhinidae	
Echinorhinus brucus (Bonnaterre, 1788)	Bramble shark
ORDER RAJIFORMES	
Family Rajidae	
Amblyraja hyperborea (Collett, 1879)	Arctic skate
Amblyraja jenseni (Bigelow and Schroeder, 1950)	Shorttail skate
Dipturus nidarosiensis (Storm, 1881)	Norwegian skate
Dipturus oxyrinchus (Linnaeus, 1758)	Longnosed skate
Dipturus spp.	Common skate complex
Malacoraja kreffti (Stehmann, 1977)	Krefft's ray
Malacoraja spinacidermis (Barnard, 1923)	Soft skate
Neoraja caerulea (Stehmann, 1976)	Blue ray
Neoraja iberica (Stehmann, Séret, Costa and Baro, 2008)	Iberian pygmy skate
Rajella bathyphila (Holt and Byrne, 1908)	Deep-water ray
Rajella bigelowi (Stehmann, 1978)	Bigelow's ray
Rajella dissimilis (Hulley, 1970)	Ghost skate
Rajella fyllae (Lütken, 1888)	Round ray
Rajella kukujevi (Dolganov, 1985)	Mid-Atlantic skate
Rajella lintea (Fries, 1839)	Sailray
Family Arhynchobatidae	
Bathyraja pallida (Forster, 1967)	Pale ray
Bathyraja richardsoni (Garrick, 1961)	Richardson's ray
Bathyraja spinicauda (Jensen, 1914)	Spinetail ray

ORDER CHIMAERIFORMES	
Family Chimaeridae	
Chimaera monstrosa (Linnaeus, 1758)	Rabbit fish
Chimaera opalescens (Luchetti, Iglésias & Sellos, 2011)	Opal chimaera
Hydrolagus affinis (de Brito Capello, 1868)	Small-eyed rabbitfish
Hydrolagus lusitanicus (Moura, Figueiredo, Bordalo-Machado, Almeida & Gordo, 2005)	Portuguese rabbitfish
Hydrolagus mirabilis (Collett, 1904)	Large-eyed rabbitfish
Hydrolagus pallidus (Hardy and Stehmann, 1990)	Pale chimaera
Family Rhinochimaeridae	
Harriotta haeckeli (Karrer, 1972)	Smallspine spookfish
Harriotta raleighana (Goode and Bean, 1895)	Narrownose chimaera
Rhinochimaera atlantica (Holt and Byrne, 1909)	Straightnose rabbitfish

Deep-water fisheries

The following provides a brief, higher-level, overview of the main deep-water and shelf-edge fisheries operating in the NE Atlantic, including those stocks considered by the Working Group on the Biology and Assessment of Deep-sea Fisheries Resources (WGDEEP; ICES, 2018) and those species included in EU TAC regulations for deep-sea stocks (EU, 2018).

Management of the fisheries for these species have changed over time, with some stocks now prohibited from landing (e.g. orange roughy). The main offshore and deep-water taxa considered for the purposes of this report are:

- Black scabbardfish *Aphanopus carbo*
- Alfonsinos *Beryx* spp.
- Roundnose grenadier *Coryphaenoides rupestris*
- Roughhead grenadier *Macrourus berglax*
- Roughsnout grenadier *Trachyrincus scabrus*
- Red seabream *Pagellus bogaraveo*
- Deep-sea sharks
- Blue ling *Molva dypterygia*
- Greater silver smelt *Argentina silus*
- Ling *Molva molva*
- Orange roughy *Hoplostethus atlanticus*
- Tusk *Brosme brosme*
- Greater forkbeard *Phycis blennoides*
- Hake *Merluccius merluccius*
- Anglerfish *Lophius* spp.
- Greenland halibut *Reinhardtius hippoglossoides*
- Northern prawn *Pandalus borealis*
- Deep-water shrimps (e.g. *Parapenaeus longirostris, Aristeus antennatus* and *Aristeomorpha foliacea*)
- Deep-sea red crab *Chaceon affinis* (=*Geryon affinis*)

Some other deeper-water teleost species are commercially important bycatch species (e.g. *Trachyscorpia, Scorpaena*), but not caught in sufficient quantities to be subject to target fisheries.

The interactions of fisheries for these species with chondrichthyans will vary with numerous factors, including the degree of spatial overlap (both geographically as well as bathymetric overlap), gear selectivity (which will vary between gears and in relation to the size and shape of the chondrichthyan), and behaviour of the fish (e.g. vertical behaviour, aggregating nature).

Fisheries for anglerfish, hake, tusk, ling, blue ling and greater forkbeard are generally on the outer continental shelf and upper slope. Whilst fisheries for these stocks may have some interaction with deep-water chondrichthyans, there is expected to be limited bathymetric overlap with deep-water chondrichthyans. Whilst included here for the sake of completeness, the main deep-water shark stocks occur in deeper water than the commercial fishing grounds for these species.

Whilst comprehensive data are lacking, there have been several published studies on the bycatch/discards of chondrichthyans in deep-water fisheries, such as for French trawl fisheries (e.g. Allain *et al.*, 2003), black scabbardfish longline fisheries along the Portuguese mainland (Veiga *et al.*, 2013), Azores (Machete *et al.*, 2011) and Canary Islands (Pajuelo *et al.*, 2010), and deep-water crustacean trawl fisheries (e.g. Monteiro *et al.*, 2001). Whilst trap fisheries for deep-water crab *Chaceon* (in the Gulf of Mexico) have a small fish bycatch, including of sharks, numbers are generally very low (Perry *et al.*, 1995).

ICES landings data (2006–2017) were also summarised, in order to determine what kinds of other deep-water species occur in recent catch statistics (noting that coding errors etc. can be present in such data sets, and detailed analyses of these data would need to be undertaken). This highlighted that some of the main deep-water taxa being reported in recent catch statistics included:

- Redfish (*Sebastes mentella, Sebastes marinus, Sebastes* spp., *Sebastes viviparus*)
- Northern prawn (*Pandalus borealis*)
- Greenland halibut (*Reinhardtius hippoglossoides*)
- Lings (*Molva molva, Molva dypterygia, Molva macrophthalma*)
- Phycid hakes (*Phycis blennoides, Phycis phycis, Phycis* spp.)
- Scabbardfish (*Aphanopus carbo Lepidopus caudatus, Trichiurus lepturus*, Trichiuridae)
- Grenadiers (*Coryphaenoides rupestris, Macrourus berglax*)
- Greater silver smelts (*Argentina silus*)
- Penaeids (*Parapenaeus longirostris, Aristeus antennatus*)
- Slickheads (*Alepocephalus bairdii*)
- Roughies and slimeheads (*Hoplostethus atlanticus*)
- Rabbitfish (*Chimaera monstrosa, Hydrolagus* spp)
- Alfonsinos (*Beryx splendens, Beryx decadactylus, Beryx* spp)
- Deep-water red crab (*Chaceon affinis*)
- Deep-water sharks (*Centroscymnus coelolepis, Centrophorus lusitanicus, Centrophorus squamosus, Scymnodon ringens, Centroscymnus crepidater*)
- Skates (*Raja oxyrinchus* (= *Dipturus oxyrinchus*)
- Morid cods (*Mora moro*)
- Black cardinal fish (*Epigonus telescopus*, Epigonidae) and cardinal fish (Apogonidae)

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Annex 2: Reviewers' comments

Consolidated referee report

Joint NEAFC-OSPAR request to ICES for scientific advice on deep-sea sharks, rays and chimaeras

Authors: Clarke *et al*. August 7, 2020

1. Background

Not unlike other long-lived, slow maturing species with a limited reproductive potential, deep-water sharks and related species (chondrichthyans) face a conservation challenge by falling victim to fisheries as incidental bycatch. Directed fisheries for deep-water sharks are prohibited, but small quotas are allocated for retention as bycatch for some species, others have a total allowable catch of zero tonnes. Effectively, such management measures may encourage discarding to take place, but there are currently no means in place to quantify it reliably. To be able to gauge risks and adjust management measures where needed, OSPAR and NEAFC requested to collect and map out detailed data about the occurrence of deep-water sharks. Wherever possible, ICES was also requested to indicate how a status of a particular species could be improved and how by-catch issues could be mitigated. Currently, all deep-water sharks are subject to a 0-TAC under the deep-water TAC and quota regulation (2019/124), but to evaluate the efficacy of this measure was beyond the scope of WKSHARK6.

In response to the NEAFC-OSPAR special request, this work was meant to provide the scientific knowledge basis about the distribution of deep-water species (i.e., sharks and rays - elasmobranchs, and chimaeras) based on available information, especially with respect to the Areas Beyond National Jurisdiction (ABNJ). Authorities managing activities in these areas are legally committed to do so jointly. The deliverables addresses four main objectives: 1) to provide distributional ranges of deep-water sharks in the NEAFC and OSPAR regions; 2) to present an overview of all available and suitable surveys; 3) to list fisheries that catch these species as bycatch; and 4) to summarize ICES advice, including an overview of current bycatch mitigation strategies. A draft report by WKSHARK6 was reviewed which summarized the work of a 2-year process.

2. General comments

The draft report of WKSHARK6 provides a comprehensive, well-written and well-illustrated document and provides the scientific knowledge basis as requested, also when considering possible future management measures. It provides detailed overviews of individual species distributions based on available survey records. It tabulates the survey data time series that were used as input data and also summarizes the fisheries that incidentally catch deep-water sharks. Relevant records were contributed from the data call. However, the overview of which fisheries spatially overlap in effort with the species-specific distribution profiles and the presentation of any recommendations to improve the status and mitigate by-catch of deep-water elasmobranch and chimaeras species could be improved and should already be highlighted in the executive summary.

3. Specific comments

a) Is the executive summary clear and succinct and meets the ICES guideline criteria?

The summary is clear and concise about the terms of reference to address, but otherwise too short and too succinct (only 158 words), and overly general, to adequately describe methodologies and summarize results. Following ICES guidelines, the executive summary should showcase any science highlights in addressing the objectives, outline the implications and limitations of the findings, describe any associated uncertainties and provide some recommendations. The summary should provide a brief but concise description of the analysis made and present the main conclusions. For example, it could be valuable to summarize as requested, what the potential options are to improve the status of deep-water species and mitigate their bycatch. It is necessary to emphasize that given the lack of reliable information with respect to an individual species' abundance, quantitative assessments of sustainable exploitation rates are not possible. Reliable fisheries-dependent information on landings and discards are needed to improve this dire situation.

b) Are the deliverables in their scope, robustness, and presentation appropriate in response to the terms of references of the special request?

Yes, but the order of their presentation should follow the order of the Terms of References to improve the structure and clarity of the evidence that has been collated. For example, the draft report should first provide an overview of the data sources that were used as input to map out distributional ranges per species, then the methods to build the maps, including the maps as results from that. The third section of the report should provide the overview of what fisheries overlap with and catch deep-water sharks and highlight mitigation options. The fourth section should summarize the ICES advice. There is some repetition between section 2 (summary of advice; P. 6: "Various regulations restrict….") and section 4 (fleets taking these species; "In 2005, …").

c) Is the methodology appropriate, and described in sufficient detail to be both understandable and reproducible?

Yes. The methods that were used are appropriate, and despite its complexity allows the reader to critically evaluate its overall validity and reliability with however, a drawback that it may be difficult to reproduce the results, if necessary. Having said that, shapefiles are being made available to be used in GIS applications. The methods that were developed to ingest and visualize survey records as distributional maps have been described in detail and are clear, but due to the use of technical terminology can be in parts a little bit difficult to follow for a non-GIS-minded reader. A stepwise process is being described that first makes use of XY coordinates from surveys, and then visualizes the recorded and known depth ranges of a species within a bathymetric layer. It would be helpful to refer to each component of the analysis in the bullet point list (P. 17) with a corresponding step number. Another minor comment is to use a consistent terminology when referring to the respective input data sources and to specify which software was used, especially given that explicit references are being made to functions and tools on how to tag layers and shapefiles. In what respect would habitat modelling provide similar or different results about species distributions compared to what has been done by the authors? More detailed overlay analysis may be needed for regional hotspots to determine bycatch risks (see Das *et*

al. 2018, as mentioned below), but adequate information is lacking for most species to even attempt such an exercise. In the distribution of species section (P. 17-18), the authors refer to 'expert judgment', as an unavoidable necessity given the scope of this work. Yet, nowhere in the report or the individual maps there is any indication of the significance, the depth and the extent of expert judgment used and if this was used for all or individual species. An indication of the extent of expert judgement could help to the 'estimation' of the bias this judgement may generate.

ToR c is incomplete: for the fleets that incidentally bycatch the species of concern, the areas of operation were not specified. The list of species should tabulate per species the associated management measure and any available evaluation of its efficacy. If those are not available or are lacking, this should be noted, again per species. (Novel) methods to mitigate bycatch should be listed by species and if needed a link established with WGFTFB to seek input for suggestions and possibilities.

P.5: Are Portuguese dogfish also from the *Centrophorus* genus, or rather *Centroscymnus*?

P. 6: Change "epochs" to "periods"?

P. 8: Where is the survey from 1936 listed in the table?

P. 14: Table 3.1: period for EVHOE survey is missing?

P. 18: "associated with each species of shark"?

P. 19: Figure 3.3.4?

P. 38: rare instead of un-abundant species?

d) Have the limitations of the available data been sufficiently described?

Yes. The authors thoroughly outline the limitations of the available data. It was emphasized that a lack of occurrence may simply indicate less sampling effort or sampling that was unsuited to catch the species of interest. They made clear that the available surveys were heterogeneous with respect to the gears used and often limited in either their spatial or temporal coverage (or both). It was also indicated that catchabilities of deep-water shark species may be survey- and/or gear-specific and that data gaps existed. Unfortunately, data from some regions (e.g., the Azores) were unavailable. But why? For example, the Azorean Portuguese survey in subarea 10 was not available to complete the Mid-Atlantic Ridge information. Such data gaps are clearly an issue for the surveys, and the lack of species-specific catch data may be due to the difficulty of species identification in the field (namely skates, Deania spp., Apristurus spp., among others). A complete list of species which can be confused with others may be helpful.

P. 11: This comment concerns the area 27.14. Based on the available data sets, maps were produced with species distribution for ICES Division 27.14. However, there is only one survey which covered the area and is cited in Table 3.1 the 'German Greenland ground-fish survey'. There are some species, for which distribution maps were produced for area 27.14, but which were not mentioned in the 'Top 5 species' list or among the 'Other significant species' list, of this particular survey. For example, there are distribution maps (i.e., see figure 3.3.7, p. 23 for *Amblyraja hyperborea*) for the area 27.14, but the only available source for this area (the German survey) does not mention these species as 'Top 5 species' or 'Other significant in Table 3.1. The reviewers hypothesised that the source is from some Icelandic survey (the Icelandic

survey according to Table 3.1 covered area 27.5.a, but the distribution map shows presence of the species North and West outside of area 27.5.a.), but that is not mentioned anywhere and has to be clarified. Is it because Iceland vessels researched within Denmark's waters (Greenland waters) and they don't want to mention that? Were there any jurisdiction issues? Have the authors forgot to mention the source? Please clarify.

P. 9: Other sources that fall in Division 27.14, regards the Reykjanes Ridge in Table 3.3.1. In this case the maps show distributions that fall away from the Ridge. This is making the source of the data used for the mapping ambiguous. The other available source which is falling within the 27.14 region is Reykjanes Ridge (see Table 3.3.1). The maps show distribution areas North and outside of the RR (Figure 3.3.9), (Figure 3.3.12), (Figure 3.3.15), (Figure 3.3.25), (Figure 3.3.43) and (Figure 3.3.53). I guess that either the source is from some Icelandic survey or the RR survey covered much broader area than the RR. In any case that is not mentioned anywhere and has to be clarified. If the aforementioned sources covered the broader area of 27.14 this should be clarified in Table 3.3.1. If not, where such specific data are deriving from and/or to what extend the 'expert judgement' was utilised?

The distribution maps for Division 27.14 refer to *Amblyraja hyperborea* (Figure 3.3.7), *Apristurus laurussonii* (Figure 3.3.9), *Centrophorus squamosus* (Figure 3.3.12), Chimaera monstrosa (Figure 3.3.25), *Galeus murinus* (Figure 3.3.43) and *Rhinochimaera atlantica* (Figure 3.3.53).

Linking species to the relevant surveys used for the mapping, would add to the clarity of the presentation. There are inconsistencies between legend & footnote in Figure 3.3.11, Figure 3.3.22, Figure 3.3.53, and Figure 3.3.54, or what the map depicts (Area 5b-7 instead of area 5b-9) Figure 3.3.17 and Figure 3.3.28.

Hydrolagus mirabilis is mentioned as one of the species in Reykjanes Ridge (Table 3.3.1) but the relevant map (Figure 3.3.48) is blank showing no distribution of the species.

Regarding *Oxynotus paradoxus* it is stated in p. 56 that only seven records been reported ''Six of these are to the West of Ireland and Scotland, with one record from the Rockall Bank''. According to Table 3.4 there is another record(s) in Area E in the MAR which is not mapped.

P.8, Paragraph 2 the report states 'from ICES area 27.1 (Northeast Arctic) to 27.14 (Azores)''. Area 27.14 covers S-SE Greenland.

In chapter 2.2 'Mitigation of bycatch' states that various measures restrict the use of nets especially in waters deeper than 200m and that NEAFC ordered the removal of all such nets from its area since 1/2/2006. However areas of OSPAR, fall outside the NEAFC regulatory area and such restrictions may not apply. Having in mind that according to Table 3.3.1, at least 17 species of true deep water fisheries which are present in waters deeper than 500 m are also found in depths shallower than 200m, as well as 3 more species of non-deep-water fisheries, the use of nets still represents a risk to the status of these species and should continue to be considered as such. In addition, a measure which can contribute to the status of these species is to encourage fishermen to report such lost gear that might become ghostnets and/or may be swept into deeper waters, so that they can be retrieved, and brought ashore for disposal.

*e) **Are there any more data sources, reports or peer-reviewed literature available to your knowledge, but which were not used or cited as part of the deliverable?***

Recent studies about deep-water shark bycatch and post-release mortality assessments in the Azores were not cited, but seem relevant. For example, Fauconnet *et al.* 2019: An overview of fisheries discards in the Azores. Fish Res. 209, 230-241. Or: Das *et al.*, 2018. Can we really avoid deep-water sharks? Or Fauconnet *et al.* 2018. At vessel-mortality and post-release survival of deep-water sharks: insights from the Azores hook-and-line fisheries. Both studies were presentations at the ICES Annual Science Conference in Hamburg in 2018. The study by Das *et al*. outlined an overlay model whereby a fishing effort layer was overlaid with the distribution/abundance data from a long-term survey to identify areas of high encounter and bycatch probability. Heessen was mentioned in the text, but not listed in the reference section. It may be worthwhile to check whether there are studies of deep-sea mounts that include survey data of local fauna.

*f) **Is the standard nomenclature consistently applied?***

In general, the standard nomenclature has been successfully and consistently applied throughout for species, and ICES subdivisions. However, some of the common species names in the main text do not agree with those cited in fishbase. Otherwise, the updated species list in section 4.2 is very accurate (based on some checks). The authors may want to check whether species names referenced in that list were used throughout for consistency. There are a few cases where species (i.e., *Apristurus laurussonii*) were misspelled. A spell check for species names may be useful. Only the formatting of the list in section 4.2 needs some attention to be consistent in the use of brackets, italicized species names and line breaks. Difficulties with regards to the accuracy of species identification from surveys could be elaborated in the "Limitations of the data" section by providing an expert opinion about which species may be difficult to tell apart in the field. Please use consistent terminology throughout: deep-water vs deepwater sharks.

*g) **Are the conclusions supported by the data?***

There is no specific conclusion section other than the executive summary which should be improved to become more comprehensive (see comment above).

Annex 3: Data call 2019 in response to the Joint NEAFC-OSPAR request to ICES for scientific advice on deep sea sharks, rays and Chimaeras

DCF national correspondents
Els Torreele, Jørgen Dalskov, Elo Rasmann, Heikki Lehtinen, Joni Tiainen, Camille Dross, Christoph Stransky, Leonie O'Dowd, Didzis Ustups, Jolanta Cesiulienė, Inge Janssen, Irek Wojcik, Emilia Batista, Pilar Vara del Río, Anna Hasslow, Matthew Elliott.

ICES ACOM members and observers
Els Torreele, Joanne Morgan, Morten Vinther, Jesper Boje, Robert Aps, Petur Steingrund, Jari Raitaniemi, Alain Biseau, Christopher Zimmermann, Gudmundur Thordarson, Ciaran Kelly, Didzis Ustups, Linas Lozys, Natalie Steins, Bjarte Bogstad, Jan Horbowy, Fatima Borges, Yury Efimov, Francisco Velasco, Massimiliano Cardinale, Pieter-Jan Schön, Kiersten Curti.

Our Ref: H.4/ACB/IM/av 8 October 2019

Subject: Data call for the Joint OSPAR and NEAFC Request for advice on deep sea sharks, rays and chimaeras.

Dear Reader,

Please find enclosed a document describing the rationale, scope and technical details of the data call to support ICES special request advice related to the distribution of deep sea sharks, rays and chimaeras. This data call is under the DCF Regulation ((EU) No 2017/1004 and Commission Decision 2016/1251/EU) for EU country members and under UNCLOS 1995[1] Fish Stocks agreement for non-EU country members.

For questions about the content of the data call, please contact: advice@ices.dk. For questions on data submission, please contact: data.call@ices.dk and for question in relation to DATRAS, please contact: datrasadministration@ices.dk.

Sincerely,

Anne Christine Brusendorff
General Secretary

cc: Maurice Clarke (Chair of WKSHARK-6), Darius Campbell (NEAFC), Joao Neves (NEAFC), Venetia Kostopoulou (DG-Mare, DCF); Bas Drukker (DG-Mare, DCF); Laura Simonayte (Ministry of Agriculture of the Republic of Lithuania, K.V. Kolonchin (VNIRO director), O.A. Bulatov (VNIRO delegate to ICES).

[1] * United Nations (UN). 2011. Agreement related to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. Available at: https://documents-dds-ny.un.org/doc/UNDOC/GEN/N95/274/67/PDF/N9527467.pdf?OpenElement

Table of Contents

Data call 2019 in response to the Joint NEAFC-OSPAR request to ICES for scientific advice on deep sea sharks, rays and Chimaeras

1. Rationale

The requested data and metadata will be used as the basis to answer the Joint OSPAR and NEAFC Request for advice on deep sea sharks, rays and chimaeras.

2. Scope of the Data call

ICES Member Countries are requested to provide all records available from surveys for the species included in annex 1 of this document. This Data call intends to localize and record data across all countries with records on species from annex 1 from national or international coordinated surveys. Data required is by haul and specified in Table 2 of this document.

Species: see Annex 1.

Areas: covered by surveys in Table 3.

Years: all records available.

Descriptions of methods used to collect the data need also to be made available (a link with the information will be enough) in case the surveys are not internationally coordinated.

3. Legal framework

The legal framework for the data call is as follows:

Generically, all the governments and intergovernmental commissions requesting and receiving advice from ICES have signed international agreements under UNCLOS 1995† Fish Stocks agreement article 5 and 6 to incorporate fisheries impacts on other components of marine ecosystems and WSSD 2002 article 30 to implement an ecosystem approach in relation to oceans policy including fisheries.

For EU Member States, this data call is under the DCF Regulation ((EC) No 2017/1004 and Commission Decision 2016/1251/EU) and in particular, Article 17(3) of regulation (EC) No 2017/1004 which states "*…requests made by end-users of scientific data in order to serve as a basis for advice to fisheries management, Member States shall ensure that relevant detailed and aggregated data are updated and made available to the relevant end-users of scientific data within the deadlines set in the request...*"

* United Nations (UN). 2011. Agreement related to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. Available at:

https://documents-dds-ny.un.org/doc/UNDOC/GEN/N95/274/67/PDF/N9527467.pdf?OpenElement

This data call also follows the principles of personal data protection as referred to in paragraph (9) of the preamble in Regulation (EU) 2017/1004 and repealing Council Regulation (EC) No 199/2008.

4. Usage of requested data

ICES will use the submitted requested data and metadata as the basis to answer the Joint OSPAR and NEAFC Request for advice on deep sea sharks, rays and chimaeras.

5. Deadlines

ICES requests that the data are delivered by the 15th of November 2019, to provide sufficient time for additional quality assurance and map production before the WKSHARK-6 meeting.

Table 1. Data submission deadline for ICES expert groups and respective chair contact.

Working Group (WG)	Chair of the Request	Email Address	Data Submission Deadline
WKSHARK-6	Maurice Clarke (Chair)	maurice.clarke@marine.ie	**15.11.2019**
WKSHARK-6	Graham Johnstone (Data coord)	graham.johnston@marine.ie	

6. Data to Report

This data call intends to gather data from surveys for the species in annex 1:

1) Surveys that are not part of DATRAS: submit the data to data.call@ices.dk.
2) Surveys that are part of DATRAS: single species cannot be uploaded for a specific survey and the full data sets with all species per year and quarter need to be re-submitted.

Notice that for many of the species ICES does not give recurrent advice and data submitted to DATRAS may not be complete.

The data fields to be summited are specified in Table 2 below. Notice that for surveys re-submitted to DATRAS, the DATRAS format should be used (https://datras.ices.dk/Data_products/ReportingFormat.aspx).

A list of surveys (non comprehensive) is provided in Table 3.

Table 2. Data submission format.

Field	Obligation	Format	Description
Country	M	Text	2-letter ISO code
Year	M	YYYY	Year
Month	O	Number	Month
Date	M	DD/MM/YYYY	Date
Vessel name	O	Text	ICES vocab SHIPC
Survey	M	Y/N	Is a survey or not e.g. Commercial data (N)
Survey code	O	Text	ICES survey acronym if available. (Check if your survey is on //vocab.ices.dk/?ref=111 and use this acronym)
Gear	M	Text	ICES vocab Metier-4
Haul/shot number	M	Number	Haul shot/number
Lat shot	M	Number	Position in decimal degrees
Long shot	M	Number	Position in decimal degrees
Lat haul	M	Number	Position in decimal degrees
Long haul	M	Number	Position in decimal degrees
Ices division	O	Text	ICES vocab ICES area
Depth shot(m)	M	Number	Depth at shooting position, in meters.
Depth Haul (m)	M	Number	Depth at haul position, in meters
Species	M	Text	Scientific name of species
Sex	M	M/F/U	Male/Female/Unsexed
Maturity	O	Number	Stehmann (2002) elasmobranch maturity scale, if recorded*
Length	O	Number	Length, to the nearest centimeter below
Number (at length)	M	Number	Number at length. If length not available, total number in haul

* http://www.vliz.be/imisdocs/publications/103008.pdf

M - Mandatory
O - Optional

6.1 Survey specification

Table 3 is a list of surveys that may contain data on the species in Annex 1 (information from most of them may have never been submitted to ICES). This list is only an orientation of the surveys available and should not restrict ICES Member Countries to deliver all data available for species in annex 1 beyond the surveys, years and areas shown in Table 3.

Table 3. List of surveys identified by WGEF (WG on Elasmobranch Fishes).

Country	Acronym	Survey description	Periods	ICES statistical areas
Ireland	IDS 2009-2011	Trawl survey	1993-2000, 2008-2011.	27.6 and 27.7
Ireland	NA	Longline survey	1993-2000.	27.6 and 27.7
Ireland	SeaRover	ROV survey. Not an ICES fisheries survey, but invertebrate data have been provided to ICES WGDEC	2017-2019	27.6 and 27.7
Scotland	Sco-IBTS-Q1, Sco-IBTS-Q3	Biennial trawl survey Scottish North Sea groundfish survey (IBTS) – q1 and q3, presumably, national subsets of the international NS-IBTS	1999-present	27.6a
Scotland	ScoGFS-WIBTS-Q1, ScoGFS-WIBTS-Q4	IBTS q1, Scottish Western IBTS and IBTS q4, Western IBTS 4th quarter (including Porcupine survey)	-	-
Scotland	SDS	Scottish deepwater trawl survey	-	-
France		Ad hoc deep trawl surveys	From 1996	27.6-27.8
UK - England		Ad hoc deep trawl surveys	From 1973	27.6 and part of 27.7
UK - England		Trawl surveys (with limited sampling from upper slope)	1980s-2002	27.7
Spain		Trawl survey of Hatton Bank	2001 to present (?)	27.6b and 27.12
Spain	SpGFS-WIBTS-Q4	Spanish groundfish survey – q4	-	-
	SpPGFS-WIBTS-Q4	Spanish Porcupine groundfish survey	-	-
Portugal	PtGFS-WIBTS-Q4	Portuguese groundfish survey - October	1980s to 2001	27.9a
Portugal	PT-CTS (UWTV (FU 28-29))	Portuguese crustacean surveys / Nephrops TV survey	1997 to present	27.9a
Azores	ARQDACO(P)-Q1	Annual bottom longline survey	1980s to present	27.10
Iceland	IS-SMB and IS-SMH	Annual bottom trawl surveys of upper slopes	-	27.5a
Greenland/ Denmark	GER(GRL)-GFS-Q4	East Greenland bottom trawl survey, upper slopes	-	27.14
Germany	-	German Greenland groundfish survey	-	27.14

Country	Acronym	Survey description	Periods	ICES statistical areas
Norway	-	Ad hoc trawl and longline surveys of Mid Atlantic Ridge (contact person: Claudia Jungen)	early 1990s to early 2000s	27.5 and 27.10
Norway	Reketokt	North Sea NOR shrimp NDSK cruise	1984-present	27.3a and 27.4a
Norway	EggaSor	Norwegian Sea continental slope NOR deep-sea fish cruise in autumn	1994-2009 (annually), 2011-2017 (or 2019) (biannually)	27.2a
Norway	EggaNor	Norwegian Sea continental slope NOR deep-sea fish cruise in spring	2012-2018 (biannually)	27.2a and 27.2b
Spain (Basque Country)	PALPROF	Annual deep-water long line survey targeting deep-water sharks (600-2400 m)	2015-present	27.8c
Portugal	project	Reduction of deep-sea sharks by-catches in the Portuguese long-line black scabbard fishery (Ref. MARE C3/IG/re ARES (2011) 1021013)	2011-2013	27.9.a and 27.10
Portugal	DISCARDLESS project	Project to examine reduction in discards	2016-?	27.9.a

6.2 Submission of data

Files should be submitted to data.call@ices.dk in as few e-mails as possible. The file name must include the year, the working group (WKSHARK6), species and country references as specified below. The email subject must include working group and country references.

"2019 [WKSHARK6] [species] [country]"

(example: 2019 WKSHARK6 dvs.27.nea PT)

Accepted data types are; Rdata, .csv, .rsd or .xlsx

7. Contact information

For support concerning any data call issues about the data call please contact the Advisory Department (advice@ices.dk).

For support concerning other technical data-submission issues, please contact: data.call@ices.dk.

For support in DATRAS submission (datrasadministration@ices.dk).

Annex 1. Species included in this data call.

Species common name (as listed in special request)	Latin name	AphiaID
Gulper shark (*Centrophorus granulosus*)	*Centrophorus granulosus*	105899
Leafscale gulper shark (*Centrophorus squamosus*)	*Centrophorus squamosus*	105901
Portugese dogfish (*Centroscymnus coelolepis*)	*Centroscymnus coelolepis*	105907
Black dogfish (*Centroscyllium fabricii*)	*Centroscyllium fabricii*	105906
Longnose velvet dogfish (*Centroscymnus crepidater*)	*Centroscymnus crepidater*	105908
Kitefin shark (*Dalatias licha*)	*Dalatias licha*	105910
Greater lanternshark (*Etmopterus princeps*)	*Etmopterus princeps*	105911
Frilled shark (*Chlamydoselachus anguineus*)	*Chlamydoselachus anguineus*	105831
Birdbeak dogfish (*Deania calcea*)	*Deania calcea*	105903
Velvet belly (*Etmopterus spinax*)	*Etmopterus spinax*	105913
Sailfin roughshark (*Oxynotus paradoxus*)	*Oxynotus paradoxus*	105915
Knifetooth dogfish (*Scymnodon ringens*)	*Scymnodon ringens*	105918
Greenland shark (*Somniosus microcephalus*)	*Somniosus microcephalus*	105919
Round skate (*Rajella fyllae*)	*Rajella fyllae*	105894
Arctic skate (*Amblyraja hyperborea*)	*Amblyraja hyperborea*	105863
Norwegian skate (*Dipturus nidarosiensis*)	*Dipturus nidarosiensis*	105871
Large-eyed rabbit fish (ratfish) (*Hydrolagus mirabilis*)	*Hydrolagus mirabilis*	105826
Straightnose rabbit fish (*Rhinochimaera atlantica*)	*Rhinochimaera atlantica*	105830
Icelandic catshark (*Apristurus laurussonii*)	*Apristurus laurussonii*	105807
Blackmouth dogfish (*Galeus melastomus*)	*Galeus melastomus*	105812
Mouse catshark (*Galeus murinus*)	*Galeus melastomus murinus* accepted as *Galeus murinus*	105813
Bluntnose six-gilled shark (*Hexanchus griseus*)	*Hexanchus griseus*	105833
Bigeyed sixgill shark	*Hexanchus griseus nakamurei* accepted as *Hexanchus nakamurai*	105834
Rabbit fish (*Chimaera monstrosa*)	*Chimaera monstrosa*	105824
Dark ghostshark	*Chimaera monstrosa var. australis* accepted as *Hydrolagus novaezealandiae*	271415